COLLECTED REPRINTS.

SIXTH SERIES.

(1907-1920)
- - - - -

PART 1.

SIR WILLIAM OSLER.BT., M.D.,F.R.S.

Regius Professor of Medicine

Oxford University.
- - -

TITLES OF PAPERS.

(Continued from Series V.)

PART I

CEREBRO-SPINAL FEVER.

By WILLIAM OSLER, M.D., F.R.S.

CEREBRO-SPINAL FEVER.[1]

By WILLIAM OSLER, M.D., F.R.S., *Regius Professor of Medicine in the University of Oxford, Honorary Professor of Medicine in Johns Hopkins University, Baltimore.*

I HAVE been asked to speak to you on the subject of cerebro-spinal fever, a disease in which I have been interested for some years, and of which I have had some experience. It possesses many most interesting characteristics as an epidemic. Let me call your attention to one or two peculiarities of infectious diseases in general. In the first place, a large proportion of them occur in cycles. Nearly all the common epidemics have periods of great prevalence, followed by intervals in which only a few cases occur. Certain of them, even the greatest, may disappear for very long periods. Had we not all thought that we had finished with the plague ? Who would have thought ten or fifteen years ago that we should ever again think seriously of a great pestilence ? Yet to-day there is no more important problem in epidemiology than the plague in India. The sweating sickness, that great epidemic which devastated Europe in the Middle Ages, has disappeared altogether. Then epidemics present curious seasonal variations of which we have as yet no very satisfactory explanation. For instance, enteric fever occurs chiefly in the autumn. The exact cause of these remarkable variations we do not know.

The particular disease I am to speak of, cerebro-spinal fever, illustrates in a remarkable way a number of epidemic peculiarities. It has occurred in remarkable periodic waves ever since its recognition, and its first description, in 1805, in periods usually of ten or fifteen years. The 1805 epidemic began in America, prevailed in Switzerland, and in one or two other parts of Europe, and lasted for eight or ten years. The second outbreak began in 1837, and became widely prevalent in parts of Europe and America. About 1850 there was a third definite epidemic wave, which was even more widespread, and which prevailed all through the period of the Civil War in America.

A fourth epidemic began in 1871, and about 1901 arose the fifth wave, on the crest of which we are at present. The disease has prevailed in many parts of America. In New York, for instance, in the past two years there have been nearly 4000 cases of this disease, with some 3000 deaths. There has been a severe

epidemic also in Silesia and other parts of Europe. In these
islands the disease has never been very prevalent. In Allbutt's
"System" you will find a list of the epidemics given in Ormerod's
excellent article. The only serious one was the Irish outbreak in
1866–67. A few isolated epidemics have occurred, but there have
been no such severe manifestations of the disease as on the
Continent and America. At present the disease has broken out
in Belfast and in Glasgow, and is causing no little alarm. A
second peculiarity is that the epidemics occur in very widely
separated areas, in which it prevails severely, but does not spread
widely. This is one of its most remarkable peculiarities. During
the past two years in which it has prevailed in parts of the
United States, the epidemic, for example in New York, did not
spread to other large cities, nor did it extend throughout the
country. At the same time, the disease occurred in such a widely
distant region as Silesia. This has been a very constant peculiarity.
The disease is never pandemic, like influenza, sweeping rapidly
over many countries. It occurs usually in small localised regions,
scattered far apart. It has another peculiarity in showing a
maximum intensity in densely populated cities, as in New York,
and in scattered mining towns and villages and in mountainous
regions. Some of the most severe epidemics in the United States
have occurred in the mountains of West Virginia, in the mining
regions of Pennsylvania, and last year one of the worst epidemics
on record was among the Silesian miners. A fourth peculiarity is
that the mortality, as an acute infection, ranks very high, perhaps
next to the plague. At times, indeed, it equals the plague as a
killing disease. The latter disease has a mortality of 60 and 80
per cent., and cerebro-spinal fever has a mortality ranging from
50 to 75 per cent. Lastly, among infections it is perhaps the
most virulent. We know of no disease which can strike patients
with such lightning-like rapidity, in so fulminant a manner, as
cerebro-spinal fever. There are instances in which death has
occurred within six or eight hours. A few years ago, in
Washington, I saw a robust, healthy man who had left his house
immediately after luncheon, and who, as he was stepping out of a
tramcar at about 2.30 P.M., had a sudden pain in the back of his
head. I saw him that night at ten o'clock. He was in a condi-
tion of extreme prostration, with high fever, violent delirium, and
with a temperature of 104°. At three o'clock in the morning he
was dead, within a little more than twelve hours from the onset.
On the other hand, there is no known infection which may so
lightly affect a patient. When the disease is very prevalent
there are curious mild attacks, with the most transient manifesta-
tions. The patient has a headache for an hour or two, a pain in
the back of the head, a little stiffness in the neck, and the whole
affair passes off in a few hours; and yet there are gradations
between these extremely light attacks, in which a man is scarcely

more than out of condition for an hour or two, and the most serious of all the forms.

The specific germ associated with it is known as the *Diplococcus intracellularis meningitidis*. It has been found only in two localities, in the exudate in the brain and cord, and in the secretion of the back part of the nose and the throat, and this is a very important matter in connection with the spread of the disease. For instance, Ostermann last year examining twenty-four throats of persons who had not the disease, but who were exposed to it, *i.e.*, who were attending upon patients, or who had been in their neighbourhood, out of these he obtained the organism from seventeen, showing that it is a widely diffused germ, and probably many throats during an epidemic harbour it, as so many of us do the pneumococcus. Indeed, the organism is a near relation to this germ, a sort of cousin perhaps, possibly a half-sister, at any rate a very close relation. The disease has, indeed, many points of resemblance with pneumonia. One remarkable feature has been brought out of late years. We have hitherto regarded cerebro-spinal fever as an epidemic, but we now know that a certain type of meningitis, the posterior basic, is due to the same organism, so that in reality cerebro-spinal fever, while not occurring as an epidemic, does exist in this sporadic variety all over the country.

From recent bacteriological studies, there can be no question that this so-called posterior basic meningitis, described by Gee and Barlow and well known in this city, represents the sporadic form of the disease. It occurs constantly in the community. There are cases in the Children's Hospital of this city every year: indeed, there are cases there now; and it also occurs in those peculiar house-epidemics, which may prevail in the absence of any special outbreak. Two or four or even five persons may be stricken one after another in the same house with the disease. There are also sporadic forms of the pneumococcus meningitis which occur in these house-epidemics.

An important point which has been discussed in all the epidemics is whether the disease is communicable directly from person to person or not. Is it actually contagious? Do we run any risk in looking after the patients? It probably has the same low degree of contagiousness that we see in pneumonia. It sometimes happens if you have a case of pneumonia in a medical ward, a case will occur in the neighbouring bed, or one of the attendants will be infected, or there may be a small ward epidemic, or in a house one case is followed in rapid succession by three or four other cases. Cerebro-spinal fever behaves in much the same way. Numbers of cases may be in the general ward of a hospital, and the disease may not spread. We had no additional cases in the Johns Hopkins Hospital in a small epidemic there, either among the attendants or among the nurses. On the other hand, there have been instances which demonstrate clearly that the disease

may be communicated from one person to another. In New York both nurses and physicians were attacked, and there were many cases illustrating the communicability of the disease. A very striking case has been reported by Dr. Hare, whose writings you all know. His assistant, a young physician of 26 or 27 years, and a very strong, robust man, attended a case of cerebro-spinal fever. As the patient was a friend, he was very devoted, and sat up with the poor fellow until his death, after an illness of forty-eight hours. This man had just come from a region in which cerebro-spinal fever was prevalent. Within twenty-four hours of the death of his patient, the doctor was attacked, and died within forty-eight hours from the onset of the disease. Dr. Hare, who had seen the original patient, and had attended his assistant, a day or two later had a slight fever, with headache and stiffness of the neck; but fortunately the attack passed off with great rapidity.

There are certain features of cerebro-spinal fever which make it rather peculiar among the forms of meningitis. It is much more a spinal affection than any other form, so that it is well called *cerebro-spinal* meningitis. In the tuberculous and in the pneumococcus forms the cerebrum is very much more involved than the cord, but in this disease the spinal meninges bear the brunt of the attack, so that we have as special symptoms the stiffness of the neck, the muscular rigidity, and the cutaneous sensitiveness. In the ordinary forms of meningitis we rarely see the great retraction of the head and the opisthotonos as we do in cerebro-spinal meningitis. There is a much greater variation in the course, and in the symptoms, in this form. For example, we rarely see a malignant acute form in which death occurs before there is any cerebro-spinal exudate; nor do we often see, except perhaps in the pneumococcus form, a chronic type. The disease may last for two or three months. Most remarkable of all is a feature which distinguishes this from all other varieties of meningitis—in fact it is the silver lining in the meningitic cloud —from 25 to 50 per cent. of the cases recover. We never see recovery in other forms of meningitis. In tuberculous meningitis one hears of a recovery, and recovery we know is possible, but the cases are so rare that a man may practise for forty years and not meet such a case. And the same is true of the streptococcus and staphylococcus varieties. All forms indeed are fatal except this one, due to the *Diplococcus intracellularis meningitidis.* Of course the percentage of recoveries is not a large one, varying perhaps from 20 to 40 per cent., but when one considers that all the other forms are fatal, we must be thankful that there is this peculiarity in the disease.

I will not deal specifically with the symptoms of the disease, but there are one or two peculiarities to which I may refer, as they are of interest. There are curious skin lesions: the purpura

which has given the name "spotted fever," the erythema, occasionally bullous eruptions and remarkable blotchy rashes about the joints. The skin eruptions vary in the different epidemics. Arthritis is a not infrequent feature in some epidemics. A very serious event is early blindness or early deafness, which form calamitous sequels of the disease. Connected with the deafness in the very young is the dumbness; and von Ziemssen states that following the great epidemic in Germany in 1871 there was a considerable increase of persons admitted to the Deaf and Dumb Asylums. The diagnosis of the disease is rarely in doubt. The symptoms are those of meningitis, and the distinction from the other forms can only be determined in two ways,—by the detection of the diplococcus in the serum of the spinal meninges, or by the fact that a person recovers who has had a marked and well-defined attack. When there are clearly defined symptoms of meningitis, if recovery takes place the chances are 100 to 1 in favour of its being a meningococcus infection. The discovery of the organism is made by the lumbar puncture, which is not a difficult operation, but the meningococcus may be present only in the early periods, and at the end of a week or ten days it may not be found.

A most important point concerns the prophylaxis of the disease. In the first place, we need not be apprehensive, I think, that there is to be a widespread epidemic in this country. The newspapers should not alarm the public unnecessarily. There has as yet been no widespread epidemic in Great Britain, and there is no reason why we should anticipate one. The immunity of these islands during the past century is very remarkable; the only epidemics really worthy of the name have been in Ireland. Usually it has prevailed only as it is occurring to-day in Glasgow and in Belfast: a hundred or more cases in large populous cities. The disease does not often prevail much beyond the winter season. It usually disappears in the spring. Where the disease is prevalent, persons in the neighbourhood of patients, the attendants and others, should have their throats carefully examined bacteriologically, and as far as possible the nose and throat should be carefully treated. This might sometimes prevent a person taking the disease, and it might stop the spread of the germ from one person to another. Not much can be said on the treatment of the disease. As with the plague, a disease which kills 75 per cent. of the persons attacked is not one for which treatment does much. But as it is the only form of meningitis in which we do see recovery, there is an element of hope, and certain measures of treatment may be carried out. The hot bath frequently repeated may be used with very great benefit and comfort to the patient. Lumbar puncture, more particularly where the fluid comes out under high pressure, should be frequently repeated; I have seen undoubted good results, and it is a harmless pro-

cedure. Or continuous draining may be tried, or one or two of
the spinal laminæ may be removed. I had it done in one case
with temporary benefit, but it is rather a serious operation. One
hopeful feature about cerebro-spinal fever is that within the past
year, Wassermann in Germany, and at the Rockefeller Institute
of New York, Dr. Flexner, have prepared a serum which promises
to be of great value both as a prophylactic and as a curative
measure. The disease may be reproduced in monkeys, and the
serum has cured them; and these workers have also been able to
render monkeys immune. A serum prepared from the horse is in
the market, and which is claimed to be of very considerable value.
These are the main points about this remarkable disease. Some
of you may never see it in epidemic form, but the sporadic cases
are always with us, and I am very glad to have had this oppor-
tunity of calling your attention to it.

ON THE LIBRARY OF A MEDICAL SCHOOL.

By William Osler, M.D.

ON THE LIBRARY OF A MEDICAL SCHOOL.[1]

By WILLIAM OSLER, M. D.

One day last spring a London bookseller called and said [109] he had a library of seventeenth and eighteenth century medical books for sale, which had been gathered by the physicians connected with the Warrington Dispensary. Looking over the catalogue I saw at once that it was a collection of value, and knowing that it would supplement very nicely the special libraries which have gradually grown up in connection with the Johns Hopkins Medical School, I wrote to Mr. W. A. Marburg and he authorized me to purchase it and to have it put in good order, and this has been done, and to complete his generous gift, Mr. Marburg has furnished bookcases as well. Dr. Welch will speak of some of the special works. I may mention in passing that the library is very rich in English medical pamphlets of the seventeenth and eighteenth centuries, and contains a large number of the works of classical medical authors which we had not in the library.

A word or two on Warrington and the men who collected these books: This old town on the banks of the Mersey, partly in Chester, partly in Lancashire, had in the middle and latter part of the eighteenth century a notable group of scientific and professional men. The Aiken family made the place celebrated as a literary center, as it was largely through the Rev. John Aiken that the Warrington Academy became so famous. His son John became well known through his "Biographical Memoirs of Medicine in Great Britain," and the large work on "General Biography." A sister of

---

[1] Remarks made on the occasion of the presentation of the Marburg collection of books to the Johns Hopkins Medical School, January 2, 1907.

[109] the elder Aiken was the distinguished authoress, Mrs. Barbauld, and Lucy Aiken, a daughter of Dr. John, became a well-known figure in English literature. But by far the most important of the scientific men who lived here in the eighteenth century was Joseph Priestley, who was tutored in " classics and polite literature " at the academy for six years, from 1761. He must have had a very stimulating effect on his colleagues. A very notable character who also has a strong interest for us on this side of the water is Thomas Percival, who was born at Warrington and practiced there before going to Manchester. Upon his work, " Medical Ethics, 1803," was founded the code of ethics of the American Medical Association. I see it stated that a brother of this Percival was also a well-known physician at Warrington, and at his death left a very large library; some of the books may possibly be those before us this evening. James Kendrick was a physician and naturalist of the same type. It was by the exertions of these men and their colleagues that this library was formed. The influence of the Warrington Academy, the educational college of the Unitarians of England, made the town a literary and scientific center, and the medi-
[110] cal profession must have benefited largely from the intellectual environment of the place. So prominent indeed did it become that a Press was organized, and in looking over Miss Nutting's interesting collection of books on " Nursing," to which I shall refer later, I noticed that from it the works of the celebrated philanthropist, John Howard, were issued. Altogether, the collection has an affiliation with a remarkable group of men, and its value is not a little enhanced to know that it has been used by such men as Priestley, and John Aiken, and Thomas Percival.

The occasion offers an opportunity to make a few remarks upon the future of the libraries connected with this school.

Books are the tools of the mind, and in a community of progressive scholars the literature of the world in the different departments of knowledge must be represented. With the existing arrangements we have gradually built up two libraries, one connected with the hospital and the other with the university. In the former are to be found the modern

(2)

works and journals relating to medicine, surgery, obstetrics, and the various specialties. Under Dr. Hurd's fostering care this side of the library has grown rapidly, and we have had several valuable donations from the libraries of the late Dr. Donaldson and the late Dr. Chatard. Files of all the more important medical journals are there to be found, and we can all testify to the very stimulating influence which this library had had upon the hospital staff and upon the senior medical students.

After the medical school had opened and the laboratories of anatomy, physiology and pharmacology been erected, the University began the collection which is in this building and which represents the modern works and journals in those scientific subjects upon which medicine is based. There are now very complete files of the scientific journals of anatomy, embryology, physiology, pharmacology, and physiological chemistry. While, in some ways, the ideal plan is to have a special library of each subject in each laboratory, the buildings here are so close together that it was thought best to concentrate all of the collections in this building.

Now it is along these two lines that a library of a medical school should progress, but there are one or two other sides of the question which may be considered. In a large city with another active medical library supported by the profession, the two should work in harmony, as great economies could be effected, particularly in the purchase of the more expensive works and journals. I am glad to know that the library of the Medical and Chirurgical Society is prepared to co-operate with the other medical libraries in this city in some such plan. It is not worth while for the library of the medical school to deal extensively with local literature or with the transactions of the State societies, or to attempt to keep files of all the smaller American journals. There are two other directions in which the library of a medical school should grow, and they are well represented by the collections presented to-night. When a man devotes his life to some particular branch of study and accumulates, year by year, a more or less complete literature, it is very sad after his death to have such a library come under the ham-

mer—almost the inevitable fate. Fortunately, such libraries are very often offered for sale *en bloc,* and this was the case with the large collection of works on teratology and embryology formed by the late Professor Ahlfeld, of Germany. Through the liberality of Mr. W. F. Jencks this very valuable library has been secured for us and will be presented to-night by Dr. Williams. These special groups of books are of the greatest value to the student. It is interesting to know that in connection with the training school of the hospital Miss Nutting has gradually formed a library of all the works relating to nursing and to the care of the sick in peace and war, and I may remind you that we are already the fortunate possessors of another remarkable collection, that of the late Dr. Fisher, who gathered together the set of portraits which was presented to the hospital a few years ago by Dr. Kelly.

This Warrington collection represents a fourth side of the library work. I think you will all agree with me that the interest which has been taken here in the history of medicine and in the biography of the great men of our profession has had a very stimulating influence on the younger men, in giving to them that historical outlook so important in scientific research. The library of a great medical school should contain the original works of all the great masters of medicine. No book should be added to a library simply on account of its age. As in modern literature so in that of the sixteenth, seventeenth, and eighteenth centuries, there is an enormous quantity of trash which is hardly worth shelf room. I would have *all* of the original works of *all* of the great men; and one special value of this Marburg gift is that it is so rich in original editions of many of our masters. For example, I would have in such a library a carefully selected group of the works of Hippocrates, not everything, of course, but the standard editions, such as the Aldine folio, and the editions Frobenius and the more important translations; the editio princeps of Celsus, 1479; the more important of the works of Galen, including the fine Aldine edition, 1525; good editions of Dioscorides, Aretaeus, and of Pliny, and of the other great medical writers of the Greco-Roman school. On the same

principle should be collected the chief works of the Arabian physicians, and a shelf or two should be devoted to the school of Salernum. The great medical Humanists should be well represented—Linacre, Caius, and others. Every scrap of the writing of such a man as Vesalius should be collected. A good beginning has been made with the 1543 edition of the "Fabrica," but of such a man all the editions of all his works should be here. The same may be said of such great anatomists as Fabricius, Malpighi, Eustachius, Sylvius, and many others of the sixteenth century. The original works of the great physiologists should be sought for. Every scrap of the writings of Harvey (and they are not numerous) and every edition should be here. In practical illustration of my remarks I beg to present to the Marburg collection an original edition of the "De Motu Cordis," 1628, perhaps the greatest single contribution to medicine ever made, and which did as much for physiology as the "Fabrica" of Vesalius did for anatomy. The "De Motu Cordis" has become an excessively rare book. I had been on the outlook for a copy for nearly ten years. It had not appeared in an auction catalogue since 1895. Then in August of last year a very much cut, stained and unbound copy was offered to me at a very high figure. It had come from the library of Dr. Pettigrew, the author of a work on "Medical Biography." I had been waiting a long time for a copy, but this looked so shabby and dirty that I decided not to take it. Some months later the booksellers sent the copy back nicely cleansed and beautifully bound, and this time I succumbed. Within forty-eight hours the same dealers sent me another copy from the library of the late Professor Milne Edwards, of Paris, uncut and very nicely bound, which they offered at the same price. Naturally, I took the larger copy and the other one went to a friend in this country. The copy I here present to the library has been a little too energetically cleansed, so that the leaves are very tender and in places have had to be repaired. It came from the library of a physician in London and the bibliographical data are found attached.

I would have the complete works of the Hunters, every fragment available of John Hunter's; everything of Haller—

[111 and that means a great deal—of Majéndie, and a complete collection of the monographs of great modern physiologists, such as Claude Bernard. The original works of the great clinicians, of Boerhaave, Morgagni, Bichat, Laennec, Louis, Corvisart, Bright, and Addison should be on our shelves; and lastly the great works relating to the history of medicine and to medical bibliography should be collected. Books in the special historical and bibliographical department of the library could very well be added to this Warrington collection, in which way the university could express its appreciation and gratitude for the very generous gift received from Mr. Marburg.

And one word in conclusion—when the plans for the medical school were under discussion, I drew in outline what I should have liked to see on this plot of land. Very much idealized it would have taken many millions for its realization. Surrounding the entire square ran beautiful stone cloisters (ornamented with busts and statues of the great men of the profession), and uniting the four chief buildings which stood in the middle of the sides of the square. On the Monument Street front was a beautiful structure in stone devoted to the library and museum. This part of my plan could yet be realized. As the museum collections grow, and as year by year the books increase in number such a building will become a necessity, and in it these special libraries will find their appropriate home.

266

A Clinical Lecture

ON

ABDOMINAL TUMOURS ASSOCIATED
WITH DISEASE OF THE TESTICLE

BY

WILLIAM OSLER, M.D.Oxon., F.R.S.

REGIUS PROFESSOR OF MEDICINE AT THE UNIVERSITY OF OXFORD

A Clinical Lecture

ON

ABDOMINAL TUMOURS ASSOCIATED WITH DISEASE OF THE TESTICLE

Delivered at the Radcliffe Infirmary, Oxford, on March 20th 1907

BY

WILLIAM OSLER, M.D.Oxon., F.R.S.

REGIUS PROFESSOR OF MEDICINE AT THE UNIVERSITY OF OXFORD

A Clinical Lecture

ON

ABDOMINAL TUMOURS ASSOCIATED WITH DISEASE OF THE TESTICLE.

GENTLEMEN,—Not infrequently the diagnosis of an obscure affection of the abdomen is determined by an examination of the testicles. More than once in my experience the nature of a peritonitis or of an abdominal tumour has been cleared up by finding a tuberculus orchitis; or in syphilis gummata may occur at the same time in the liver and in the testicles. But it is more particularly in malignant disease of these organs that abdominal features are met with, and the case before you illustrates in a singularly complete manner many of the peculiarities of this association.

This well-built fellow, aged 22 years, with a suspicious pallor of the face, was sent by Mr. R. R. Hatherell from Kingston Bagpuze and Mr. Parker has kindly sent him for my clinique. When seven years of age he fell from a tree and injured the left testis which was transfixed by a small spike. Ever since it has been a little enlarged, but it gave him no trouble until about six months ago, when it began to grow and to be a little painful. A few weeks ago he noticed a swelling of the abdomen. He has lost about 8 pounds in weight. The left testicle is of about the size of a small orange, round, and firm; the epididymis is enlarged and there is a gland of the size of a filbert just above it, which I thought at first was the cord. There is no sign of the old injury. In

both inguinal grooves the lymph glands are enlarged and hard, forming visible tumours. The abdomen presents a very remarkable appearance (as illustrated in the accompanying illustrations,[1] Figs. 1 and 2). A prominent mass occupies the left upper quadrant, lifting the costal border, and causes bulging of the eighth, ninth, and tenth ribs. Below it reaches to the level of the navel and to the right a little beyond the linea alba. It appears to descend slightly on

FIG. 1.

View of abdominal tumour from the front showing the high position.

deep inspiration, and on close inspection there is a shock-like pulsation in the whole mass and in the splenic region. On palpation the mass is very solid and immovable, emerges directly beneath the costal border, and extends to the level of the navel, but below the limits cannot be accurately made

[1] These photographs were taken by Dr. R. H. Sankey on April 9th. The tumour has grown very much.

out. To the right it reaches to the middle line but the epigastrium itself is not occupied nor does the liver appear to be enlarged. Passing deeply in the flank it cannot be grasped between the hands and moved up and down like a renal or splenic tumour. It has rounded outlines without nodules and is painless on pressure, firm, and has a feeble pulsation, not expansile, but just such as one feels in deep-seated abdominal growths. The throbbing of the abdominal

FIG. 2.
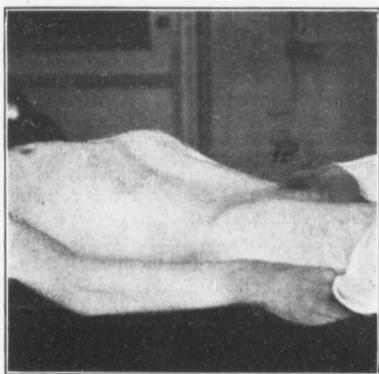
View of abdominal tumour from the side.

aorta is felt just above the navel. There are enlarged glands both above and below Poupart's ligament on both sides. There is an enlarged gland just above the left clavicle.

Two very common events in connexion with malignant disease of the testicle are illustrated by this case—the influence of trauma (which in some statistics has been as high as 50 per cent. of the cases) and the very rapid generalisation. Following an injury the tumour may appear in a few months, or, as

in this patient, 15 or more years may elapse. It is well to bear in mind that the course may resemble an acute orchitis. Some years ago I saw with Dr. McGill of Catonsville, a young man, aged 19 years, who had bruised one testis on his bicycle. This was followed by swelling, gradual enlargement, and the tumour persisting the organ was removed. It contained blood and much grumous matter thought to be pus. About a year later he began to fail in health and when I saw him he presented two large tumours in the upper abdominal region, evidently connected with the liver. There was fluctuation and the masses felt like sacs of pus. An exploratory operation showed the condition to be a rapidly growing soft sarcoma of the liver.

The generalisation is, in the majority of cases, through the lymphatics, and, as in this case, may take place very early. I have not sufficient experience with tumours of the testicle to say on simple examination just what variety this is, though from its firmness in places and its elastic tendency in others it is quite possible that it belongs to the remarkable group of embryomata or teratomas. I wish particularly to bring before you the characters of the abdominal tumour in malignant disease of the testicle. There are two groups of cases : (1) the tumour is a secondary involvement of the lymph glands, as in the case before you ; and in the other (2) the tumour is primary involvement of the retained testis in a monorchid or a cryptorchid. To understand the relation of the secondary tumours you must bear in mind that the lymphatics of the testicles discharge very high up into the aortic lumbar glands —on the left side into three glands to the left of the aorta just below the renal artery, on the right side into from three to five glands to the right of the vena cava and between it and the aorta. The secondary tumour is, therefore, above the level of the navel, and usually begins in the upper quadrant of the abdomen on the side of the affected organ. This explains the position of the tumour in the present case. It has all the characters of a deep-seated mass which has sprung from the retro-peritonial lymphatic glands. The solidity of the growth, its depth, the immobility, the absence of an outline conforming to the well-known shape of a renal or a splenic tumour, and

the impossibility of grasping it bimanually, which can be done
in the majority of all new growths of the kidney, and the
character of the throbbing impulse which is so marked in these
deep-seated lymphatic tumours in the neighbourhood of the
aorta—all these points favour the view that we have to deal
with a large secondary mass involving the lymph glands con-
nected with the left testicle. Here, too, the first glandular
barrier has been broken through and the germs have reached
the cervical lymphatic gland on the left side. An unusual
point in this patient is the involvement of the inguinal glands,
which, as a rule, escape, unless the scrotum itself is attacked.
Later in the disease the lungs may be involved, the heart, the
liver, and other organs. I have already mentioned a case in
which there was extensive secondary disease of the liver. It
is not always easy to determine the precise nature of an
abdominal growth which has developed many years after
removal of a testicle. The patient may have gummous
orchitis and syphilis of the liver or there may be tuberculosis
of one testicle, and years later tuberculois of the liver. This
rare association happened in the following case :—

On Oct. 14th, 1903, Mr. L. was sent by Dr. Schofield of
Charlestown, West Virginia. Ten years previously he had
had the right testicle removed by Hunter McGuire for tuber-
culosis, but the patient himself said that the nature was doubt-
ful, and a subsequent letter from Stuart McGuire states that
the tumour was a sarcoma. The patient had had stomach
trouble for a couple of months and a week before consulting
me had noticed a lump in the abdomen. He was positive
that he had never had any syphilis. He had had good health
and had not lost in weight. I dictated the following note :
" Healthy-looking fellow ; fairly good colour. Tongue is a
little furred. Hands are a little pale. Pulse is regular.
He weighs 120 pounds. Abdomen is prominent in epigastric
region and a mass descends with inspiration, having the
unusually great vertical excursion of at least five inches,
reaching to a little above the navel. Transverse extent of the
prominence is fully three inches. Marked communicated

pulsation over whole epigastric region. Right infracostal groove obliterated. Navel is normal. Superficial glands are not enlarged. On palpation the mass corresponds to a firm, hard, ridge-like tumour, very freely moveable, rounded, without a definite edge, but fingers can be got above and below. It is difficult to say whether it is attached to the liver or not. At the outer edge of the right rectus it feels as though it were, and here the edge of the liver is distinctly palpable, fully two fingers-breadth below the costal border. Edge of spleen is easily and distinctly palpable. The mass is singularly painless on palpation. There is resonance over it. Percussion gives upper border of liver at the seventh rib in nipple line. Glands are a little shotty. After inflation of stomach the mass is not nearly so prominent. It does not change specially in position, remains the same, rather less than more resonant. The shadow of its descent is not so definite. The edge is a little more definite and prominent just by the rectus border." My opinion was that he had a sarcoma of the liver following the tumour of the testicle. I urged him to have an exploratory operation. This was done by Ransohoff of Cincinnati, who has reported the case in the *Medical News* of April 16th, 1904. A tumour was found embedded in the left lobe of the liver. The omentum was adherent to the free border. "What was felt as the tumour mass was now found to be the left lobe of the liver hardened and nodular." The tumour was removed with the thermocautery. The patient died on the sixth day after operation from severe vomiting of blood. Dr. Hiller reports that the tumours had the histological features of tuberculosis, though tubercle bacilli could not be demonstrated.

As is well known the testicle retained in the inguinal canal is very often the seat of new growth. In the following case a large abdominal tumour followed removal of a sarcomatous right testicle :—

The patient was a man, aged 36 years (surgical numbers 5936 and 7448). He was admitted to Dr. Halsted's clinique on Oct. 19th, 1896, complaining of a swelling in the right

groin. His family and personal history was unimportant. The right testicle had been undescended but it had been palpable in the right groin. It never gave him any trouble until 18 months ago, when he first noticed that it was enlarged and extended higher up than before. It continued gradually to increase in size but with only an occasional attack of pain on

FIG. 3.
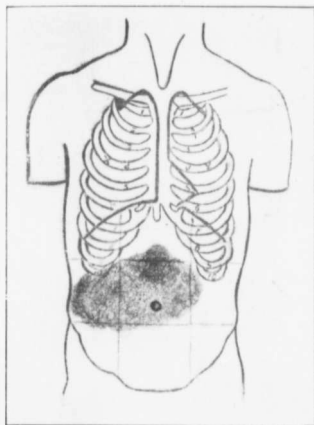
Tumour of retro-peritoneal lymph glands secondary to sarcoma of right testis.

standing or exertion until three weeks ago, when pain was more severe and extended down the leg. The pain was stabbing in character and accompanied by a sensation of itching and tingling. The bowels were constipated; for three weeks he had had frequency of micturition but the urine was scanty. There was no loss in weight and the appetite was good. Examination showed a somewhat sallow complexion; the

mucous membranes were of fair colour, the pulse was normal, and the heart and lungs were normal. With regard to the abdomen, the spleen was not palpable. In the right hypochondrium there was some resistance which was too superficial for the liver. The scrotum contained only the left testical, which seemed normal; the right testicle was absent. Rectal examination revealed a firm prostate. As to the lymphatic glands, in the left axilla was a small nodule of the size of a marble. The submaxillary glands on the left side were somewhat harder than on the right. In the right inguinal region above Poupart's ligament was felt a tumour mass, ovoid in shape, of about the size of an orange, 13 by 11 centimetres, extending from within five centimetres of the anterior superior spine of the ilium to the scrotum. The mass lay just beneath the skin, was freely moveable, and was not tender or sensitive on manipulation. The tumour was very hard, tense, and seemed to fluctuate slightly. The tumour seemed to be just beneath the external ring, and when one invaginated the scrotum the resistance of the tumour above could be readily felt. The patient said that the sensation in the mass was the same as in the other testicle. On Oct. 23rd, 1896, Dr. Bloodgood removed the tumour. It lay beneath the skin and had the usual coverings of a hernia. There was no evidence of infiltration of the tissues outside of the capsule. The tumour proved to be a myxosarcoma. The patient made a uneventful recovery and was discharged on Nov. 15th, 1896. He was readmitted on Feb. 21st, 1898, about 14 months after operation, with recurrence in the retroperitoneal glands. For about six weeks he had been having pains in the back, with swelling of the abdomen, on which account he drank to excess. The bowels had been very constipated. Two days before readmission he had some burning pain and hæmaturia. On Nov. 22nd I made the following note: "Skin decidedly icteroid; scar on right side extending parallel to Poupart's ligament; little fulness of abdomen in right half, chiefly in the upper portion. The left infracostal groove more distinct than right; walls soft, no resistance on palpation. Occupying the central upper portion of the abdomen is a solid, irregular

mass; to the right it extends far over into the flank, below to the level of the spine of the ilium. To the left it does not extend so far, but in the epigastric and upper umbilical regions it extends as far as nipple line. There is bulging above the navel. It can be felt most pronouncedly midway between the navel and ensiform cartilage. Outline between mass and liver not clearly defined. It is very resistant and immobile and does not descend with inspiration or posture. On bimanual, the mass seems an unusually deeply placed tumour. Everywhere gurgling in the intestines can be felt, but the edge of the liver is not palpable. The right rectus is more rigid than left. The upper level of liver dulness is on a level with the upper margin of sixth rib and extends to costal border." The patient was discharged unimproved on March 28, 1898.

In the second group, not nearly so common, the tumour originates in the retained testes of a monorchid or a cryptorchid. The following cases have come under my observation: two of them in the surgical clinique of the Johns Hopkins Hospital my colleague Halstead allowed me to demonstrate to my clinical class:—

CASE 1. *Cryptorchismus; abdominal tumour; diagnosis of sarcoma of retained testicle; removal; rapid recurrence.*—A man, aged 29 years, Surgical No. 2900, was seen in Dr. Halstead's ward with Dr. Bloodgood on March 21st, 1894. The patient was a resident of Maryland and had been at several cliniques seeking advice as to the nature of his trouble. He was a medium-sized, slightly-built man, somewhat effeminate looking in the face, with a fair-sized moustache but with very little hair on the cheeks. He had been pretty well up to six or eight weeks ago, when he noticed for the first time a lump in his abdomen, since which time there had been gradual enlargement and he had lost in strength and weight. He looked pale; there was no fever; the pulse was good. The abdomen was uniformly distended, having the appearance of an ordinary ascites; the superficial veins were not enlarged. On palpation it was moderately tense and fluctuation was

readily obtained. In the middle line on deep palpation a firm, hard body was touched which was felt to occupy the right lower quadrant of the umbilical region and the greater portion of the hypogastric, extending, however, much more to the right than to the left side. The surface was irregular and there was a very marked prominence to the right. It could be moved a little from side to side, but there was too much

FIG 4
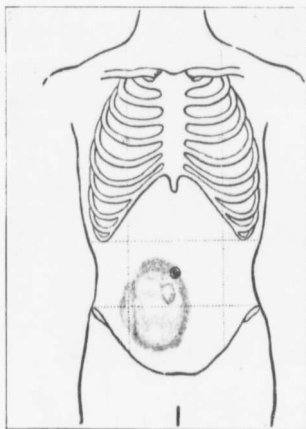
Abdominal tumour formed by retained testicle.

fluid in the abdomen to make any satisfactory bimanual palpation. It was hard and resistant and in the process of dipping for it with the tips of the fingers it evidently yielded and could be depressed from one side to the other. The scrotum was empty but somewhat distended; the inguinal canals were open and the ascitic fluid passed directly into the sac of the scrotum. Examination by the rectum revealed the

presence of a hard indurated mass on the right side. Considering that the patient was a cryptorchid and the known proneness of the retained testicle to new growth, the diagnosis of sarcoma of one of the intra-abdominal testicles was made. On the 24th Dr. Halsted operated; he removed the ascitic fluid and found a tumour formed by the enormously enlarged and sarcomatous right testicle. The organ had retained its shape; a groove separated the body from the greatly enlarged epididymis. The tumour was greyish-white in colour, firm and hard in some places, soft and partially cystic in others. A portion of growth on the pelvic floor could not be removed. The patient left the hospital on April 14th very much improved in his general health, but returned on May 12th with signs of recurrence.

CASE 2. *Monorchid ; tumour in the right side of abdomen ; ascites.*—The patient was a married man, aged 46 years. Surgical number 2992. He was admitted on April 17th, 1894. His family history was negative. His personal history was negative, except for alcohol to excess until 41 years of age. The present illness began about eight months ago with a sharp sudden pain in the left side of the abdomen of very excruciating character, which lasted about five minutes. This was followed by a soreness for several days in the left ilio-costal space. About three weeks after this attack he noticed a hard tumour in the left side of the abdomen which was painful on pressure. For some months prior to September, 1893, the patient had noticed increasing difficulty in moving his bowels, and this had progressively increased, and now only strong purges or enemata were successful. About December, 1893, he had pain around the neck of the bladder on micturition ; now it occurred only occasionally. The tumour had not increased perceptibly in size. He said he had become paler and had probably lost weight. There had never been any blood in the urine or stools The patient was an emaciated, cachectic man, with pale mucous membranes ; the radial pulse was small and weak, with the vessel wall decidedly sclerosed. There was no

general lymphatic enlargement. The abdomen was distended and prominent, particularly in its lower half, where two tumour masses were seen, one in the right inguinal region and the other more to the left of the navel. The abdomen was soft in its upper half, but below and to the right of the navel was felt a large, hard tumour with irregular margins, painful on deep pressure. The small nodule in the diagram corresponds to the epididymis and was more painful than the rest of the mass. The growth was not moveable nor was it adherent to the skin. There was much fluid in the abdomen, which had been increasing since admission. The difficulty in moving the bowels had also increased. The inguinal glands were slightly enlarged and tender. The left testicle was absent and could not be felt, while the right was normal. The inguinal canal on the left side was open, though the internal ring was barely felt. Blood: 4,200,000 red cells, 6500 white. Since admission the fluid had increased in the abdomen and the patient had become weaker. The urine was clear on examination. The patient was discharged unimproved on May 7th as Dr. Halsted refused to operate.

CASE 3. *Monorchid : tumour in the right lower quadrant of the abdomen : operation.*—On April 25th, 1900, I saw with Dr. Henry Jackson and Dr. Cabot in Boston a robust healthy man, aged 45 years. He had had for years an undescended testis on the right side, which had once been just at the inner ring but subsequently had receded. For three or four months he had had irregular pains in the abdomen, thought to be due to gas, chiefly in the right iliac fossa. About six weeks previously Dr. Jackson noticed the presence of a lump in this locality and three weeks previously Dr. Cabot operated and found a large, solid tumour corresponding to the testis but passing deeply and surrounding the vessels in such a way as to make it inoperable. The patient was a healthy-looking man, though he had lost a good deal in weight. He did not look at all cachectic. The hypogastric region was a little prominent and there was a bulging just below and to the right of the navel. On palpation the right inferior quadrant of the abdomen was filled with a

solid mass. Above it extended beyond the level of the navel and to the left about the middle line. It was fixed, slightly irregular on the surface, not painful. The prominence noticed was evidently the colon pushed up to the top of the mass. The fingers placed above Poupart's ligament came directly upon the tumour. There was very little pain. He had begun to have a little uneasiness down the course of the anterior crural nerve. He gradually became cachectic as the tumour increased and died about six months after I saw him.

In this group the tumour is in the lower abdomen, usually on one side, and, as in Cases 1 and 2, it may have the outlines of an enlarged testis with the epididymis attached. It is interesting to note that in two of the cases there was ascites, a not uncommon event in connexion with the solid abdominal tumours, particularly of the ovary.[2] The general contour of the abdomen in Case 1 suggested simple ascites and the tumour was only discovered on deep palpation. The cases are not very common. Chevassu in his recent study[3] has collected 128 cases of tumour of the testicle from recent literature, and of these ten were inguinal and five abdominal. There is not much difficulty in the diagnosis, as very often the tumour has the shape of the testicle with its epididymis. In the cases of Abel[4] and of Marion[5] the tumour occurred in hermaphrodites with the external genitalia of women. The nature of the growth was of course not suspected until operation when the uterus and ovaries were absent and sarcomatous change was found in one of the abdominal testicles. The question of prompt surgical treatment is important, as involvement of the glands may occur very early as in this case. The abdominal tumour has been removed in many instances, but

[2] I have reported two cases of solid tumours of the ovary in which the ascites recurred for many months, requiring repeated tapping, and in both patients the diagnosis of the solid tumour was only made on examination after tapping. Both patients recovered after the removal of the affected ovary and both are alive to-day, one 20 and the other seven years after the operation.

[3] Tumeurs du Testicule. Paris, Steinheil, 1906.

[4] Virchow's Archiv, Band cxxvi., p. 420.

[5] Annales des Maladies des Organes Génito-urinaires, tome xxiii.

great difficulty has been met with in complete extirpation, as
in Case I. The retained testis lies so close to the posterior
abdominal wall that the adjacent tissues are soon involved.
Considering the liability to rapid involvement of the lymph
glands of the affected testicle it would seem reasonable in all
cases to remove them as well as the primary tumour. It adds
greatly to the seriousness of the operation, but in young
persons the risk is worth taking. It was done by Roberts[6] of
Philadelphia, but his patient was old and fat and the operation
was secondary to a recurrence.

[6] Annals of Surgery, 1902

The Royal Medical Society of Edinburgh.

BY

WILLIAM OSLER, M.D., F.R.S.,

Regius Professor of Medicine, Oxford.

I do
to p
in a
affil
hon
few
you
mak
Not
gran
rich
capt
mac
mal
mec
the
the
not
if t
Roy
refe
Mo
Mo
and
Me
I fi
fath
spir
and

Ak

THE ROYAL MEDICAL SOCIETY OF EDINBURGH:

PARTICULARLY ITS RELATIONS WITH THE PROFESSION OF THE UNITED STATES AND CANADA. REMARKS AT THE DINNER OF THE ROYAL MEDICAL SOCIETY, FEBRUARY 2, 1907.

By WILLIAM OSLER, M.D., F.R.S.,
Regius Professor of Medicine, Oxford.

I DO not know, Mr. President and Gentlemen, that I ever rose to propose a toast with greater pleasure. I had known, of course, in a vague way, about this ancient Society with its widespread affiliations, and I remember with what satisfaction I received its honorary membership a few years ago; but it was not until I got a few days ago a list of the members that I appreciated the pride which you must all feel in belonging to it. For what is it that should make, and that so justly does make, you Edinburgh men proud? Not the beauty of your city, beautiful beyond all others; not the grandeur of its buildings, nor their historic associations; not the rich legends, nor the bewitching poetry with which you have captivated the race; but the *men* who in the past generations have made you what you are to-day. And it is this feature which makes your Society of such interest, ante-dating as it does all other medical societies of the English-speaking world. Looking over the list of members since 1737 I was prepared, of course, to find the names of many of the great men of the profession, but I did not expect to find a list of such extraordinary distinction. I doubt if there is any other Society in the world, except, perhaps, the Royal Society of London, with such a roll of honour. Let me just refer to some of the eighteenth century members. I skip the famous Monros, whom we all know, to express the hope that the John Monro of the second session (1738) was the father of Monro primus, and the fine old army surgeon who did so much to establish the Medical School and the Infirmary. And among the names in 1740 I find a Robert Willan, afterwards a practitioner at Hull, and the father of the father of Dermatology (the Robert Willan whose spirit I know both Allan Jamieson and Norman Walker invoke), and who was himself a member of the Society in 1777.

You have two of the great medical poets on your list—Mark Akenside, whose "Pleasures of the Imagination," once so popular,

3

is now almost as neglected as his scanty professional writings; but what would I not have given to have been a member of this Society in 1753, when Oliver Goldsmith sang Irish songs and told his stories! That must have been a memorable session—for hilarity, if not for work! In almost every year some memorable name occurs:—Fordyce (1756), of fever fame; Thomas Percival (1762), whose medical ethics formed the basis of the Code of Ethics of the American Medical Association; William Withering, of the same year, whose little book on the *Fox-Glove* is still worth studying, and whose name should be ever remembered in connection with one of the great drugs of the pharmacopœia; Joseph Black (1776), whose fine portrait graces this hall, one of the greatest of your members, and perhaps the most distinguished chemist who has ever been a professor of medicine; Andrew Duncan, whose portrait is one of your treasures; Gilbert Blane; both the Hopes, great friends of the American students; Currie—cold-water Currie —of Liverpool, the biographer of Burns; Parry, who described the symptoms of ex-ophthalmic goitre long before Basedow or Graves; John Aiken, the biographer; Saunders of Guy's Hospital, who took Edinburgh methods of teaching to London; Fothergill—the great Fothergill—the Quaker, and the friend of the American colonists, whose memory is still precious in the profession of Philadelphia; Lettsom, remembered now by a rhyme! Beddoes, the discoverer of Sir Humphrey Davy; Mathew Baillie, the founder of British pathology, nephew of the great Hunters, who were, I believe, only extraordinary members of the Society; and Gregory of *the powder*. It is a wonderful list, which could be greatly extended; but I must take time to speak a word of Cullen, to whom this Society owes so much, and who had such a good influence with generations of the young men who came under his spell. The famous controversy which convulsed this Society in the seventies, started by that remarkable genius Brown, is remembered and discussed, while the theories over which the members quarrelled so hotly are now as dead as their originators. Perhaps to-night this hall may tell another story, and after we are gone Cullen may step out of his frame and wage a ghostly war of words with his old adversary!

And what a list in the nineteenth century!—Richard Bright, Marshall Hall, W. B. Carpenter, C. J. B. Williams, William Sharpey, John Hughes Bennett, Goodsir, Thomas B. Peacock, John

Burdon Sanderson, Murchison, and greatest among them all, Charles Darwin, whose father, uncle and grandfather were Edinburgh men, and his father a member of the Royal Medical.

But I found on your roll names that touch one more closely than any of these. As you know, I have been for more than thirty years associated with the profession of Canada and the United States. To few men has it been given to see the work of his colleagues over a wider area—from the banks of the St. Lawrence to the ever-glades of Florida, and from the Mississippi to Nova Scotia—and interested always in the history of the profession, and in the ideals which have gradually moulded it, imagine my surprise and delight to find that many of the men held in highest honour in those two countries had been members of this Society. Let me refer to some of them. The founders of the first medical school in the United States—the University of Pennsylvania—were all Edinburgh men. John Morgan, whose celebrated *Discourse* led to the foundation of the Philadelphia School; Adam Kuhn; William Shippen, the father of Anatomy in America; and Caspar Wistar, still a famous name in Philadelphia. During the winter the distinguished visitor to that city is sure to hear his name in connection with the well-known Wistar Parties which he inaugurated, and which still hand on the traditions of the jovial character of a man whose motto was, "Go, seek the cheerful haunts of men." But, greatest of all, greatest name perhaps in American Medicine, is Benjamin Rush, the favourite pupil of Cullen; indeed, he has been well named the American Cullen. But you can claim a still greater American—Benjamin Franklin—whom you elected to honorary membership in 1786. During the nineteenth century I find the names of two very distinguished Philadelphians—Nathaniel Chapman (1801), the fragrance of whose memory still lingers in that city, and though dead and gone these sixty odd years, patients still write to him from different parts of the country—at least they did a few years ago; and Samuel G. Morton whose *Crania Americana* is one of the most important contributions to anthropology by an American anatomist.

In New York, too, the men who founded the old King's College, now Columbia, were your colleagues. Samuel Bard, a favourite pupil of Cullen and of Hope, was a devoted member of the Society, of whose proceedings, in 1762, he gives a most interesting account

in a letter to his father.[1] He wrote an early and accurate account
of malignant sore throat (1771), and his *Treatise on Obstetrics*
was the first work on the subject issued in America. An even
more interesting New Yorker, whose memory is perpetuated in
the beautiful hall of the Academy of Medicine of New York, is
David Hosack, of the session of 1792-93. And a third was Samuel
Latham Mitchell (1784), a physician-naturalist of the best type.
These three men laid the foundation of the medical institutions
of New York.

From the Southern States a large number of young men came
here for their education. A few years ago I bought from Johnston's,
of George Street, a collection of 120 theses of American students
who had graduated between the years 1750 and 1820, and more
than one-half of them were from Virginia and the Carolinas. I
find on your roll the Moultries of Charleston, S.C., David Ramsay,
and many others not so well known. One of your Presidents
(1784) I must mention, as his grandson's name is a household
word in the profession to-day, the brilliant Thomas Addis Emmet,
of Dublin, who was in the 1798 Rebellion, and afterwards went to
America.

One of the seven medical societies organised in the United States
in the eighteenth century is the Medical and Chirurgical Faculty
of the State of Maryland, the headquarters of which are in
Baltimore, a Society with which I have been closely connected
for the past sixteen years. I knew that a number of the founders
were Edinburgh men, but I was not prepared to find that at least
eight of them were graduates of this university, and four of them
were members of this Society. Upton Scott, the first President of the
Faculty, became a member in 1751. His descendants are prominent
members of the profession in Maryland to-day, and one of his
great-great-grandsons is a Rhodes scholar with me in Oxford.

---

[1] It may be worth while to quote a sentence or two. After stating that it was organ-
ised by Cullen and Akenside in 1737, he says : " It now consists of between twenty
and thirty members, who meet every Saturday evening, in a room in the Infirmary,
where they dispute upon medical subjects in the following manner : Each member
has about six months beforehand a set of papers given him to write a comment upon,
consisting of a practical case, a question on some medical point, and an aphorism
of Hippocrates. Every Saturday a set of these papers is produced and read before
the Society by the author, having circulated a week before among the members, who
come prepared with objections, and the author with argument to defend them."—
Gross, *Am. Med. Biography*, p. 175.

Not all of the American students belonged to this Society, and I find that George Buchanan and David Moores, both founders of the Maryland Faculty, were Presidents of the Royal Physical Society. To two other members I must refer—John Shaw, who went to Canada with that great coloniser, whose memory we Canadians all cherish, Earl Selkirk, and who afterwards settled at Annapolis, Ind.; and John Birnie (1772), a nephew of Upton Scott's, whom I mention for the sake of his grandson, Clotworthy Birnie, a country practitioner of Maryland, whom to know makes one proud of his profession, and who could sit among you here to-night looking more of a Scot than many I see.

And all my Philadelphia friends will be glad to know that in 1838 Samuel Lewis was of your company. A Barbadian who had migrated to the United States, a learned bibliophile, he devoted many years and much money to the Library of the College of Physicians of Philadelphia, in which a handsome room and a special collection of books bear his name.

But I have not finished, and, at the risk of wearying you, I must speak of your Canadian members, as they did a great service in that country, particularly in Montreal. The founder of McGill College was of course a Scot, and the men who organised the Medical Faculty were all Edinburgh men—Stephenson, Holmes, Robertson and Caldwell (I am not quite certain about the last named), and they brought with them the best traditions of this school, which have been so well maintained by their successors that McGill has been called the Edinburgh of Canada. Stephenson and Robertson were members of the Royal Medical. I am sorry I cannot find Holmes' name, as he was *facile princeps* among them. Then I find many names well known in the profession of Lower and Upper Canada—the Sewells (four of them), Badgeley, Arnoldi, Crawford, Peltier, Belin, Hallowell, M'Nider and others. Altogether you may feel proud of the over-sea record of your members, which brings the Society into such close affiliation with the profession of the United States and of Canada.

I had intended, Mr. President, to speak on the value of the Medical Society in the education of the medical student, but I can only spare time to refer to one point. We do not lay to heart the remark of Bishop Butler, that instruction is often the least part of education, and there is much more in a medical student's life than giving him a professional training. In a

society such as this he may be taught that all-important acquire-ment—to think and talk while he stands on his feet. The whole question of professional economics should be taught in the schools, and men should not be allowed to go into practice without a thorough knowledge of the business, social, and professional relations of their calling; but this is too large a question to touch upon here.

And let me, in conclusion, call to remembrance the memory of a man to whom we all owe a great debt. I hold in my hand a volume of the MSS. Notes of the Lectures of John Rutherford, who introduced clinical teaching into Edinburgh in 1747-48. It was my intention to leave this precious volume here, but to my joy I found this afternoon, in the Library of the Royal College of Physicians, the lectures of 1749-50, and in the same handwriting, curiously enough. This set is of the session 1748-49, and as the introduction is the same, and there is the same description of his method, I decided very promptly not to leave the two sets in the same city. Possibly the first set may turn up. They are of great value as a record of the initiation of clinical teaching in the English-speaking schools; and what has been called the Edinburgh method dates from the introduction by Rutherford of practical classes in the Royal Infirmary. But we owe the method to the Dutch, who are our masters in this as in nearly all the advances in modern civilisation. Rutherford and his colleagues, Plimmer, Sinclair and Innes, were pupils of Boerhaave, the Dutch Hippo-crates, under whom the objective method of Sydenham reached its highest development, and out of which, when united to the "anatomical thinking" of Morgagni, and the new methods of physical diagnosis, modern clinical medicine has evolved.

It has been a special privilege to be with you this evening, and to have been assigned the toast of the Royal Medical Society, from the members of which the English-speaking profession on both sides of the Atlantic has derived its most enduring inspira-tion, and I ask you to drink to its continued prosperity.

On multiple hereditary telangiectases

ON MULTIPLE HEREDITARY TELANGIECTASES
WITH RECURRING HAEMORRHAGES

By WILLIAM OSLER, M.D., F.R.S.

REGIUS PROFESSOR OF MEDICINE, OXFORD

With Plates 10, 11

STRICTLY speaking, telangiectasis is a dilatation of the terminal vessels, i. e. of the capillaries, but we use the term also to describe dilated venules. While applied most correctly to the congenital condition, the term naevus is sometimes used for the acquired form. Telangiectases occur on all parts of the skin. We see them under the following conditions : (1) On the cheeks, the nose, and the ears in persons who are exposed to the weather, and in heavy drinkers ; but this Rosacea, as it is called, may be present also in young persons and be a source of much distress. A very interesting form is that so often seen as aborescent, distended venules on the skin of the thorax along the line of the attachment of the diaphragm.

2. Small pinkish spots from two to five millimetres in diameter, perfectly smooth and uniform, without visible venules, which disappear completely on pressure. These may be not more than a pin point in size, and they often have a vivid pink colour. They may appear suddenly and last for several years and then disappear.

3. The small nodular forms, raised and of a bright crimson or purple colour, varying in size from one to five millimetres. They may be congenital, and there are few bodies on which they are not seen, but with the patches of pigmentation and the yellow, plague-like warts they form common senile changes in the skin of every one above sixty years of age. A point of interest is their supposed connexion with cancer of the abdominal organs, particularly of the stomach, but they are so common in old persons and in so many different conditions that the association is probably only accidental.

4. The spider form, made up of a central dot, sometimes raised and nodular, from which radiate five or six venules, or more correctly, towards which these vessels converge. This, the so-called *naevus araneus*, is seen on the skin of the eyelids and on the cheeks of children and young girls, and by its vivid colour may be very disfiguring.

The most interesting association of the spider naevus is with cirrhosis of the liver. In no other condition may we watch the development of such remarkable telangiectases. The typical form in this disease is a plaque, ovoid or circular, two to three centimetres in diameter, of a pink or dark purple colour due

to a diffuse dilatation of the capillaries, and across these plaques spider veins converge to a nodular centre. In some instances there are no visible veins, only a rosy red circular spot with a darker centre. On the forehead and cheeks there may be four or five. I have counted a dozen or more scattered over the arms and trunk. They do not appear to have any relation to jaundice. A remarkable circumstance is their complete disappearance without any change in the condition of the patient. They are met with also in organic disease of the liver, but are not so frequent as in cirrhosis, of which they may indeed be a diagnostic indication. One patient had troublesome bleeding from a spot, the nodule of which he had scratched. An interesting instance occurred in a medical student in connexion with an attack of catarrhal jaundice. A dozen or more of these spider naevi appeared on his face, and after persisting for three or four months gradually went away. Remarkable spider naevi occur on the scars of the X-Ray burns, and they may appear in enormous numbers on the skin in scleroderma.

5. The mat form. Among the most remarkable acquired variety is that which may be well called by this name, as it represents a large area of the skin, $1\frac{1}{2}$ to 4 inches in extent, which becomes involved in a capillary telangiectasis. At a distance the spot looks like an abrasion or an area of intense hyperemia, but on close inspection with a lens the smaller vessels of the skin are seen to be uniformly dilated. The colour is often of a vivid pink, but without the depth or intensity of the common birth-mark. This form, too, I have seen in cirrhosis of the liver and once in leukaemia.

6. The generalized, acquired telangiectases—the *télangectases essentielles en plaques* of the French—a form in which there appear in large numbers over the trunk or extremities numerous stellate venules. This is a rare form, of which only some fifteen or sixteen cases are on record. I have reported a case in the Johns Hopkins Hospital Bulletin for this year.

And lastly, *the multiple hereditary form with recurring haemorrhage,* which is the special subject of this paper.

In the Johns Hopkins Hospital Bulletin, vol. xii, I reported the history of two brothers who had numerous telangiectases of the skin and mucous membrane, and who had had from childhood bleeding from the nose and from some of the spots. Seven members of the family had been subject to it. The bleeding had usually been from the nose, on the mucous membrane of which spider naevi could be seen. One of the brothers died under my care, and telangiectases were found in the mucous membrane of the stomach, as well as in that of the nose. The third case, reported in the same paper, has been under my observation on and off since 1896. He had had attacks of bleeding from the nose from his tenth year, and from the telangiectatic spots on the gums and lips. The bleeding had been profuse, and he has frequently had to have the nostrils plugged. I saw this patient last in January, 1907. He had only recently recovered from a severe attack. The appearance of his face was very much like that given in the coloured illustration of Dr. Kelly's patient (see Plate 11), and the representation of part of his face is given in Plate 10. I had not seen him

three years, and, though very numerous, the spots were smaller and some of them had disappeared. One special change had occurred in the ten years he has been under observation, in the more nodular character of some of the spots, so that many now form definite naevi raised two or three millimetres above the level of the skin. No members of his family have been subject to the trouble. I have here to report another family, and shall analyse briefly the literature of a subject which has attracted some attention since the appearance of my paper in 1901.

Family X.—In the summer of 1904 I was called to New York to see a patient with Dr. ——, aged 53, who had been in active practice for more than twenty-five years. I was at once attracted by his pallor, and the presence of numerous telangiectases of the skin of the face, ears, and lips, all of which stood out with great clearness on account of the anaemia. He stated that for years he had been a bleeder, chiefly from the nose, but also from the spots. The bleeding had begun at his tenth year, and it had been a source of constant distress from his youth. Though usually from the nose, he had bled from the spots on the skin of the face and of the head, once badly from a spot on the arm, and very frequently from the mucous membrane of the mouth. Within the past year the bleeding has been very profuse, scarcely a day passing without loss of blood. I saw at once the resemblance of the case to those I had already reported. I asked about the family history, and he said that he belonged to a bleeder family, that his grandfather, father, and one sister had had the spots, and had bled in the same way, and that his son, a young man of twenty, had had occasional epistaxis, but no spots. He regarded the condition as one of haemophilia. Fortunately, he fell into the hands of my friend, Dr. Coe, who has reported the case in the Journal of the American Medical Association, October 6, 1906. I saw Dr. —— in January, 1907, and was at once impressed with the remarkable improvement in his appearance. He was no longer anaemic, the spots were much less marked, and he told me that by Dr. Coe's advice he had begun to take calcium lactate, 20 grains three times a day, and he had had some of the more prominent spots on the face touched with the electric needle. For more than a year he had scarcely had any bleeding. The coagulation time, which had been to six or seven minutes, had been lowered to a minute and a half. He had gained in strength and weight, and felt in every way better than he had done for years. The other members of his family, who have been affected, have bled in just the same way from the spots alone or from the nose, never from the cuts, and have never had joint troubles as in ordinary haemophilics.

The telangiectases in this condition are of three sorts—the pin point, which may be readily overlooked and which may be numerous on the skin of the hands or of the face; the spider form, which is most common; and the nodular variety, which may gradually arise in the centre of a spider naevus and form a solid, vascular tumour the size of a split pea. The coloured illustrations here annexed show at a glance the very characteristic condition. I am much indebted to Dr. Kelly for allowing me to reproduce the illustrations of his case.

At least eight families, the subject of this peculiar affection have been recognized: *Family I.*—Wickham Legg[1]—Man aged sixty-five, in whom numerous naevi had appeared over the face and parts of the trunk ; first noticed after his fortieth year. He had had epistaxis from boyhood, and had bled from slight traumatism. One sister, a son and a daughter had suffered from epistaxis. Legg reports the case as one of haemophilia. *Family II.*—Chiari[2]—The case of two sisters with multiple telangiectasis of the skin and mucous membrane. They had also relatives who were subject to epistaxis, and the sisters are said never to have bled much from cuts. I have not been able to consult Chiari's paper in the original as it is not in any of the libraries accessible. *Family III.* —Rendu—When I reported my paper the only cases at all similar that I could find are those reported by this author[3]—a man aged fifty-two, whose mother and brother had been subject to epistaxis, was admitted in a condition of profound anaemia, having had for three weeks a daily recurrence. He had bled from the nose at intervals since the age of twelve. On the skin of the face and on the mucous membrane of the lips and mouth were numerous small telangiectases. *Family IV.*—Kelly[4]—Two sisters with the characteristic telangiectases of the face and mucous membrane, recurring bleedings, usually from the nose. One sister bled from the spots on the tongue and lips. The elder sister died of syncope induced by a severe and persistent epistaxis. *Family V.*— Hawthorne[5]—Woman, aged forty-nine, repeated epistaxis from childhood with multiple telangiectases. The father, the sister and the eldest daughter had small spots on the skin, and her nine children had had attacks of epistaxis, but apparently only one had had the spots. *Family VI.*—Parkes Weber[6]—The patient, a woman (shown at the first meeting of the Association of Physicians in May), aged sixty, presented very characteristic condition of the face and mucous membranes. She had had repeated bleedings from the nose, never from any of the other spots. The telangiectasis appeared when she was forty-two, a few years after the onset of the epistaxis. The mother had epistaxis, and spots on her face. Of the patient's nine children three sons and one daughter have epistaxis, and two of the sons have multiple angiomata of the skin and mucous membrane. *Family VII.*—Osler—Two brothers, aged fifty-five and fifty-seven. The father had had bleeding from the nose from boyhood. One sister had bled from the nose and one from both nose and mouth. The niece and the grandniece also had epistaxis. *Family VIII.*—Osler—The family here reported, four members of which have been affected. And lastly, there is the case of the man referred to in this paper, in whose family, so far as we know, there has been no epistaxis and no spots. I have not included the family reported by Babington (*Lancet*,

[1] *Lancet*, 1876, vol. ii, p. 856.

[2] O. Chiari, *Erfahrungen auf dem Gebiete der Hals- und Nasenkrankheiten*, S. 60 et seq, Wien, 1887.

[3] *Gaz. des Hôpitaux*, 1896. [4] *Glasgow Medical Journal*, June, 1906.

[5] *Lancet*, 1906, vol. i. [6] *Lancet*, 1907, vol. ii.

1865, ii.) as the patients had only epistaxis, and there was no reference to telangiectasis.

The disease is one of very serious character, as the bleedings are often of great severity, and in some of the cases have recurred with such frequency that a state of chronic anaemia has been produced. My first patient, Mr. C., stated with his quiet humour that 'he had been in the habit of bleeding to death', and on several occasions he returned to the hospital profoundly anaemic with swelling of the face and oedema of the feet. One of Dr. Kelly's patients died in syncope following a haemorrhage. In the great majority of the cases the bleeding is from the nose, and has the usual character of epistaxis. In other instances the blood comes from the spots on the lips, the tongue, gums, and mucous membrane of the palate. Only in a few instances has the bleeding been from the spots on the skin, and once from spots on the scalp. One of the cases bled severely from a spot on the arm.

From the nose the bleeding takes place spontaneously. It is easy to understand how the picking of the nostrils or violent blowing of the nose would cause rupture of the dilated, thin-walled vessels. In one of my cases a section of the mucous membrane of the septum was made, and a large number of dilated veins were found just beneath the epithelial layer. From the lips, tongue and gums a slight traumatism in the act of eating is the usual cause. It is more particularly when a central portion of the spider naevus is raised as a small nodule that the bleeding is likely to occur. In one of the cases there were a dozen round foci, each from three to four millimetres in diameter, in the mucous membrane of the stomach, but though cancer was present, there had been no active haemorrhages. None of the patients appeared to have any tendency to spontaneous haemorrhages, except Wickham Legg's, and in this case there is only a general statement to this effect.

While the telangiectases may occur early in life, as in my third case, as a rule they are not noticed until later, and in other cases apparently they follow the epistaxis. It is quite possible that the condition of anaemia induced thereby may be a factor in the development of the angiomota, which certainly vary a great deal in size and even in number from time to time. In Case III of my series the patient stated that the spots were always less noticeable after he had had a freedom from severe bleeding for some months. When I last saw him in January of this year the spots on his face had diminished greatly in size.

That severe bleeding may occur from a small naevus is well known. I saw an instance in a case of chronic Bright's disease in which the patient bled from a little naevus on the lip. He subsequently had diffuse purpura. Dr. William Bligh [7], of Caterham Valley, Surrey, reports the case of a man, aged thirty-two, who bled profusely from a small naevus on the left forearm. There were small spots on the neck, forehead and left wrist. On several occasions he had had severe bleedings from the tumours. Dr. Bligh has kindly sent me word that there is no trace of haemophilia in the family.

[7] *Lancet*, 1907, vol. ii.

The treatment of the condition is important. At the outset it is probable that very careful cauterization of the stellate veins in the nostrils would prevent the haemorrhage. We tried this in one of our cases, and although the patient bled very profusely afterwards, losing within twenty-four hours 1,400 c.c. of blood, it seemed, however, to do good, as he had no severe epistaxis for many months. This patient had the ingenious device of a finger of a very thin rubber glove which he inserted into the nostril, and by means of a small bit of rubber tubing he blew out the finger, turned a tap and in this way successfully plugged the nostril. Calcium chloride was used in this case very freely without, I must say, any special benefit. The most successful treatment was carried out by Dr. Coe in the case reported in this paper. Certainly, the change in the patient's appearance was remarkable. Many of the spots on the face and lips had been touched with the electric wire, and, as I mentioned, the calcium lactate was given in large doses over a prolonged period. For a year he had enjoyed excellent health and had been free from bleeding. This plan of treatment should be carried out thoroughly in all the cases.

FIG. 1.

FIG. 2.

Face, and mucous membranes of mouth. Dr. Kelly's case.

Fig. 3.—Lower part of face of Mr. C.

ON TELANGIECTASIS CIRCUMSCRIPTA UNIVER-SALIS.

By WILLIAM OSLER, M. D.

ON TELANGIECTASIS CIRCUMSCRIPTA UNIVER-
SALIS.

By WILLIAM OSLER, M. D.

For many years I have been interested in the nævi and [401]
small telangiectic spots which one sees so frequently in the
routine examination of patients. Their increase as age ad-
vances, their peculiar distribution, their temporary char-
acter in young persons, the association with cirrhosis of the
liver, the possible association with internal carcinoma, the
occasional eruptive-like outbreak in jaundice, the remark-
able hereditary form associated with epistaxis (of which I
have reported three cases)[1] the presence of the spider-nævi
in scleroderma, and their occurrence in the scar of X-ray
burns—these a.e points upon which I have dwelt over and
over again in the routine work of the wards. On January
21, 1906, while I was taking one of Dr. Barker's ward classes,
I found a patient whose case is here described, and I saw
immediately that it was a form of generalized telangiectasis
which I had never met with before. The case belongs to an
excessively rare form of the disease of which only some
fifteen or twenty cases are on record, and Dr. Barker has
very kindly allowed me to report it. The history may be
given in full:

W. J. H., age 39.—Patient complains of pain in the right side
of abdomen.

F. H.—Family history is negative. The parents are living and
well. He has no brothers nor sisters. His parents deny em-
phatically any joint or skin trouble in the family, but the mother
had urticaria when young.

P. H.—Patient has not had any infectious disease. He has
not had tonsillitis. He had attacks of " grippe " for several con-

---

[1] Johns Hopkins Hospital Bulletin, 1901, Vol. XII, 333.

secutive winters. The first, during an epidemic in Paris in 1889, was severe. In 1893-94 he had " pleurisy " though from his description one would suspect it to be lumbago. The pain was in the lumbar region, chiefly in the right side, very severe, relieved by hot packs and turpentine, in many ways resembling his present pain except that the former attack has been entirely in the back. He has believed his back to be weak and has taken gymnastic exercises. He has always been of neurotic temperament, and after 3½ years of hard work with much privation as an artist in Paris he broke down in 1893 with " nervous prostration," and for six years could work only intermittently. He thinks he has never entirely recovered.

Head.—He has had attacks of giddiness about once a week for past three years. He has considerable astigmatism which causes severe headaches relieved by glasses. Has never had any flashes of light; has never fallen; never has vertigo; no ear trouble.

Respiratory system.—No chronic cough, bronchitis, or haemoptysis.

Cardio-vascular.—During the past three months he has been rather short of breath after meals and on running up stairs. No pain around the heart.

Renal.—Not any oedema of ankles or of face. No blood in urine before present illness. The urine has been examined several times in the past few years and always found normal. No increase in frequency.

Gastro-intestinal.—No symptoms on the part of these organs; bowels always regular.

Habits.—Until six years ago he was an excessive smoker; since then moderate. Formerly a moderate drinker; now abstemious. Denies all venereal trouble.

Skin.—The skin condition has evidently not attracted much attention. The patient states he had noticed the purplish mottling only for the past ten years. His mother is sure that his [402] skin was normal when a baby and during youth and she has noticed the present condition only during the past two years. The patient says the mottling has become more intense during this time. At no time has it entirely disappeared, although more intensely colored during cold weather than in summer. During the summer of 1889 he had an attack of hives, and he gives an indefinite history of several attacks since. In November, 1905, he began to have epistaxis which has recently recurred without apparent cause and lasting about five minutes. During his attack of " nervous prostration " he was troubled with hæmorrhoids and was operated on. He has never noticed any tendency to prolonged bleeding from slight cuts. Has never had

hæmoptysis. He denies absolutely any attacks of joint pains, [402] colic, vomiting, or diarrhœa.

During the past month the patient's feet have bothered him by intense itching, so severe as to cause him to rise at night and apply a lotion. During the past two weeks patient has undergone a great deal of mental and physical exhaustion in connection with an art exhibition.

P. I. —Came on suddenly at six o'clock in the morning of January 20 (yesterday), with the passage of about a pint of bloody urine (dark red), followed by pains in the right abdomen "just below the last rib on the right side." Gradually the pain became extreme, and in ten minutes was at its height, causing the patient to double up and roll about in agony. The pain remained localized and did not radiate to the thighs or shoulder, nor was it paroxysmal. The pain lasted about twenty minutes and then gradually ceased, the patient breaking into a free perspiration. In half an hour after the onset of the pain he felt all right again, arose from bed and went about his days work (mounting and selling pictures). Last night he retired at 11.30. During the day patient passed his water three times and while it appeared dark, he did not notice that it contained blood. Last night the patient slept fairly well and did not get up to urinate. About six o'clock this morning (January 21), patient had a peculiar sensation in right abdomen, and a "presentiment of another attack." He arose from bed and passed another pint of brick-red urine, during which passage there was no pain, but immediately afterward pain came on gradually and in five minutes was extreme. A doctor was summoned who diagnosed the case appendicitis. The pain was agonizing and this time lasted five hours (until morphine was given sufficient to relieve it), and was accompanied by fever. The patient does not remember that he was short of breath during the attacks. In the first attack he had considerable nausea but was unable to vomit. In the second attack he vomited freely, especially after taking morphia. He has had no diarrhœa with the attacks. His appetite is good and he says it always has been.

Since the onset of his trouble the patient has noticed a prickly sensation in the end of his penis on urination.

Patient's mother says that the urine passed in the first attack contained blood definitely, but she is quite sure there was no blood in the urine passed before the attack on the second morning.

Fairly well nourished man. Face rather flushed; keeps eyes closed; pupils rather wide. Pulse 68, with occasional slight irregularity. Vessels well felt but not sclerotic.

Thorax.—Is symmetrical, except that right side is slightly fuller than left, and sternum deviates slightly to left. There is

a well-marked lateral curve to right in mid-dorsal region. Movements of chest are equal. Lungs clear in front.

Heart.—Apex impulse visible and palpable in fifth interspace about in mammillary line, 9.3 cm. from median line and dulness extends 3.7 cm. to right. Impulse is of moderate intensity. First sound at apex slightly prolonged, suggesting a systolic murmur. Second sound clear. Sounds are clear elsewhere. Second left or pulmonic, a little louder than second right. During examination a number of patches of urticaria have appeared. There is fairly well-marked dermatographia and where he has been blue-penciled there is urticaria, which is appearing also as wheals bordered by a wide blush over places marked for dermatographia. *Abdomen* is natural. *Liver* is not palpable or enlarged. *Spleen* is readily palpable, falling, with patient on right side, 3-4 cm. below costal margin. The tenderness previously present has now disappeared.

R. B. C...............................5,320,000
W. B. C...............................11,900
Hb. ....106 (corrected).
Coagulation time = 4 mins. (slide method).

Fresh blood cells.—Appear of good color and uniform in size and shape. Not much tendency to rouleaux formation nor crenation. Leucocytes rather numerous but no marked leucocytosis.

On January 24 I made the following note: The skin presents a very remarkable appearance. On the face there are a few spots like acne rosacea. The skin of the neck is clear. Over the trunk and the extremities are numerous dark red spots looking exactly like a fresh purpura. Their distribution is very well shown in the accompanying photographs. They are very thickly set over the chest and back and on the flexor surfaces of the forearms and inner aspects of the arms (Figs. 2 and 3). The spots vary in size from two to six millimeters in diameter, and often coalesce to form large blotches. While of a dark purplish tint, as a rule, they can be changed by rubbing to a vivid red. Everywhere on palpation the spots disappear completely, leaving a slight brownish stain. They are not raised and the color is uniform. There are no individual blood vessels seen. It is evidently a capillary dilatation. It is remarkable the difference in appearance after friction of the spots on the arm. They become of a bright red color, return instantly after pressure, while the other spots are of a dark livid hue and the blood returns very slowly. The condition of the hands

and feet is very remarkable. As seen in Fig. 1, the fingers
are cyanotic and look like the picture of Reynaud's disease.
The soles and margins of the feet and the toes have the same
deep purple color. Factitious urticaria is readily produced,
as is well shown in Fig. 4. The patient remained in hospital
until March 9. He was on a modified Weir Mitchell treat-
ment and did remarkably well. Dr. Bordley reported that
he had a slight choroiditis in the right eye. During his
stay in the hospital the patient had several severe attacks of
abdominal pain, which was relieved by acupuncture. I saw
the patient again an January 2, 1907. The skin was in
practically the same condition. Though still somewhat ner-
vous, he had kept pretty well and was able to attend to his
work. The best account I have found of this condition is in
La Practique Dermatologique, T. IV, by Brocq, under the
title of Primitive Generalized Telangiectasis. Very few
of the reported cases have had anything like the same exten-
sive distribution as in the one here described. In one
reported by Vidal[2] he calls it *Télangiectasie accidentale
symétrique et généralisée*—a female, aged 31, nervous and
hysterical; at the age of fourteen noticed the red spots appear-
ing under aspects of the forearms. They extended gradually
and appeared symmetrically on the arms, chest, neck, fingers,
the backs of the hands, and the lumbar and dorsal regions.
Before they came out she was very much troubled with a
chronic urticaria, and she had a very marked hyperæsthesia
of the skin. Levi[3] has reported two cases, the second one,
a woman, aged 33, had only 35 spots in all, which had ap-
peared in different parts of the body between 1897 and 1900.
In his first case, a woman aged 70, the spots were much
more extensive, and with a distribution very much as shown
in the photographs here given, but there was not the extreme
involvement of the feet and hands.[4]

One or two points about this case require comment. From
the statement of the mother there can be little question that

[2] Bull. d. la Soc. Méd. des Hôpitaux, 1880-81, page 186.

[3] Gaz. Hebdom., 1901, p. 13.

[4] Presse Médicale, 1896.

[403] this is an acquired, not congenital form. Everywhere it is the capillaries, not the small venules that are involved. The appearance of the back and of the arms is not unlike that seen in the most extreme grade of vasomotor mottling. The patient, Juliet D., medical number, 16254, who was in the ward G in October, 1903, had an appearance of the back and feet very similar to this patient. She was also extremely neurotic, but under treatment the mottling entirely disappeared. This is a permanent dilatation of the capillaries of localized areas. The condition of the hands and feet suggests the local asphyxia of Reynaud's disease. The skin of the soles of the feet and the toes was quite purple. The color could be changed to a vivid red by friction. In the interval of a year, which elapsed after I first saw him, no change had occurred, so that it is evidently a state of permanent ectasia of the blood vessels of the skin. Dermatographia, common enough in conditions of vasomotor instability, is seen in a marked degree in many cases of neurasthenia. Two other symptoms are of special interest in the case. The recurring attacks of colic, for which no cause could be found, may have been associated with a gastro-intestinal urticaria, that is a localized area of infiltration of the gastro-intestinal wall, such as has been shown to be responsible for the colic in the so-called Hennoch's purpura. The hæmaturia may be a form of so-called renal epistaxis, such as is met with sometimes in Reynaud's disease. Bleeding is a common event in the remarkable generalized telangiectasis of the hereditary form, and some of the cases have been described as hæmophilia. Since the report of the cases in the *Bulletin*, already referred to, I have found another family. The bleeding is usually from the nose, but it may be from the lips or mouth, only rarely from the spots on the skin.

PLATE XXXVII.

Fig. 3.

Fig. 4.

Fig. 2.

THE HISTORICAL DEVELOPMENT AND RELATIVE VALUE OF LABORATORY AND CLINICAL METHODS IN DIAGNOSIS.

THE EVOLUTION OF THE IDEA OF EXPERIMENT IN MEDICINE.

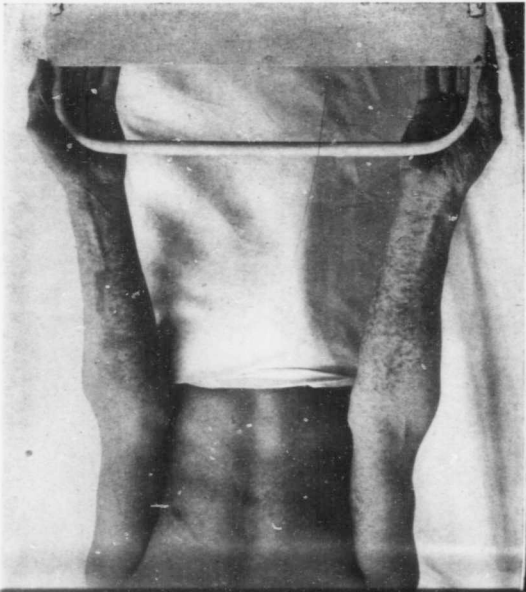BY WILLIAM OSLER, M.D.

Regius Professor of Medicine, Oxford.

THE HISTORICAL DEVELOPMENT AND RELATIVE VALUE OF LABORATORY AND CLINICAL METHODS IN DIAGNOSIS.

THE EVOLUTION OF THE IDEA OF EXPERIMENT IN MEDICINE.

BY WILLIAM OSLER, M.D.,

Regius Professor of Medicine, Oxford.

That man can interrogate as well as observe nature was a lesson slowly learned in his evolution. Of the two methods by which he can do this, the mathematical and the experimental, both have been equally fruitful—by the one he has gauged the starry heights and harnessed the cosmic forces to his will; by the other he has solved many of the problems of life and lightened many of the burdens of humanity.

Of the beginnings of experimental science we have no accurate knowledge, but the men who invented the gnomon and predicted ellipses on the plains of Mesopotamia, that mysterious Sumerian race, laid its foundation, and their knowledge became a powerful instrument in the hands of the Ionian nature-philosopher, of whom Thales is the venerable head. Great thinkers, and with magical instinct, these old Greeks had anticipations of nearly every modern discovery, but we have details of one really fundamental experiment, and that was when Pythagoras discovered the dependence of the pitch of sound on the length of the vibrating chord. "The mono-chord which he used for his experiments on the physics of sound consisted of a string stretched over a resounding board with a movable bridge, by means of which it was possible to divide the strings into different lengths, and thus to produce the various high and low notes on one and the same string."

Had the Greeks added to their genius for brilliant generalization and careful observation the capacity to design and carry out experiments, the history of European thought would have been very different, but neither Plato nor Aristotle had any conception of the value of experiment as an instrument in the progress of knowledge. Hippocrates appreciated the *fact* as an essential element more highly than any of his contemporaries, and though he had theoretical conceptions of disease, yet to him facts, as obtained by observation,

were the Alpha and Omega of the art. To seek for facts by alter-
ing the conditions which nature presented did not occur to him,
and yet it must over and over again have happened in the treatment
of fractures that he had to try new methods and devise new pro-
cedures; and to shake a man with fluid in his chest to get what we
call the Hippocratic succession was a noteworthy clinical experiment.

With the great masters of the Alexandrine school, time has dealt
hardly. Had we their complete works we should find that they
were not only the first great anatomists, but that to clinical acumen
of an extraordinary quality was added a zeal for experimentation,
which, if Celsus is to be credited, led to the vivisection of criminals.
Like his teacher, Praxagoras, Herophilus made the state of the pulse
the measure of the strength of the constitution, and timed it with
a water-clock, but both to him and to Erasistratos we owe more
anatomical and clinical than physiological observations. They
extended the Hippocratic art of observation to the dead house and
were the first to see the value of morbid anatomy.

Among the dogmatics and empirics arose the science of toxi-
cology and the study of poisons and their antidotes led to an active
cultivation of this side of experimental medicine. Not only animals,
but criminals were used to test the effects of poisons, and the art
reached its climax in antiquity in the royal student, Mithradates,
who could to-day talk intelligently with Ehrlich about immunity, in
which he had grasped two fundamental facts—the conference of
protection by gradually increasing dosage of the poison, and the
use of the blood of animals rendered immune. What an interested
visitor he would be to-day in a diphtheria antitoxine laboratory, in
which he could compare the methods in use in the horse with those
which he employed for his ducks. The name of the great king was
embalmed in the profession for nearly two thousand years in the
universal antidote, Mithradaticon, with 50 to 60 ingredients.

One man alone among the ancients could walk into the physiolog-
ical laboratories to-day and feel at home. Claudius Galen was not
a greater observer than Hippocrates, nor perhaps a greater anatomist
than Herophilus or Erasistratos, nor was he so brilliant and daring
a surgeon as Antyllus, but he stands out in our history as the first
physician who had a clear conception of medicine as a science. He
recognized that valuable as observation was, the bare fact was not
science, but only the preliminary, the first step towards that organized
grouping of facts from which principles and laws could be derived.
Not structure alone, with which anatomy is satisfied, but function,

the use of the part, was to be ascertained; not the symptom of the disease alone was to be investigated, but the cause, how it arose. In brilliant experiments upon the heart and arteries he almost demonstrated the circulation of the blood; in his work on the nervous system he anticipated the discoveries of Bell and Marshall Hall, and he laid the foundations for our knowledge of the physiology of the brain and spinal cord.

For long centuries the anatomy, the physiology, the surgery and the practice of Galen dominated the schools—Byzantine, Arabic, Salernitan all bowed in humble, slavish submission to his authority, taking from him everything but his spirit, everything but the new instrument which he had put into the hands of the profession. Valuable observations were added, and the middle ages were perhaps not as barren as we are taught to believe, but there was nowhere any attempt to take up the experimental work which had so auspiciously begun. Still a brilliant torch was lighted by the Arabians from the lamps of Aristotle and Galen, and in the first Greek Renaissance between the 8th and the 11th centuries the profession reached, among them, a position of dignity and importance to which it is hard to find a parallel in its history. The foundations of modern chemistry were laid, and many new drugs were added to the pharmacopeia, but though Rhazes was known as the experimentator, neither in his writings nor in those of other men of the Arabian school do we find any solid contribution to anatomy or physiology. Nor did the second Greek Renaissance, at the end of the 15th century, at once bring relief. Men were too busy scraping off the Arabian tarnish from the pure gold of Greek medicine, and correcting the mistakes of Galen in anatomy, to bother about disturbing his physiology or pathology. Here and there among the great anatomists of the period we read of an experiment, but it was the art of observation, the art of Hippocrates, not the science of Galen, not the carefully devised experiment to determine function, that characterized their work. There was indeed every reason why men should have been content with the physiology and pathology of that day, as from a theoretical standpoint it was excellent. The doctrine of the four humors and of the natural, animal and vital spirit afforded a ready explanation for the symptoms of all diseases, and the practice of the day was admirably adapted to the theories. There was no thought of, no desire for change. But the revival of learning awakened in men at first a suspicion and at last a conviction that the ancients had left something which could be reached by

independent research, and gradually the paralytic-like torpor passed away. Independent spirits like Paracelsus defied all academic traditions and threw the doctrines of Galen and Avicenna to the winds. But throughout the 16th century there was very little experimental work in medicine, and though Paracelsus and his followers made researches in chemistry and improved the art of pharmacy, it was still the age of the eye and the devising hand, as an instrument of the mind had not yet been called into requisition. Astronomy, which had given science the start originally, again gave it the needed stimulus, and the inventions and discoveries of Copernicus, Kepler and Galileo revived mechanical invention and experimentation in medicine. At our second Congress, you remember how graphically Dr. Weir Mitchell told the story of instrumental precision in medicine. An important part of this address was taken up with an account of Sanctorius and his construction of the thermometer and the pulsilogum of Galileo and the balance. Nothing can be added to Dr. Mitchell's account of the experimental and clinical work of Sanctorius; indeed it is the only complete account in English, and, as he pointed out, in the investigations of this Italian physician we have the beginnings of our clinical and experimental work in the physics of the circulation and respiration and in metabolism. The memory of the great investigator has not been helped by the English edition of the aphorisms, which is a feeble work, with the picture of the author in his dietetic balance, and we must turn to the originals or to Dr. Mitchell's address to appreciate that with him the science of medicine takes a new start in aiding observation with instruments of precision.

Contemporaneously with Sanctorius, Harvey was quietly working at the problem of the circulation of the blood and perfecting through a series of years his remarkable demonstrations. It is interesting that his method of work was a new departure, and showed a new spirit. We have to go back to Galen and his hemi-section of the spinal cord or to his division of the recurrent laryngial nerve for similar studies on function deliberately planned and deliberately carried out by way of experiment.

Neither Sanctorius nor Harvey had the immediate influence upon their contemporaries which the novel and stimulating character of their work justified. Harvey's great countryman, Bacon, although he lost his life in making a cold storage experiment, did not really appreciate the enormous importance of experimental science. It was a philosopher of another kidney, René Descartes, who did more

than anyone to help men to realize the value of the better way which Harvey had pointed out. That the beginning of wisdom was in doubt, not in authority, was a novel doctrine in the world, but he was no arm-chair philosopher, and his strong advocacy and practice of experimentation had a profound influence in directing man to *la nouvelle methode*. He brought the human body, the earthly machine, as he calls it, into the sphere of mechanics and physics, and he wrote the first text-book of physiology, *De l'homme*. Locke, too, became the spokesman of the new questioning spirit, and before the close of the 17th century experimental research became all the mode, and Evelyn tells us that the Merry Monarch had a laboratory and knew many of the empirical medicines. Lower, Hooke and Hales were probably more influenced by Descartes than by Harvey, and they made noteworthy contributions to experimental physiology in England. Borelli brought to the study of the action of muscles a profound knowledge of physics and mathematics and really founded the iatro-mathematical school.

Modern experimental chemistry had its origin in the alchemy of the Arabians, and we can trace its progress through Basil, Valentine, Paracelsus, van Helmont, Boyle and Sylvius. Mayow, in a brilliant series of researches, solved the problem of combustion, and demonstrated the essential part played in respiration by the nitro-aerial part (the oxygen as we now know it) of the air. * * * *

In the latter half of the eighteenth century experimental science received an enormous impetus through the work of two men. Spallanzani demonstrated the chemical nature of the digestive process, and from him dates our modern science of reproduction. In John Hunter there met a rare triple combination—powers of observation which in width and acuteness have rarely been equalled, a perfect genius for experimentation, and such a philosophic grasp of the problems of disease as enabled him to raise pathology into a science. To his student and friend, Edward Jenner, we owe the great experiments from which date our practical work on immunity.

In the beginning of the last century the art of observation, the great instrument of Hippocrates, found the full development in the hands of the French school, by which the diagnosis of disease was put upon a sound basis, while in the forties the keen eyes of Virchow revealed to us for the first time the true seats of disease. The work of Bichat, of Laennec, of Louis, and the monumental studies of the great Berlin pathologist, illustrated what the rigid inductive method

could accomplish by minds freed from all dominating theories under the control of the law of facts, and no longer trafficking in hypotheses. But the century was well advanced before the profession realized the full worth of the method of Galen, of Harvey and of Hunter. How slow we were to appreciate this is illustrated by what Helmholtz tells of the celebrated professor of physiology in the fifties, who, asked to see an experiment in optics, said, "A physiologist has nothing to do with experiments, though they might be well enough for a physicist!" The last half of the century may be called the era of experimental medicine, and the truly prodigious results have been along three lines—the discovery of the functions of organs, the discovery of the causes of disease and the discovery of new methods of treatment. A single generation, indeed, has witnessed a complete readjustment of our outlook on physiology, pathology and practice, and all this has come from a recognition that experiment is the very basis of science. Much has been done, but when we look ahead at what remains we see that only a beginning has been made, and there is not a department in practical medicine in which there are not innumerable problems of the first rank awaiting solution. And every new advance in physiology demands from the pathologist and clinician a change of view and a reopening of old questions believed to be settled. Such work as that of Starling's on the correlation of secretions has already opened a new field for observation and research. With the advances in physics and chemistry it becomes increasingly difficult to find men with the training necessary to attack intelligently these complicated problems. We need in association with all our large hospitals clinical laboratories in charge of men who will be selected to do this work by directors who are themselves thinkers as well as workers. For often all the essence of a successful experiment is the thought that precedes it. *Deviner avant de démonstrator* must be the motto of every experimental investigator. We must have clinicians who keep in close touch with physiology, pathology and chemistry, and who are prepared to transfer to the wards through proper channels the knowledge of the laboratory. The organized medical clinic is a clearinghouse for the scientific traders who are doing business in all parts of the body corporate, and the application of new facts to medicine must come through it, or through that small but happily increasing group of men who find time amid the daily cares of practice. One thing is certain; we clinicians must go to the physiologists, the pathologists and the chemists—they no longer come to us. To our

irreparable loss these sciences have become so complicated and demand such life-long devotion that no longer do physiologists, like Hunter, Bowman and Lister, become surgeons, chemists, like Prout and Bence-Jones, clinicians, and saddest of all, the chair of pathology is no longer a stepping-stone to the chair of medicine. The new conditions must be met if progress is to be maintained. In every country there will be found strong men, like Weir Mitchell, Mackenzie of Barnley, and Meltzer and Christian Herter, who find it possible to combine experimental work with practice, but we must recognize the pressing need of organization if internal medicine is to keep in close touch with the rapid advancement of the sciences. A glance at the program of the Association of American Physicians' meeting indicates the dominance of experiment at the present day.

To each one of us life is an experiment in Nature's laboratory, and she tests and tries us in a thousand ways, using and improving us if we serve her turn, ruthlessly dispensing with us if we do not. Disease is an experiment, and the earthly machine is a culture medium, a test tube and a retort—the external agents, the medium and the reaction constituting the factors. We constantly experiment with ourselves in food and drink, and the expression so often on our lips, "Does it agree with you?" signifies how tentative are many of our daily actions. The treatment of disease has always been experimental, and started indeed in those haphazard endeavors of friends and relatives to try something to help the sufferer. Each dose of medicine given is an experiment, as it is impossible to predict in every instance what the result may be. Thousands of five-grain doses of iodide of potassium may be given without ill effect, and then conditions are met with in which the patient reacts with an outbreak of purpura, or a fatal result may follow. A deviation from what we had regarded as a settled rule, a break in a sequence thought to be invariable, emphasizes the impossibility of framing general rules for the body of the same rigid applicability as in physics and mechanics. The limits of justifiable experimentation upon our fellow creatures are well and clearly defined. The final test of every new procedure, medical or surgical, must be made on man, but never before it has been tried on animals. There are those who look upon this as unlawful, but in no other way is progress possible, nor could we have had many of our most useful but very powerful drugs if animal experimentation had been forbidden. For man absolute safety and full consent are the conditions which

make such tests allowable. We have no right to use patients entrusted to our care for the purpose of experimentation unless direct benefit to the individual is likely to follow. Once this limit is transgressed, the sacred cord which binds physician and patient snaps instantly. Risk to the individual may be taken with his consent and full knowledge of the circumstances, as has been done in scores of cases, and we cannot honor too highly the bravery of such men as the soldiers who voluntarily submitted to the experiments on yellow fever in Cuba under the direction of Reed and Carroll. The history of our profession is starred with the heroism of its members who have sacrificed health and sometimes life itself in endeavors to benefit their fellow creatures. Enthusiasm for science has, in a few instances, led to regrettable transgressions of the rule I have mentioned, but these are mere specks which in no wise blur the brightness of the picture—one of the brightest in the history of human effort—which portrays the incalculable benefits to man from the introduction of experimentation into the art of medicine.

271

ON OCHRONOSIS

REPORT OF A CASE

By EDGAR REID, M.R.C.S., L.R.C.P., Assistant Surgeon
Swansea Hospital.

THE CLINICAL FEATURES

By WILLIAM OSLER, M.D., F.R.S.

THE URINE

By A. E. GARROD, M.D.

With Plate 32.

OCHRONOSIS is an affection of such extreme rarity that no apology is needed
for calling attention to the following case:—

Mrs. T., widow, aet. 67, was admitted to the Swansea Hospital, on June 15,
1907, complaining of a large ulcer on each leg; she showed patches of dark
pigmentation in the eyes and ears, and had been passing urine of a black colour.
These symptoms were recognized to correspond with those presented by the
patient who came under Dr. Pope's care in Leicester Infirmary in 1895: an
excellent report of that case, with coloured plates, appeared in the *Lancet* of
Jan. 6, 1906, and was reproduced in the *Medical Annual* of 1907.

Family and personal history. No similar condition is known to have
existed in any of her relatives. She has borne five children. She has never
been troubled with varicose veins or bad legs during her pregnancies. With the
exception of her ulcered legs she has always considered herself a strong and
healthy woman.

About thirty years ago, and some few years after her last confinement, she
was admitted to the Swansea Hospital under the care of Dr. Latimer, suffering
from large ulcers of the legs. They healed in a few weeks' time, but shortly after-
wards broke down again. The ulcers spread, became very painful, and have
never since shown any signs of healing. Carbolic oil (1 in 20) was found to
give greater relief from pain than any other of the many applications that she
tried, so that for nearly thirty years she has applied strong carbolic dressings
twice daily to raw surfaces of some considerable extent.

Six years ago she first noticed that the whites of her eyes and her ears
were turning black. For about eighteen months before admission she noticed

that her urine was occasionally black. At times it was passed quite black 'like soot', at other times it only turned black some hours afterwards.

During this period the urine was, she thinks, of a natural colour more often than it was dark. She noticed nothing unusual in regard to the amount or the frequency of micturition.

Condition on admission.

The skin of the face, neck and hands has a decidedly sallow tint compared with the covered parts of the body. There is a small naevus on the lower lip. There is a small patch of xanthoma on each upper eyelid.

Eyes. There are two patches of pigmentation in each eye situated laterally in the sclerotic midway between the corneal margin and the inner and outer canthus when the eyes look straight ahead. Each patch has irregular edges and is circumscribed by a zone of normal sclerotic. There are prominent blood vessels running laterally from the periphery of the globe to each pigmented area. The pigment varies in colour from a blue-black at the circumference to a brown-black in the central parts (the colour here being evidently due to the freer vascularization). The portions of the globe above and below the cornea are quite free from staining and are of that transparent bluish colour often seen in old age.

The ears. Both ears show a large area of pigmentation which, seen from the front, involves the conchar concavity of the antihelix, leaving the tragus lobule and helix free. The colour is a deep slate-blue, especially dark at the prominent ridges which border the concha. The staining of the left ear shows this posteriorly. The skin is not involved, the pigment evidently lying in the cartilages.

The hands. The extensor tendons, as they pass subcutaneously over the metacarpo-phalangeal joints are of the same venous blue colour as the surrounding superficial veins. With clenched fist the knuckles show just a suspicion of blue. There are small varicosities of the vessels about the palmar surface of the fingers.

The feet. No pigmentation is to be seen. The cartilage of the nose is not stained. The ribs are too well covered to be seen. There is no staining around any of the large joints. Her muscles are soft and her gait unsteady owing to her long residence in bed. The reflexes are normal.

At the lower and middle third of each leg there is a large ulcer some 5 or 6 inches long, on the left side completely surrounding the limb, but on the right leaving a small bridge of skin posteriorly. Each ulcer is shallow, the edges look healthy and clean cut and are neither undermined nor unduly prominent. The surface is an angry red covered with small sharp granulations, there is little discharge and no offensive odour. The ulcers bleed readily and are acutely painful to pressure.

Urine. On admission a careful examination was made by Dr. Florence Price. Sp. gr. 1010, pale amber, acid; no albumin or sugar; no blood, pus,

or other deposit. A microscopic examination of the centrifugalized deposit showed a few squamous epithelial cells, white corpuscles, and amorphous urates. The urine did not change colour on addition of alkalies or after standing for 48 hours.

The urine has been carefully watched daily for more than 5 months with only negative results, no discoloration or other abnormalities have occurred, the specific gravity has varied between 1010 and 1024, the most constant figure being 1020.

Shortly before admission, when she first came under my care, I made a hasty and superficial examination of a specimen of her urine. It was of a dirty black colour with no suspicion of green, it became darker on standing and contained a substance which with heat reduced the copper of Fehling's solution. Unfortunately a more careful analysis was postponed until I could avail myself of the facilities afforded by a hospital ward, a delay which I have had ample cause to regret. For, as I have already pointed out, the urine has, since her admission on June 15, displayed no pathological changes and this in spite of every attempt we have made to place our patient under conditions precisely similar to those prevailing at her own home. The strength of the carbolic oil has been increased from 1 in 20 to 1 in 15, and for a time the dressing was procured from the same source as she had herself obtained it for very many years.

At the time of writing these notes, i.e. five months after her admission to hospital, there is a noticeable improvement in the colour of her face; the sallow tint has to a great extent disappeared, the staining of the ears is certainly less intense, and there is some diminution in the pigmentation of her eyes. The carbolic dressings have been continued, and the ulcers are steadily healing, so that now the absorbing raw surface is barely half what it was. The patient is bright and cheerful, and expresses herself as feeling quite well.

Summary. The fact that the last three cases reported, viz., Pope's (1), L. Pick's (2), and the present case, each have a history of many years' association with carbolic acid; makes it impossible to deny that the staining of cartilage and fibrous tissue typical of ochronosis can be produced by the absorption of phenol in small, but long-continued doses. This assumption is further strengthened by the fact that in this patient the staining of skin and other parts has obviously decreased as the ulcers have healed, and the absorption of the carbolic diminished in quantity.

Another point of interest is that the pigmentation has selected those parts of the body exposed to light—thus the hands, face, and neck alone are of a dusky hue; the cartilage of the ears is affected, while that of the nose escapes; the sclerotics are stained only in the more exposed parts; the extensor sheaths of the hands are stained, while those of the feet are free of pigment.

I can think of nothing to explain the abrupt manner in which this patient, on admission to hospital, ceased to pass the dark urine; the fact is interesting, but none the less deplorable from a scientific point of view. Dr. Garrod,

however, has analysed the urine from time to time, and he is able to assert that the specimens give ample evidence of a slight carboluria, although insufficient to reduce the copper in Fehling's solution, or to show the ordinary tests for hydroquinone.

Our thanks are due to Prof. Osler, who saw the case at the hospital, and Dr. Garrod for the great personal interest they have taken in this patient, and for their kindness in adding the following notes. I am indebted to Mr. H. A. Chapman, of Swansea, for the picture from which the accompanying plate has been produced.

THE CLINICAL FEATURES OF OCHRONOSIS.

In a majority of the cases there are no symptoms directly associated with the staining of the cartilages and fibrous tissues. There is nothing in the anomaly of nutrition which either impairs health or shortens life. The three things for which patients consult a medical man are, the condition of the urine, which easily excites attention, the disfiguring pigmentation of the face and ears, and the associated arthritis.

In the alkaptonuric group the presence of a *copper-reducing substance in the urine* has not infrequently led to the diagnosis of diabetes. This was the case in two members of the Maryland family which I have described (3). One brother was the first case of alkaptonuria recognized in the United States. He had applied for a Life Insurance, and Dr. Barton Brune determined the presence of a copper-reducing substance in the urine. For a time he was supposed to have diabetes, but in conjunction with Professor Marshall, of the University of Pennsylvania, Dr. Brune worked out the nature of the substance in the urine, and the man was accepted as a good life. The brother, whose case I have reported fully, had been an active politician and business man, and in the year 1894, came to Europe for a prolonged rest. He had cardiac arrhythmia, and his Paris physician found a copper-reducing substance in the urine, and told him he had diabetes. He took the Carlsbad cure, and subsequently came under the care of a Berlin physician. He became very much worried over his condition as the supposed diabetes persisted. He was referred to me by his London physician. At first I, too, had no doubt at all as to the question of a glycosuria, but in a short time Dr. Futcher determined that the case was one of alkaptonuria. Now that the knowledge of this condition is so much more widely diffused, there is not the same likelihood that this mistake will be repeated.

In the group of cases with carboluria, to which Dr. Reid's patient belongs, there is still less chance of mistake now that we recognize that ochronosis may be present.

The pigmentation. This it is which gives the characteristic feature to ochronosis, and it was the blackening of the cartilages that suggested to Virchow the name. We now know that it is not only in alkaptonuria that this pigmentation may occur, as in the case here reported it has been associated with carboluria. The staining is very widely diffused, involving all the fibro-cartilaginous structures, and even the coats of the arteries and the endocardium. Clinically, the pigmentation is evident in the sclerotics, the skin, and in the thinner external cartilages and tendons.

The pigmentation of the eyes is very characteristic, and is very well shown in the annexed plate. The staining is in the sclerotic, in the exposed portion, in either a semilunar or a v-shaped patch on either side. In none of the cases has all of the exposed sclerotic been involved, but there has been a clear part between the corneal margin, and another between the pigmentation and the inner or outer canthus. In one of my cases, under observation for nearly ten years, there was a progressive increase in the extent of the pigmentation, but here, too, it has not involved all of the exposed parts. In one instance there was a small patch beneath the upper eyelid. In another there was slight staining at the margin of the cornea. The colour varies from a deep brown to a jet black.

This type of pigmentation of the eyeball is almost pathognomonic of ochronosis. It differs from the pigmentation of the conjunctiva seen in the negro, and occasionally in Addison's Disease. Moreover, in all the reported cases it has, I believe, been symmetrical. A local spot of pigmentation is occasionally met with on the sclerotic without any obvious cause. Such an instance I saw in a young girl of eighteen or nineteen, to whom the spot of jet black pigment in the sclerotic on the outer side of the left eye was a source of great annoyance.

Pigmentation of the skin. In only a few cases of ochronosis has the skin been affected. In Dr. Reid's case here reported there is no involvement. In one brother of the Maryland family the skin presented a very remarkable appearance. Over the nose and cheeks, in a distribution very like that of lupus erythematosus, the skin had a coal-black colour. I thought at first that it might be due to comedones, very thickly set together, but I soon found that it was an intense melanosis of the skin itself. The line of pigmentation over the nose was narrow, and then widened as it passed to the cheeks and extended over the malar bones and along the zygomata. The extent of the staining has increased within the last few years. There was no thickening of the skin, which could be picked up easily. He has also at present, Dr. Futcher tells me, a commencing pigmentation of the back of the hands. The character is very remarkable, quite unlike any ordinary pigmentation, either the brown discoloration of Addison's Disease, or the steel-grey staining of argyria. It is like a pure melanosis, just as if a patch of the blackest negro skin had been inserted. Neither this man's brother, nor sister, nor son, all of whom had alkaptonuria, presented any change in the skin. The extent to which the

pigmentation may occur in the cases associated with chronic carboluria is well illustrated in the case reported by Dr. Pope. The face was uniformly pigmented, and of a deeper colour than the deepest Addison's Disease. While the face was chiefly involved, there was also staining of the hands, particularly the palmar surfaces.

Even when widespread, the staining of the cartilages and fibrous tissues is only visible in certain situations. By far the most characteristic, and in a situation that at once attracts attention, is the pigmentation of the ears. This is very well shown in the plate in Dr. Reid's case. The staining is of a blue-black or leaden colour, very like that produced by dilated veins. It is deepest in the concha, and extends along the antihelix. In certain positions, and when the light falls into the ears, the colour is very striking. It was present in three of the four alkaptonurics in the Maryland family. It also occurred in Dr. Ogden's patient in Milwaukee. I have not noticed the pigmentation of the cartilage of the nose or of the larynx, nor of the eyelids, though these are situations in which it should readily be seen in advanced cases. The staining of the fibrous tissues and tendons is best seen about the knuckles, the knees, and the tendons of the feet. When the patient makes a fist, the knuckles stand out a steel-grey colour, and the same tint may be seen along the tendons.

Arthritis. Four or five of the reported cases have had chronic arthritis. The two brothers of the Maryland family also had for years irregular joint troubles, but the most remarkable feature was the gait, characterized by a slight bend or incline forward of the trunk, and a curious waddle in walking, a sort of 'goose gait'. With this I could never determine any definite lesion of the hip joint itself. The cases reported, which have been tabulated by Pope (1), show that the patients have been the victims of a variety of maladies, particularly tuberculosis, arterio-sclerosis, heart disease, and, in the carboluria cases, chronic ulcer, treated for a period of many years with carbolic acid lotions. A full discussion of the relation of ochronosis to alkaptonuria and other conditions will be found in L. Pick's papers in the *Berliner Klinische Wochenschrift,* 1906, and is considered in this number by Dr. Garrod.

THE URINE IN OCHRONOSIS.

In the appearance of the affected tissues, and in the distribution of the staining, cases of ochronosis resemble each other very closely, but they differ widely as regards the presence of abnormal pigment in the urine; so much so indeed, that the conclusion can hardly be avoided that even the few recorded examples of this very rare condition fall into distinct groups, and that the blackening of the cartilages and other tissues, which constitutes ochronosis, may result from several different causes.

It must be confessed that our knowledge of the urinary changes is still

so imperfec
merely suff
future case:
Now t
sclerotics a
structures,
time of th
examination
at a post-
examination
In the
of any pecu
no pigment
In nin
or of urine v
intermittent
alkaptonuri
been verifie
visible pign
practically
Pick, a diag
out at the a
In two
post-morten
uries, althou
selves comp
available fo
urine blacke
moniacal sil
acid was c
after death,
small a spec
of the acid
in a discuss
1907), only
everything
ance of a br
of cuprous
is in my exp
darkening
action of th
Clemen
analytical r
had homog

so imperfect that no definite statements are yet warranted. The known facts merely suffice to indicate profitable lines of investigation to be followed in future cases.

Now that the recognition of the characteristic pigmentation of the ears, sclerotics and skin, which usually accompanies the blackening of the deeper structures, has rendered possible the recognition of ochronosis during the life-time of the patients, far better opportunities are afforded for a systematic examination of the urine, than when the diagnosis could only be established at a post-mortem examination; and we may reasonably hope that such an examination will be carried out in any suspected case.

In the accounts of some of the recorded examples (4, 5, 6), no mention is made of any peculiarity of the urine, and we may infer that in these cases there was no pigmentary anomaly sufficiently obvious to attract attention.

In nine cases, including that here recorded, the excretion of dark urine, or of urine which became black on standing, has been described as a continuous or intermittent phenomenon. Three of these were well authenticated cases of alkaptonuria, and although in none of them has the staining of the cartilages been verified post-mortem, the identity in character and distribution of the visible pigmentation with that observed in verified cases of ochronosis leaves practically no doubt as to their nature; especially as in a case recorded by Pick, a diagnosis made during life, on precisely similar grounds, was fully borne out at the autopsy.

In two other cases in which the cartilages showed the ochronotic staining post-mortem, there was strong reason to suspect that the patients were alkapton-urics, although the authors who described them were unable to satisfy them-selves completely on this point. In both instances the quantities of urine available for chemical investigation were very small. In Albrecht's case (7), the urine blackened on standing, reduced Fehling's solution, and also reduced am-moniacal silver nitrate solution in the cold. Zdarek's (8) search for homogentisic acid was carried out upon only 20 c.c. of urine removed from the bladder after death, and his failure to obtain crystalline lead homogentisate from so small a specimen does not appear to me to afford conclusive evidence of absence of the acid in question. In Clemens's case (9), which is very briefly reported in a discussion at the Congress für innere Medicin at its last meeting (April, 1907), only half a litre of urine was available, as the moribund patient passed everything under him. The behaviour with Trommer's test, viz., the appear-ance of a brown colour even before heating, and independently of the separation of cuprous oxide, which Clemens regarded as unlike that of an alkapton urine, is in my experience a constant appearance with such urines, as also is a distinct darkening with Nylander's test, not due to reduction of bismuth, but to the action of the hot alkaline reagent upon homogentisic acid.

Clemens obtained a crystalline lead salt of an abnormal acid, but his analytical results were not such as were to be expected if the product were lead homogentisate. Nevertheless, it is at least possible that further investi-

gation, had more urine been available, might have shown that this was really a case of alkaptonuria.

However, the possibility cannot be wholly excluded that under certain conditions urine is excreted which closely resembles alkapton urine in its properties, but in which the abnormal ingredient is not homogentisic acid, but some closely allied substance. Both Albrecht's and Clemens's patients were in the last stage of tubercular disease.

Von Moraczewski has described a case of alkaptonuria which apparently developed towards the end of life in a patient dying of tubercular disease. A lead salt was obtained from the urine, and the acid isolated therefrom had the correct melting point of homogentisic acid. In the record of the autopsy, no mention occurs of blackening of the cartilages, which could not have escaped notice if present. Fürbringer also described the autopsy on an alkaptonuric and, here again, no mention is made of pigmentation of the cartilages.

It will be seen, then, that of 14 cases of ochronosis recorded, three have occurred in well authenticated alkaptonurics, and in two others alkaptonuria was strongly suspected. In no case of unquestionable alkaptonuria has the blackening of the cartilages yet been demonstrated post-mortem, for in the two cases in which such demonstration was possible, the presence of alkaptonuria was not established beyond possibility of doubt. Nevertheless, in spite of the difficulty of explaining the oxidation of homogentisic acid within the tissues, it can hardly be doubted that alkaptonuria is a cause of ochronosis, although it seems certain that it is not the only cause.

In three other cases, excluding the present one, black urine was passed over long periods, but all the evidence available points to there not having been cases of alkaptonuria. In Hansemann's case (10) there was a history of the excretion of black urine for no less than eighteen years. Salkowski, who examined the fresh urine, found that it gave none of the reactions of melanuria, and Langstein (11), who only had the opportunity of examining a specimen which had been kept for some years, could find no evidence of the presence of homogentisic acid, and considered that alkaptonuria could be definitely excluded. He anticipated the objection that during the long keeping the homogentisic acid might have been destroyed, but I may mention that I was able to recover this acid from some specimens of alkapton urine which had been kept for eight years, which were perfectly black, and alkaline in reaction.

In Hecker and Wolf's case (12) dark urine had been passed at intervals for eleven years. The urine varied in colour, and darkened on standing, but only specimens which had a brown tint when passed became actually black. Addition of ferric chloride caused immediate blackening, just as with true melanuria, and other oxidizing agents produced a similar effect. The urine did not reduce Fehling's solution, and alkaptonuria was obviously excluded. This is the only instance in which the dark urine associated with ochronosis has been shown to give the characteristic reactions of melanuria. In cases of melanotic sarcoma with melanuria, pigmentation of the cartilages has not been

met with, but in such cases the period during which melanogen is circulating in the blood is usually short.

The two remaining cases appear to form with the case here described a definite group. In all three instances ulcers on the leg had been treated for many years by the application of strong solutions of carbolic acid, and it is difficult to avoid the conclusion that this was the actual determining cause of the ochronosis.

In Pope's case the ulcer had existed for twelve years. The surface pigmentation was extreme as the picture of the patient well shows. The urine was almost black, gave a dark brown precipitate with liquor ferri perchloridi and a slight white precipitate with bromine water. No sugar or other copper-reducing substance was present. The colour varied in intensity, and was attributed at the time to carboluria.

Pick, whose case resembled Pope's so closely that the picture of the one patient might be taken as a representation of the other, attributes the ochronosis in both to the application of carbolic acid, but the urine in his case showed no darkening, and Langstein (13), who examined it, was able to exclude both melanuria and alkaptonuria.

In attributing the ochronosis in these cases to a mild form of carbolic acid poisoning, with the circulation for years of small amounts of phenol and its derivatives, Pick does not suggest that the cartilage pigmentation was due to hydroquinone derivatives themselves, but to melanin formed from such substances by the action of a tyrosinase.

It is unfortunate that in the present case the blackening of the urine, which had previously been present, was wholly absent during the patient's stay in hospital, but it is a suggestive fact that it ceased with the discontinuance of the carbolic application. No sufficient evidence is forthcoming as to the nature of the pigmentation, but at that time the urine had a slight reducing action, as in carboluria. A specimen passed in hospital which I had opportunities of examining, did not darken on standing, even when ammoniacal decomposition had set in. All the reactions of melanin and of alkapton urines were wholly wanting. Dilute ferric chloride solution gave neither the transient blue colour of alkaptonuria, nor the blackening of melanuria. The urine did not reduce Fehling's solution. In a second specimen sent after the carbolic application had been resumed, but when the ulcers on the leg were nearly healed, the aromatic sulphates amounted to over 85% of the total sulphates, and the urine had a slight smoky tint.

It will be seen from the above summary that whereas the nature and origin of the urinary pigmentation in some cases of ochronosis remains obscure, there is good reason to believe that in one group of cases the ochronosis is due to the metabolic error which is known as alkaptonuria, and in another has its origin in the local application of carbolic acid extending over many years.

REFERENCES.

1. F. M. Pope, *Lancet*, Lond., 1906, vol. 1, p. 24.
2. L. Pick, *Berliner klin. Wochenschr.*, 1906, vol. 43, pp. 478, 509, 556, 591.
3. W. Osler, *Lancet*, Lond., 1904, vol. 1, p. 10.
4. R. Virchow, *Virchow's Archiv*, Berlin, 1866, vol. 37, p. 212.
5. E. Bostroem, *Festschrift zu R. Virchow's 70jähr. Geburtstag*, Berlin, 1891, Bd. ? vol. 29, p. 177.
6. Heile, *Virchow's Archiv*, Berlin, 1900, vol. 160, p. 148 (2 cases).
7. H. Albrecht, *Zeitschr. f. Heilkunde*, Berlin, 1902, vol. 23, p. 366.
8. Zdarek, *Ibid.* p. 379.
9. Clemens, *Verhandlungen des Cong. f. innere Med.*, Wiesbaden, 1907, vol. 24, p. 249.
10. v. Hansemann, *Berliner klin. Wochenschr.*, 1892, vol. 29, p. 660.
11. Langstein, *Hofmeisters Beiträge*, Brunswick, 1903, vol. 4, p. 145.
12. Hecker und Wolf, *Festschrift zur Feier d. 50jährigen Bestehens des Stadtkrankenhauses zu Dresden-Friedrichstadt*, 1899, p. 325.
13. L. Langstein, *Berliner klin. Wochenschr.*, 1906, vol. 43, p. 597.

PLATE 32.

Case of ochronosis showing pigmentation of the sclerotics and the cartilages of the ears.

A Clinical Lecture

ON

ERYTHRÆMIA

(POLYCYTHÆMIA WITH CYANOSIS, MALADIE
DE VAQUEZ)

Delivered in the Radcliffe Infirmary, Oxford, on November 28, 1907

BY

WILLIAM OSLER, M.D., F.R.S.

REGIUS PROFESSOR OF MEDICINE, UNIVERSITY OF OXFORD.

A Clinical Lecture

ON

ERYTHRÆMIA

(POLYCYTHÆMIA WITH CYANOSIS, MALADIE DE VAQUEZ)

Delivered in the Radcliffe Infirmary, Oxford, on November 28, 1907

BY

WILLIAM OSLER, M.D., F.R.S.

REGIUS PROFESSOR OF MEDICINE, UNIVERSITY OF OXFORD.

A Clinical Lecture

ON

ERYTHRÆMIA

(POLYCYTHÆMIA WITH CYANOSIS, MALADIE DE VAQUEZ).

GENTLEMEN,—It is interesting to follow the stages in the recognition of a new disease. Very rarely does it happen that at all points the description is so complete as at once to gain universal acceptance. Albuminous urine and its association with dropsy had been noted before Bright studied the changes in the kidneys and drew with a master hand the picture of the disease which we now know so well. Complete as was Addison's monograph it took a good many years before we recognised fully the relation of the suprarenal bodies to the disease that now bears his name. The original description of simultaneous disease of lymph glands and spleen by the distinguished old Quaker physician, Hodgkin, had not attracted any more attention than had his equally remarkable contribution on insufficiency of the aortic valves (which antedated by several years Corrigan's account), until Wilks, the "grand old man" to-day of British medicine, drew attention to the condition. And so it was with myxœdema, which was well known for years in England before our continental brethren recognised its existence. First a case here and there is reported as something unusual; in a year or two someone collects them and emphasises the clinical features and perhaps names the disease. Then in rapid succession new cases are reported and we are surprised to find that it is by no means uncommon. This has been the history of a very remarkable malady of which the patient before you is the subject.

In 1892 Vaquez, a Paris physician, well known for his researches on the pathology of the blood, described a condition of hyperglobulism with cyanosis, which he believed to be due to an over-activity of the blood-forming organs. Then in 1899 Cabot of Boston reported a case and a second in the following year, and McKeen another Boston case. In reporting a fifth case Saundby and Russell seem to have been the

first to realise that the condition was a "definite clinical entity and one which was new to medical science." In 1901 I had become greatly interested in the question, having under observation a case of chronic cyanosis with a very high blood count. Then in quick succession I saw two other cases and these formed the basis of a paper [1] in which I brought forward the available evidence in favour of the view that we had to deal here with a new disease. In the following year I returned to the question and was able to summarise 17 cases.[2] Within the past three years the litera-ture on the subject has grown apace. From almost every country cases have been reported. The Index Medicus for 1906 has 12 references to papers, while in the numbers for this year to date there are 17. Papers of great value have been published by Türk of Vienna, Weintraud of Wies-baden, Bence of Budapest, Senator of Berlin, Parkes Weber, Robert Hutchison, Watson and Saundby in this country, and by Engelback and Brown and by Howard Anders in the United States. There are now at least 70 cases on record, which indicates that we are dealing with a fairly common affection and one which, like myxoedema, only requires to be known to be recognised.

The patient before you illustrates in a typical way the features of the disease. We are much indebted to Dr. E. Morton, of Woodstock, who brought her in and to Dr. W. P. Richardson of Blisworth, Northampton, who has arranged for her to return for a more careful study. A married woman, aged 54 years, with five children, she has had all her life exceedingly good health. For the past three years she has not been so well, suffering with pains in the hands and feet, which a medical man whom she consulted called neuritis. She has been able to attend to her work, but of late years has lost somewhat in strength. She has not been short of breath and she has not had headaches. About a year ago she noticed that the abdomen was swollen. For some time she has known that her face has changed in colour. It is darker and in the cold becomes intensely blue. The hands and feet, too, have become blue, particularly the feet and legs after she has been walking about, and they are at times painful. Altogether, the history presents very few points of moment and the condition has come on insidiously in a very healthy woman. When admitted the cyanosis was extremely marked and the house physician, Dr. J. W. S. Macfie, an old pupil of Dr. G. A. Gibson of Edinburgh, and who naturally knows all about cyanosis, immediately made a blood count and had the diagnosis of the new disease ready for us.

The patient's appearance at once attracts attention. The face has a dusky hue and the lips a purple tint; she rests quietly without dyspnœa and with the head low. Over the cheeks and nose there are numerous small distended venules.

[1] American Journal of the Medical Sciences, 1903.
[2] Brit. Med. Jour., Jan. 16th, 1904.

The conjunctivæ are not suffused ; the tongue is of a deep,
purplish-red colour. The hands and feet are very much
cyanosed, though not so deeply as they were on admission.
She tells us that after very slight exposure to cold they
become livid. One remarkable circumstance is the degree
of vaso-motor instability. If the hand of a healthy person is
held down for a little while there is a slight and perceptible
change in colour, but it does not become actually cyanosed
unless, perhaps, in cold weather. Usually, however, a
marked difference in colour is noticed and when held up
above the head the skin gradually becomes pale again. You
can see the change, for instance, in a normal hand in a
very few seconds. When this patient holds the hand down
within 30 seconds the veins become turgid and full and the
skin of a deep-blue colour ; held up the blood rapidly
leaves the hand and it becomes pale. The effect of posture
is still more striking in the feet. If she sits on the edge of
the bed for a few minutes the legs, as high as the knees,
become purple. One can almost see the blood drop into
them. When she returns to bed and the leg is held up the
blood very quickly runs out and the skin becomes pale. Over
the general surface of the body there is a dusky tint which is
best seen by pressing the hand firmly upon the skin of the
abdomen or the back. The anæmic impression remains for
some seconds and is very slowly obliterated. Another feature
of interest about the skin—when a series of lines are drawn
with a sharp edge the usual reaction is hyperæmic (which
from its intensity in some conditions of the nervous system
has been called the *tache cérébrale*), the result of a vaso-
dilator action. But here just the opposite takes place.
Along the line of irritation there is a vaso-constrictor action
in the small arterioles and the lines stand out as bands of
anæmia, in this instance of unusual width, fully four milli-
metres on each side of the line.[3]

The second feature of importance relates to the abdomen,
the skin of which is relaxed and scarred, and to the left of
the umbilicus there is a marked prominence. On palpation
this is easily made out to be a greatly enlarged spleen ;
the edge is just at the navel but to the left it extends
fully four fingers' breadth below this level. Into the
left flank the edge may be readily traced, where it is
two fingers' breadth above the anterior superior spine of
the ilium. A notch is readily palpable and when grasped in
the two hands the whole organ is freely moveable. The flat-
ness on percussion extends as high as the eighth rib. The
liver is not enlarged and there is nothing else of any moment

[3] This "white line," one of the most interesting manifestations of
what S. Solis-Cohen calls vaso-motor ataxia, is met with: (1) in many
normal persons; (2) in hysteria and neurasthenia ; and (3) in conditions
of cutaneous irritations when dermatographia may be produced. It
may come out and persist as a white line; transient hyperæmia may
precede it, active hyperæmia may follow it, or occasionally factitious
urticaria. Recent French writers have suggested its association with
adrenal insufficiency.

in the abdomen. Except for the cyanosis and the dilatation of the superficial veins there is nothing of special moment in the circulatory system. The apex of the heart is tilted into the fourth interspace, but the organ is not enlarged. The sounds are clear at the apex and base and there is no special accentuation of the aortic second sound. The pulse is 96 and the blood pressure is 118. The superficial arteries are just palpable. There are numerous petechiæ scattered over the skin of the legs. The examination of the lungs is negative. There is no emphysema. The third point of special interest is in the examination of the blood, which flows in a large drop from finger or ear when pricked, and is sensibly richer in colour than normal and the drop is unusually viscid. A number of counts have been made which show the red blood corpuscles to range from 9,200,000 to 9,710,000 per cubic millimetre; the leucocytes are about 24,000 per cubic millimetre and the hæmoglobin from 130 to 160. The red blood corpuscles look normal; the average diameter is 7·5 microns. There are a few poikilocytes. The most striking feature is the presence of a number of nucleated red blood corpuscles of all forms. A differential count of the leucocytes show polymorphs 73·6 per cent., lymphocytes 18 per cent., large mononuclear forms 3·6, and coarsely granular eosinophiles 4·8 per cent.

Dr. G. Mann has estimated for me the specific gravity of the blood which is 1·0755; the normal average is 1·0777. He has also very kindly made a comparative estimate with the hematocrit of the ratio of plasma and corpuscles, which was the following:—

Patient.					Normal person for control.				
Red cells	...	...	...	76·5	Red cells	...	...	...	48·5
White cells	...	...	...	4·85	White cells	...	...	...	3·0
Plasma	...	...	...	18·67	Plasma	...	...	...	48·5

Dr. G. Mann estimated that the patient had fully 58 per cent. more red blood corpuscles than the normal individual. Miss Mabel Fitzgerald has estimated on several occasions the alveolar CO_2 by Haldane's method and it was found to range from 4·13 to 4·61, just at the lower limit of normal. The urine looks normal. Dr. W. Ramsden of the physiological laboratory has made a careful study of it with the view of determining the presence of an excess or abnormality of the pigments. The specific gravity is 1016. A small quantity of albumin is present. There is no sugar, the pigments normal and not in excess; urea was 18 grammes for the 1000 cubic centimetres; the chlorides 5·8 grammes.

You must not expect to see in every case the triad of symptoms so well marked as in this patient. I think you will agree with me that we have here a condition which does not conform to any known disease and I am in full accord with those who regard it as a hitherto unrecognised affection of the blood-making organs. We may now discuss the features in greater detail.

The cyanosis, the signal symptom, which at once calls attention to the condition, has been present in a great majority of the cases. And yet it is accidental and at any time can be made to disappear.[4] Keep this patient for an hour or even less at a temperature above 80° and the cyanosis will change to a vivid red. The first case I saw presented remarkable alterations in this respect. In the hot summer days he was "red as a rose" and looked bursting with blood and in the winter he became as blue as indigo. The colour of the skin in health depends on two circumstances—the degree of fulness of the peripheral vessels and rate of the circulation in them. There may be general pallor and apparent anæmia with a normal blood count. These pseudo-anæmias are most interesting and deceptive. Only the other day I saw a young girl who at once attracted attention by her colour, or rather by an entire absence of colour, but when I remarked upon it she answered, " Oh, I never worry about that, I was born pale." The symptoms did not suggest anæmia but I was not prepared to have a report from Dr. A. G. Gibson that she had more than 5,000,000 of red blood corpuscles to the cubic millimetre. It is a matter of local distribution. Just the opposite condition may be present—the colour may be good with pronounced anæmia. The old writers recognised a *chlorosis rubra*. A few years ago there was admitted to Ward E of the Johns Hopkins Hospital a well-built, healthy looking man, complaining of shortness of breath and palpitation of the heart. His colour was high and due, as could be seen with a lens, to fulness of the small venules of the skin. Even the skin of the body looked reddish. To our astonishment the count was 2,000,000 of red blood corpuscles per cubic millimetre. We called the case anæmia rubra. It was not until the count sank below 1,200,000 per cubic millimetre that the features of anæmia became evident.

In individuals, and indeed in nations, there are remarkable differences in the degree of fulness of the cutaneous vessels. The out-of-door life and the damp cold, plus sometimes the plethora-producing beer and the vaso-dilator influence of spirits, tend to make the exposed skin of the Englishman much more vascular than in his American or colonial relatives. Chillblain, so common in this country, is one expression of this extreme local congestion under the influence of cold. A state of permanent turgescence of the capillaries and small veins of the hands and face may be entirely local—the feet may not be involved—and is usually of no moment, save in women who worry over the appearance and appeal to us—in vain, I fear—for help. I saw one rare sequel of this chronic engorgement of the vessels of the hands—viz , clubbing of the fingers. The man had had for 20 years or more a red face and red beefy-looking hands—in

[4] When this patient was shown at the Clinical Section of the Royal Society of Medicine as the room got hot and doubtless in part due to the excitement her colour changed and the skin lost the cyanotic hue,

the winter always blue and cold. There was no heart lesion. He had noticed the change in the shape of the terminal joints for five or six years.

The other circumstance upon which the colour of the skin depends is the rate of blood flow. If now I rub vigorously this patient's left hand, or place it in warm water, the activity of the circulation in the skin is increased, as can be seen at once by the rapidity with which an area of pressure anæmia is filled up. And with the increased rapidity of blood flow the colour changes from a reddish-purple to a bright red. In the one the blood is arterial, in the other venous; the change in colour is due to a rapidly produced change in the rate with which the blood passes through the capillaries of the skin. Normally the current is so rapid that the tint of the skin is arterial. Cyanosis results whenever the capillaries are full and the current is slow. The factors must be combined. Conditions in which the stream in force and volume sinks to a minimum may be associated with pallor, not with cyanosis. I had once a unique experience. I remember it well, as the patient was one of the first to apply after the opening of the Johns Hopkins Hospital. She had Raynaud's disease and held up her right hand, the fingers of which presented a remarkable appearance. The little one was normal, the ring finger was as white and as cold as marble, the middle finger was deeply cyanosed (local asphyxia), while the index finger was as "red as a rose." There was probably just as much blood in the index as in the middle finger, but in the one the arterial sluices were wide open, the capillaries distended, and the stress rapid, while in the other the arteries were contracted, the capillaries full, and the stream slow. In the dead-white ring finger there was probably more than contraction of the arteries and slowness of the stream— an angio-spasm involving all the smaller vessels, arterioles, capillaries, and venules. In the patient before us there may be two accessory factors favouring slowness of flow in the terminal vessels. The observations of Parkes Weber, Haldane, and others have shown that the whole volume of blood is greatly increased. In one case Haldane estimated the total amount to be more than double the normal. With this the specific gravity is higher than normal. But another element, the viscosity, is still more important and this has been shown by many observers to be greatly increased. It may be readily seen with the drop as it flows, for example; it takes an unusually long time to spread under a covered glass. It would, of course, be in the capillaries that this increased viscosity would be effective.

There is one other factor in inducing cyanosis upon which Saundby, very rightly, lays great stress—namely, the dilatation of the venules and the loss of tonicity in the peripheral veins. In this patient the cyanosis in the legs is a question altogether of gravity. Dependent they are blue, held up they become pale. As she is recumbent in bed they are of a dusky purplish red. We must not forget, however,

that cyanosis is not altogether a question of stasis and capillary engorgement. The peculiar colour is a corpuscular affair depending upon the hæmoglobin whether oxidised or reduced. There are remarkable forms of cyanosis in which the colour of the skin is altogether due to changes in the hæmoglobin : the methæmoglobinæmia due to the taking of the coal-tar products, the enterogenous cyanosis which has been studied and reported by the Dutch physicians (Stokvis and Talma) and by Samuel West and Wood Clarke in this country, and the form reported by Gibson and Douglas in which colon bacilli were isolated from the blood. West and Clarke give an analysis of all the recorded cases of this idiopathic cyanosis, both met- and sulph-hæmoglobinæmia. It has been called enterogenous on the view that the change is due to the action of substances absorbed from the bowels. The tint of skin and mucous membranes of both toxic and entero-genous forms differs from that of ordinary cyanosis and may be recognised at a glance, as it is rather an ashen-grey lividity, suggesting a light type of argyria. A popular American headache remedy introduced of late years into this country is responsible for many cases, and on several occasions I have put the question point-blank, '' Have you been taking —— ?'' There is a certain characteristic colour of the polycythæmic cyanosis which is referred to by Cabot and one or two other observers—a sort of red Indian hue which is most marked in circumstances when the arterial is just beginning to obscure the venous tint. And one more point may be mentioned ; as with all conditions in which there is persistent hyperæmia of the skin pigmentation may occur ; this was very marked in a case of Stockton and Lyon. There have been cases reported in which the pains in the hands and legs with the extreme congestion have suggested the erythromelalgia of Weir Mitchell—the red, painful neuralgia. In Joseph Collins's case this was a very marked feature and the patient complained a good deal of pains in the hands and feet, but in the few cases of erythro-melalgia I have seen only one extremity was attacked, and it was, as it name indicates, a red erythema, not influenced by gravity to any extent. The extreme grade of local asphyxia may suggest Raynaud's disease, and this has been the diagnosis in a case which Dr. W. S. Thayer very kindly showed me.

For the recognition of the disease a blood count is necessary, not simply a blood examination, as in the cases of leukæmia. The essential feature, the *polycythæmia*, the *erythræmia*, can be determined only by counting the number of red blood corpuscles in a cubic millimetre. A true polyæmia, a plethora vera, is present. Haldane estimated that a patient of Parkes Weber had nearly double the normal amount of blood and post mortem the cases have shown a state of great fulness and engorgement of the internal vessels. This is another point of analogy with leukæmia, in which also there may be an extraordinary increase in the total volume of blood. The counts have been very remark-

able—this patient has nearly double the normal. Cabot has reported 12,000,000 per cubic millimetre, and in a case of Köster the count was 13,600,000 per cubic millimetre. The question has been raised whether it is possible to pack this number of red blood corpuscles into a cubic millimetre. Dr. G. Mann, who has interested himself in this point, tells me that it would be possible to put $13\cdot9$ millions of red corpuscles into this space, so that the maximum recorded count is within this limit. You might suppose that in every condition of local engorgement with cyanosis the blood count would be high, but this is not the case. In a case of alcoholic neuritis with legs just as purple as those of this woman, in Raynaud's disease, in the skin of a "Bardolphian" facies bursting with blood, the number of red blood corpuscles per cubic millimetre may be normal.

The *enlargement of the spleen* is variable. It rarely reaches the size seen in this patient. Cases have been reported in which the edge of the organ has reached the crest of the ilium. It may precede the occurrence of the cyanosis and it may not have been noticed during life but have been found post mortem. It has been present in a large proportion of all the cases.

Many additional features have been noticed. This patient presents very few symptoms, only pains in the hands and feet and a slight loss of vigour. Headache has been a common complaint and a distressing sense of fulness with occasional attacks of vertigo. One of my cases had recurring attacks of nausea and vomiting. Constipation is a very common symptom. High blood pressure is the rule and it is remarkable considering the great increase in the volume of blood that it is not increased in the present case. Sclerosis of the superficial arteries and a trace of albumin in the urine have been frequently noted. In the first case I studied this combination of albuminuria, high blood pressure, and arterio-sclerosis had suggested a diagnosis of Bright's disease. Attacks of bronchitis and of asthma have been described. In Case 1 of my series during the winter season piping râles were constantly present in the bronchial tubes. Hæmorrhages have occurred in a number of instances, sometimes petechial, as on the skin of this patient, sometimes from the mucous membranes—hæmoptysis, hæmatemesis, or hæmaturia. Death from cerebral hæmorrhage has occurred in several instances.

We scarcely know enough to discuss intelligently the pathology of this interesting affection but there have been five or six post-mortem examinations within the past 18 months which throw some light upon the condition. Theoretically, polyglobulism may be due to a diminished destruction of the red blood corpuscles, to an excessive loss of plasma, and to an increased production of red cells. A relative polycythæmia is by no means rare and occurs in many clinical conditions associated with loss of fluids. It rarely reaches the high grade seen in these cases. Weintraud suggests that the polyglobulism of this disease is due to retarded destruction but there are no clinical or anatomical facts in support of this

view; nor, on the other hand, is there any evidence of increased hæmolysis in the deposition of pigment in organs, such as occurs in hæmachromatosis, or in changes in the proportion of the urinary pigments. A true erythræmia follows a residence at high altitudes and is present in congenital heart cases, in both probably an adaptive process, more corpuscles being required to carry on the O_2 metabolism. The studies on the bone marrow by Miller and others have shown it to be in a state of active hyperplasia in congenital heart cases. Recently Ambard and Fiessinger [5] have reported a case of congenital cyanosis with polycythæmia in which there was the most intense proliferation of the bone marrow.

In this splenic polycythæmia there have been at least six post-mortem examinations—all with practically the same anatomical changes—a plethora vera; intense hyperplasia of the bone marrow, a myelomatosis rubra; and enlargement of the spleen, with histological changes indicative of chronic passive congestion, a uniform hyperplasia of all its elements. It may be that the spleen participates actively in the process, as the histological studies do not indicate that it is an enlargement due to the accumulation of the products of hæmolysis. Neither spleen nor lymph glands ever lose their power of making red blood corpuscles, though in normal states in the adult they hand the function over to the bone marrow. But even with an undoubted evidence of myelomatosis we are not nearer the essence of the disease—the *why*—the cause of the mysterious flooding of the body markets with the products of its red-blood factories. From a score of causes the output may at any time be doubled, either by working overtime or by setting in motion all the blood-making machinery. After a hæmorrhage the little discs are turned out in countless billions and if from any cause, as in high altitudes, or in congenital heart disease, there is trouble in the lung-exchange to barter the CO_2 for the O_2, an extra supply of corpuscles is soon forthcoming to make up the defect. Nothing is more certain—in the microcosm as in the macrocosm, given a demand and there is soon a supply. But here is a condition in which, so far as we know, there is an over-supply without any corresponding demand and the same riddle confronts us as in leukæmia and several other diseases of which over-production of a normal tissue or element is the essence. The interesting suggestion has been made by Korányi and Bence that the disease is due to a lessened power of the red blood corpuscles to absorb oxygen. Given a hæmoglobin of poor quality, incapable of combining normally with O_2 a greater number of erythrocytes would have to be manufactured to meet the usual demands of the system. With this, too, they regard the increased viscosity of the blood as an important element in producing the

[5] Arch. de Med. Experiment. Mars., 1907.

cyanosis. Saundby has brought forward the view that there is such a state of capillary dilatation with slowing of the blood current that each little boatlet of blood cannot discharge its proper cargo, and to make up for this failure more are put into circulation, the antithesis of the condition existing at high altitudes when as each little boatlet cannot get a sufficient cargo of O_2 in the space of time it remains in the lung capillaries, three are sent out to do the work for which two usually suffice. The remarkable combination of symptoms is one which lends itself to theoretical considerations. We have not yet got to the heart of the mystery of leukæmia, and in this remarkable disease is added another to the many interesting problems relating to the physiology and pathology of the red blood corpuscles.

A word about the name, always a difficulty in connexion with a new disease. The choice lies between an eponymic, an anatomical, or a symptomatic name. The one suggested by Parkes Weber—splenomegalic polycythæmia—has been adopted in this country. In France it has been called maladie de Vaquez, or Vaquez-Osler, and in the United States some of my friends have been kind enough to associate my name with it. But the priority of description rests with Vaquez and if a name is to be associated with the disease it should be that of our distinguished French colleague. Among other names which have been suggested are polycythæmia rubra and erythrocythæmia megalosplenica. In many ways the name erythræmia, suggested by Türk of Vienna, seems to be the most appropriate. It is short and it designates the most striking and the most constant peculiarity ; it has the great advantage of an analogy with leukæmia, and both affections are associated with states of morbid activity in the bone marrow.

We know as yet very little about the treatment of the disease. As a long experience with leukæmia has demonstrated, we have nothing at our disposal which controls the morbid processes in the bone marrow. Two or three measures have been carried out which have given relief. When there are fulness of the head and vertigo repeated bleedings have been tried with great relief. Inhalations of oxygen have been used and cases have been reported in which the cyanosis has been relieved and the number of red blood corpuscles greatly diminished. We shall ask to have this given a thorough trial and Dr. Sankey has agreed to apply the x rays over the spleen, which seems to have been helpful in some instances of enlargement of the organ.[6]

---

[6] For a month this patient has had the oxygen inhalations daily and the x-ray treatment. She has gained several pounds in weight and is feeling very much stronger. The oxygen inhalations have had no influence on the cyanosis, nor is there any change in the polycythæmia. The spleen is somewhat reduced but the cyanosis this morning (Jan. 1st) is very marked.

VIENNA AFTER THIRTY-FOUR YEARS.

WILLIAM OSLER, M.D.
Regius Professor of Medicine at the University of Oxford.
OXFORD, ENGLAND.

I spent the first four months of 1874 here. I came from
Berlin with Hutchinson, an Edinburgh man (Sir Charles F.,
who has recently died), and we lived together near the
Allgemeines Krankenhaus. As illustrating the total blotting
out of certain memories, particularly for places, I may men-
tion that strolling to-day up the *Alserstrasse* I could not recall
the street, much less the house, where we had lived for the
four months. I found my way readily enough to the *Riedhof,*
where we were in the habit of dining, and where I first met
my old friends, Fred Shattuck, E. H. Bradford, E. G. Cutler
and Sabine of Boston. An extraordinary development has
taken place in the city within thirty years, and I scarcely
recognized the *Ringstrasse.* Then, only the foundations of the
new university buildings and of the *Rathaus* had been begun.
Now these, with the parliament house, the courts of justice,
the twin museums of art and natural history and the new
Bourg Theater, form a group of buildings unrivaled in any city.

THE GERMAN CONGRESS FOR INTERNAL MEDICINE.

The primary object of my visit was to attend the *Congress
für Innere Medizin,* and I had the pleasure of having with me
my old student and friend, Dr. Joseph H. Pratt of Boston.
We reached Vienna in time for the preliminary Sunday even-
ing social gathering in the *Kursalon* of the City Park. Here
we found a greeting in true German fashion and a hearty wel-
come from the president, Professor Müller of Munich. The
work of the congress began at sharp 9:30 on Monday morning
with a discussion on the "Relation of the Diseases of the Female
Generative Organs to Internal Maladies." Unfortunately, the
large University Hall, in which the meeting was held, was
most unsuitable. Though seated not very far away, Profes-
sor Rosthorn's remarks were almost inaudible. It is a miser-
able mistake in introducing a discussion on any subject to
speak for more than half an hour, but to continue for an
hour and a quarter is too much for human endurance, and a
great many did not wait for Professor Lenhartz's discussion
of the problem from the standpoint of internal medicine.

Nothing new was brought out, and so far as I could gather, Professor Rosthorn took much the same ground as Clifford Allbutt in his well-known Goulstonian lectures dealing with the intimate relationship through the sympathetic nervous system of the generative functions with those of the other organs.

Quite an animated discussion followed, in which Stintzing, Turban, Klemperer and others took part. Dr. Singer read a most interesting paper on "Intestinal Diseases in the Climacteric," calling attention particularly to frequent hemorrhages which he had known to arouse suspicion of malignant disease.

In the evening the city fathers gave a magnificent banquet to the congress in the superb hall of the *Rathaus*. At three long tables were seated some 600 guests.

On Tuesday morning Professor Neisser of Breslau opened the discussion on the "Present Position of the Pathology and Therapy of Syphilis." This was a splendid address, delivered without notes, in a good clear voice, and the subject matter arranged in a most orderly manner. He dealt particularly with the three points brought out by recent investigations—Schaudinn's discovery of the spirochete, the discovery of Metchnikoff that apes could be infected, and the discovery of Schaudinn that the fluids of infected persons reacted specifically. He dealt very fully with his own experimental work in Java, much of which has appeared, but it was particularly interesting to hear the relation of the extraordinary influence of atoxyl on the infected animals. It acts as a specific and prevents the development of the spirochetes, so that if given soon the disease could be completely stopped, and later the animal reinfected. Neisser was followed by Professor Wassermann, who described with great clearness his studies on the specific reaction. We have now apparently a diagnostic means by which the presence of the disease may be definitely determined at a very early stage. As the reaction may be present before secondary symptoms appear, it will have a very important influence in early treatment. The general expression of opinion is very favorable to the method. Professor Finger spoke of it to me in the warmest terms. It persists after all clinical symptoms have disappeared, and a positive response in locomotor ataxia and in general paralysis clinches the question of the true syphilitic nature of these maladies. Both Neisser's and Wassermann's addresses were models.

One of the most important communications of the congress was from von Noorden's clinic. Two of his assistants have been carrying on researches on the "Mutual Relations of the Pancreas and Thyroid." For many years von Noorden has had the idea that there was some important mutual influence between these two organs. The remarkable fact comes out that in animals from which the thyroid gland has been removed it is impossible to produce diabetes by any of the

known methods, not even by the Claude Bernard puncture of the medulla.

Of the third day of the congress I saw but little. Professor Schmidt of Halle introduced a discussion on "New Clinical Methods of Investigating the Functions of the Intestine," in which he went over his recent work very fully, most of which has already been referred to in THE JOURNAL.

DINNER TO THE CONGRESS.

At the dinner of the congress His threw out the interesting suggestion (apropos of the presence of Grünbaum and Trevelyan from Leeds, Pratt from Boston, Barr from Portland, Ore., and myself), that the time had come to have an International Congress for Internal Medicine. The physiologists, the laryngologists, the alienists and others have such gatherings, and there now exist in France, Germany and Italy, England and the United States special societies devoted to internal medicine. A congress once in four or five years would be most helpful. We should get to know each other and be able to appreciate better the work done in different countries. Professor Schultze of Bonn gave his usual humorous sketch of the proceedings of the congress, which was greatly appreciated. A ripple of excitement spread around the tables when it was noticed that the places in the orchestra of the pianist and the first violin had been taken by von Neusser and His. The members gathered around the elevated gallery and the distinguished artists were greeted with loud applause and had a vigorous encore.

THE VIENNA LIBRARIES.

Prof. Max Neuburger, whose name is so well known in association with Pagel as editor of the "Handbuch der Geschichte der Medizin," very kindly arranged to show me the points of interest in the Vienna libraries. I may mention, by the way, that Professor Neuburger's new work on the "History of Medicine," of which one volume has appeared, is being translated and will be published from the Oxford University Press. He expects to have Volume II completed this year, and we hope to issue the English edition complete in one volume within the next fifteen months. I was greatly interested to see the new home of the Wiener medizinische Gesellschaft, built under the presidency of Billroth, which combines features of a library, a club and meeting place. The auditorium is exceptionally well arranged with seats for 300, and there is a large gallery. The library now numbers more than 40,000 volumes and is very rich in current periodicals. The university library is one of the largest in the city, and the arrangement in it for the accommodation of the medical students seems to be excellent. At the time of our visit the section of the reading room assigned to them was nearly full. A room has been set aside in connection with the medical

faculty for the collection of all the literature relating to the history of the school, for the collection of the works of all the famous old men connected with it, and a repository for pictures and instruments, etc., the whole to form a collection illustrating the evolution of the history of the medical department of the university. This example could very well be followed in all of our medical schools. It has been done to some extent at the University of Pennsylvania, as William Pepper III. has already made large collections for this purpose.

The *Hofbibliothek* is unusually rich in manuscripts and early printed books. I was anxious to see the copy of "Christianismi Restitutio" of Michael Servetus, 1553, in which for the first time the lesser circulation is described. This is one of the only two known copies in existence. The entire edition was confiscated, and the author, at the time a practitioner in the little town of Vienne, near Lyons, fled for his life to Geneva. Here his heterodoxy was quite as obnoxious to Calvin, into whose hands he fell, and he was burnt at the stake in the same year. The "Restitutio" is one of the rare books of the world. Only two of the 1,000 copies known to have been printed have survived. The one in the *Bibliothèque Nationale* originally belonged to Dr. Mead, and the history is fully given in an appendix in Willis' work, "Servetus and Calvin." The Vienna copy is in excellent preservation, beautifully bound, and states on the title page that it came from the library of a Transylvanian gentleman living in London. It fell into the hands of Count de Izek, who presented it to the emperor of Austria. It is a thick, small octavo of about 700 pages. The first one to give credit to Servetus for his discovery of the lesser circulation was Wotton, whose "Reflections Upon Learning, Ancient and Modern," 1694, is a most interesting book, for an introduction to which I have long been grateful to my friend, Dr. Norman Moore. The other work that I was most anxious to see was the famous manuscript of Dioscorides, prepared at the end of the fifth century for Julia, daughter of the Emperor Flavius. It is one of the great treasures of the library. Now to us in the West only a name, Dioscorides, an army surgeon of the time of Nero, fills a great place in the history of medicine, and is still an oracle in the Orient. He was not only a great botanist, but he was one of the first scientific students of pharmacology. Scores of fine editions of his work, with commentaries, were issued in the fifteenth and sixteenth centuries. Two years ago this Vienna manuscript was reproduced in *fac simile* at Leyden. Though very expensive, the two volumes costing $150, it is a work which all the larger libraries should get, and it is just the sort of present librarians should make our wealthy consultants feel it a privilege to give.

THE HOSPITALS.

I was surprised to hear Professor Müller say that he thought in hospital architecture Vienna led the world, and that there was here a group of architects who were adepts in all matters relating to hospital construction. I have come to his conclusion, on what may appear to be very hastily acquired data. It is not often that in the same day and in the same institution one passes from eighteenth to twentieth century conditions. Dr. Koessler took us to the old medical clinic, now in charge of von Neusser, where I found the old wards very much the same as I remember them in 1874. Except in minor details, not only Oppolzer and Skoda, but probably also Peter Frank and de Haen could return to the *Allgemeines Krankenhaus* and not be surprised by any very unfamiliar sights. There is the same extraordinary wealth of clinical material. I must say it was a surprise to see the old type of nurse; not, of course, that she is necessarily either unintelligent or inattentive. Indeed, as we passed a bed in which there was a new patient whom the junior assistant had not seen, he turned to one of the nurses, who in reply to his question said, "Yes, Herr ———— says she has mitral stenosis and insufficiency!" I was interested to see in the ward a case of Pick's disease, the pericardial pseudocirrhosis of the liver. The old question comes up here as to priority of description. In the special number of the *Wiener klinische Wochenschrift*, issued for the congress, Professor von Neusser describes it as "Morbus Bamberger." He states that in 1872 Bamberger described the condition as a special malady which he had already known for a long time and which up to that time had not been recognized in the literature. Certainly Pick deserves credit for having brought together all the known facts relating to a clinical condition to which very little attention had been given before his paper. I had a most interesting talk with Pick and Brauer and Wenckebach on the whole question, which is not one simply of pericardial adhesion. Wenckebach has helped to solve the problem in a recent number of Volkman's *Vorträge* in an article on the "Relation Between Respiration and Circulation." Brauer of Marburg, who is coming over to the session of the American Medical Association, will discuss the subject in connection with his operation of cardiolysis.

If anyone interested in hospitals—in every possible detail, construction, situation, general arrangements for the comfort of the patients, for the convenience of the students, for the advancement of science—if such an one wishes to have a Queen-of-Sheba sensation, let him visit the first group of the new buildings of the *Allegemeines Krankenhaus*. They have begun the rebuilding with the departments for women, and two of the three clinics, for midwifery and gynecology, are completed, one for Professor Schauta and the other for Professor Rosthorn, recently called from Heidelberg. About

10,000 deliveries a year take place in the three clinics, one of which is for midwives. The new clinics are exact duplicates of each other, and each has accommodation for about 200 patients. The buildings are of four stories, a central building with wings, built of brick and stucco, with spacious corridors, large windows, tiled floors and white oil-finished walls. Inside and out they form the most attractive hospital buildings that I have ever seen. But it is not so much this aspect that gives one that sinking of the heart of which the Queen of Sheba complained when Solomon showed his treasures—it is the organization and the completeness of the arrangements for teaching and for the scientific study of disease. One large floor is assigned to students, who all live in the building while attending the midwifery cases. Each clinic has its own laboratory, a special museum for teaching purposes, a library and a fully equipped small laboratory adjoining the gynecologic operating room, so that an opinion may be given immediately as to the nature of a growth. Down to the smallest detail every care has been taken to make these two clinics the most perfect of their kind, and if the hospital is completed on this elaborate plan it will, indeed, be worthy of the fame of the Vienna school and there will be nothing like it in Europe or America. The government foots the bills, and the total cost of the two buildings has been 9,000,000 kronen ($1,800,000).

Professor Schlesinger very kindly took us to the Franz Josef Hospital, also a new building, on a less elaborate scale but very complete in all its appointments. It is particularly well arranged for the acute infectious diseases, and the most elaborate precautions are taken to isolate and disinfect the patients. Professor Schlesinger is very popular with American students, and we found working in his wards Dr. George Cheyne Shattuck III. of Boston, and young Dr. Fischel of St. Louis, both of whom have for some months been acting as voluntary assistants. It was interesting to see two wards devoted entirely to erysipelas; as far as possible all the cases in the city are sent here. Connected with this hospital is a beautiful new children's department, built by Professor Schlesinger's father-in-law. It looked to be an admirable model for the new Harriet Lane Johnston's children's department at the Johns Hopkins Hospital. In the arrangement for isolating cases, in the simple and easily worked character of the wards, in the laboratory arrangements and in the special incubators for feeble babies the hospital seemed much in advance of anything I had ever seen.

The scientific laboratories of the medical school have been completely transformed. Dr. Fröhlich took us through Professor Meyer's Pharmacologic Institute and through the new physiologic laboratory and the anatomic department—such a contrast to the old days!

CRITICISM OF WORK OF CONGRESS.

The general impression one gets of the work of the congress is very favorable. Too much, perhaps, is attempted. There are too many papers, but the keenness of the men and the scientific interest are most stimulating. As I remarked about the congress two years ago in Munich, there is a strong tendency in internal medicine to-day toward physiologic and chemical problems. On the long list of papers, eighty-eight in number, there were only about five dealing with bacteriologic questions. An extraordinary number dealt with questions in physiologic pathology and presented the results of experimental work.

INFLUENCE OF VIENNA ON AMERICAN MEDICINE.

As a medical center Vienna has had a remarkable career and her influence, particularly on American medicine, has been very great. What was known as the first Vienna school in the eighteenth century was really a transference by van Swieten of the school of Boerhaave from Leyden. The new Vienna school, which we know, dates from Rokitansky and Skoda, who really made Vienna the successor of the great Paris school of the early days of the nineteenth century. But Vienna's influence on American medicine has not been so much through Skoda and Rokitansky as through the group of brilliant specialists—Hebra, Sigmund and Neumann in dermatology; Arlt and Jaeger in ophthalmology; Schnitzler and von Schrötter in laryngology; Gruber and Politzer in otology. These are the men who have been more than others responsible for the successful development of these specialties in the United States. Austria may well be proud of what Vienna's school has done for the world, and she still maintains a great reputation, though it can not be denied, I think, that the Esculapian center has moved from the Danube to the Spree. But this is what has happened in all ages. Minerva Medica has never had her chief temples in any one country for more than a generation or two. For a long period at the Renaissance she dwelt in northern Italy, and from all parts of the world men flocked to Padua and to Bologna. Then for some reason of her own she went to Holland, where she set up her chief temple at Leyden with Boerhaave as her high priest. Uncertain for a time, she flitted here with Boerhaave's pupils, van Swieten and de Haen, and could she have come to terms about a temple, she doubtless would have stayed permanently in London, where she found in John Hunter a great high priest. In the first four decades of the nineteenth century she lived in France, where she built a glorious temple to which all flocked. Why she left Paris, who can say? but suddenly she appeared here, and Rokitansky and Skoda rebuilt for her the temple of the new Vienna school, but she did not stay long. She had never settled in northern Germany, for though

she loves art and science she hates with a deadly hatred philosophy and all philosophical systems applied to her favorite study. Her stately Grecian shrines, her beautiful Alexandrian home, her noble Roman temples, were destroyed by philosophy. Not until she saw in Johannes Müller and in Rudolph Virchow true and loyal disciples did she move to Germany, where she stays in spite of the tempting offers from France, from Italy, from England and from Austria.

In an interview most graciously granted to me, as a votary of long standing, she expressed herself very well satisfied with her present home, where she has much honor and is everywhere appreciated. I boldly suggested that it was perhaps time to think of crossing the Atlantic and setting up her temple in the new world for a generation or two. I spoke of the many advantages, of the absence of tradition—here she visibly weakened, as she has suffered so much from this poison—the greater freedom, the enthusiasm, and then I spoke of missionary work. At these words she turned on me sharply and said: "That is not for me. We gods have but one motto—those that honor us we honor. Give me the temples, give me the priests, give me the true worship, the old Hippocratic service of the art and of the science of ministering to man, and I will come. By the eternal law under which we gods live I would have to come. I did not wish to leave Paris, where I was so happy and where I was served so faithfully by Bichat, by Laennec and by Louis"—and tears filled her eyes and her voice trembled with emotion—"but where the worshipers are the most devoted, not, mark you, where they are the most numerous; where the clouds of incense rise highest, there must my chief temple be, and to it from all quarters will the faithful flock. As it was in Greece, in Alexandria, in Rome, in northern Italy, in France, so it is now in Germany, and so it may be in the new world I long to see." Doubtless she will come, but not till the present crude organization of our medical clinics is changed, not until there is a fuller realization of internal medicine as a science as well as an art.

On
dite d
duran
fièvre
élevée
l'état
lorsqu
due a
mais
tieuse
évolut
reaux
Souve
disme
tive à
tieuse
Le
chron
1).
six foi
2).
inaug
allure
souver
sympt
3).
modifi
côté d
gemen

ENDOCARDITES INFECTIEUSES CHRONIQUES,

par M. le Professeur WILLIAM OSLER (d'Oxford)

On peut observer, dans d'assez diverses circonstances, une endocardite dont la fièvre est le symptôme dominant, et qui peut se prolonger durant des semaines et même des mois. Chez l'enfant, à la suite d'une fièvre rhumatismale, une endocardite peut maintenir la température élevée pendant plusieurs semaines sans autres symptômes, alors que l'état général reste bon. Dans les affections valvulaires chroniques, lorsque la lésion cesse d'être compensée, une fièvre légère, irrégulière, due à une récidive d'endocardite, peut se prolonger plusieurs mois; mais il est de règle que la durée des formes graves d'endocardite infectieuse soit moindre que trois mois. Néanmoins, certains cas ont une évolution bien plus longue, comme l'avaient vu Wilks, Bristowe, Lancereaux et d'autres. Bristowe rapporte un cas d'une durée de cinq mois. Souvent les frissons répétés que l'on observe ont été pris pour du paludisme, d'où l'opinion que l'endocardite maligne pourrait être consécutive à la malaria. Dix cas de ce type chronique d'endocardite infectieuse sont résumés dans le tableau ci-dessous.

Le tableau clinique, dans mes dix cas, était celui d'une septicémie chronique présentant les caractères suivants :

1). Dans tous les cas, il existait une lésion valvulaire latente, qui six fois était une séquelle du rhumatisme articulaire aigu.

2). La fièvre était le symptôme prédominant. Son invasion est parfois inaugurée par des frissons ; d'ordinaire elle n'est pas élevée et son allure est du type rémittent. Des transpirations profuses s'observent souvent. Pendant plusieurs mois le malade peut n'éprouver aucun autre symptôme et se sentir assez bien pour se lever.

3). La lésion valvulaire antérieure n'est cliniquement guère ou point modifiée, et jusque vers la fin il peut n'y avoir point de symptômes du côté du cœur, les signes physiques ne présentant que fort peu de changements.

N°s	Noms.	Age.	Date.	Rhumatisme antérieur.	Lésion valvulaire ancienne.	Symptômes initiaux.	Type fébrile.	Lésions cutanées.	Embolies.	Lésions cardiaques à l'autopsie.	Durée de la maladie.
1	J. M.	28 ans	Juillet 1888	A l'âge de 12 ans.	Mitrale.	Fièvre.	Rémittente.	Nodosités érythémateuses douloureuses.	0	Endocardite mitrale.	13 mois.
2	T. B.	13 —	Mars 1902	0	Mitrale.	Frissons, fièvre.	Rémittente.	Purpura.	0	Endocardite mitrale.	10 —
3	F. D.	21 —	Mars 1895	Atteinte légère en octobre 1908.	Mitrale.	Frissons, fièvre.	Rémittente.	Nodosités érythémateuses douloureuses.	Cerveau	Pas d'autopsie.	7 —
4	M. B.	19 —	Juin 1890	Dans l'enfance.	Mitrale.	Frissons, fièvre.	Rémittente.	Nodosités érythémateuses douloureuses.	Cerveau	Pas d'autopsie.	5 —
5	R. B.	33 —	Mai 1902	0	Aortique.	Frissons, fièvre.	Rémittente avec frissons	—	—	Pas d'autopsie.	4 —
6	Dr T.	33 —	Septem. 1902	0	Aortique.	Arthrite, frissons, fièvre.	Intermittente et rémittente.	Nodosités érythémateuses douloureuses.	—	Pas d'autopsie.	9 —
7	Dr R. T.	53 —	Février 1903	Dans l'enfance.	Mitrale.	Fièvre et sueurs profuses.	Rémittente.	Nodosités érythémateuses douloureuses.	Rétine, rate, reins.	Endocardite mitrale, aortique et tricuspide.	8 —
8	R. W.	36 —	Novem. 1906	Dans la jeunesse.	Mitrale.	Frissons et fièvre.	Rémittente.	Purpura.	—	Pas d'autopsie.	6 —
9	Dr C.	52 —	Mai 1907	0	Mitrale.	Fièvre.	Rémittente.	Nodosités érythémateuses douloureuses.	Cerveau	Pas d'autopsie.	7 —
10	A. A.	20 —	Janvier 1908	Il y a cinq ans.	Mitrale.	Fièvre.	Rémittente.	Nodosités érythémateuses douloureuses.	—	Pas d'autopsie.	7 —

4). Les phénomènes emboliques ne sont pas fréquents et s'observent seulement vers la fin.

5). On voit se produire, au niveau de la peau des doigts et des orteils, des taches érythémateuses douloureuses éphémères; elles sont rares sur le reste du tégument. Leur diamètre varie d'un centimètre à un centimètre et demi ; elles sont rouges, papuleuses, souvent pâles en leur centre. Elles disparaissent généralement au bout de quelques heures, mais elles peuvent subsister pendant une journée entière. Elles font efflorescence par poussées, sans être jamais très abondantes. Je les ai rencontrées dans sept cas de ma série. Elles ressemblent à de petits éléments d'érythème noueux et n'ont aucune analogie ni avec les nodules rhumatismaux sous-cutanés ni avec les nodosités éphémères de Ferréol.

6). La lésion anatomique est une endocardite proliférative chronique, souvent très étendue, siégeant sur la mitrale ou la tricuspide et sur les cordages tendineux, mais possédant peu de tendances destructives. Les lésions emboliques ne sont pas suppurées.

7). Dans mes cas, comme dans ceux de Harbitz et de Lenhartz, l'hémoculture a montré que le streptocoque est le microorganisme le plus souvent en cause. Mais le staphylocoque, le pneumocoque et le gonocoque ont aussi été trouvés. L'évolution lente et chronique de la maladie est probablement en rapport avec une atténuation de virulence du germe.

8). Dans un petit nombre de cas des vaccinations antimicrobiennes ont été faites avec succès.

ACUTE ENDOCARDITIS
DISEASES OF THE VALVES OF THE HEART
DISEASES OF THE ARTERIES
ANEURISM

BY

WILLIAM OSLER, M.D.

CHAPTER IV.

ACUTE ENDOCARDITIS.

By WILLIAM OSLER, M.D., F.R.S.

Definition.—Acute inflammation of the lining membrane of the heart and its valves, an incident in an infection or a terminal event in some chronic disease, is characterized anatomically by vegetations, necrosis, and ulceration. Chronic endocarditis, which may be either a primary change or a sequence of the acute process, will be discussed with chronic valvular disease of the heart.

Classification of Forms.—A good working classification, either etiological, anatomical, or clinical, is not easy to make. According to the *nature of the infecting agent* we speak of streptococcic, staphylococcic, pneumococcic, rheumatic, typhoid, or gonococcic; according to *the character of the lesion*, of verrucose or ulcerative; according to the *severity of the symptoms*, of benign and malignant varieties.

There is always a lesion of tissue—erosion of endothelium, vegetative outgrowths, ulceration—and the danger depends, first, on the nature of the infecting agent; secondly, on the extent of loss of substance, and thirdly, on the state of the body, *i. e.*, blood defences. But in any case there is no *benign* or *simple* form. Endocarditis is always a serious lesion, if not immediately by loss of substance, etc., remotely by the sclerotic changes which it initiates, and which lead in a majority of the cases to retraction and insufficiency of the valve. The so-called benign endocarditis kills in the long run a very much larger number of persons than the malignant form. Nor is the term acute free from difficulties. Infectious endocarditis is usually an incident in some acute infection, and the duration is reckoned by weeks or by a few months, and yet there are cases in which the process is active and symptom-producing for eight, ten, twelve, or more months—an essentially chronic condition.

There are clinically four great groups of infective endocarditis:

I. The *simple* endocarditis of the general infections (rheumatic fever, scarlet fever, typhoid fever, etc.), and, as a terminal infection, of many constitutional disorders. In itself, as a rule, harmless at the time, it leads in many cases to sclerosis of the valves and to chronic heart disease.

II. The *ulcerative*—the lesion is part of a septicopyæmia arising in a local infection, a skin wound, the puerperal process, an acute bone disease, gonorrhœa, etc.; less often in septic processes without external lesion, as in pneumonia. The endocarditis is only an incident, although often a serious one, in the infection.

III. The *recurrent* endocarditis on the old sclerotic valves of chronic heart disease, a common form, which may be slight or severe.

IV. *Chronic septic* endocarditis, in which for many months a state with remittent or intermittent fever is caused by the growth of vegetations on the valves.

In groups I and II the symptoms are part of an infection in which the endocarditis is an incident. In III and IV the symptoms are directly due to the focus of infection on the valves.

History.—Here and there in the sixteenth, seventeenth, and eighteenth centuries there are references in the writings of Guy de Chauliac, Boerhaave, Senac, Morgagni, and others to alterations in the valves or in the lining membranes of the heart. Cowper,[1] the anatomist (1666–1709), described disease of the aortic valve, and Vieussens, in 1715, noted the same lesion. It was not until the nineteenth century that endocarditis was recognized as a special affection. Allan Burns (1809), whose little monograph is a storehouse of valuable observations upon the circulation, recognized the importance of changes in the valves. Matthew Baillie, in the first illustrated work on morbid anatomy published in the English language (1799), figures very well the results of endocarditis.

Krysig, in 1815, recognized the association of rheumatic fever and endocarditis. It is not a little remarkable that Laennec, in the first edition of his immortal work, makes no mention of the subject, but in the second edition, 1826, he speaks of it. Our accurate knowledge dates from the work of Bouilland (1840), who for the first time dealt with the question in an exhaustive manner, and we may say that our modern knowledge dates from him. He recognized inflammation of the valves, cardiovalvulitis, its great importance, and the frequency of the association with rheumatism.

A new chapter was written by Virchow in his studies upon pyæmia and embolism, and the observation of Kirkes showed the great importance of the severer forms and of the relation of the vegetations to embolic processes. The infective character of endocarditis has only been fully recognized since the studies of Winge, Köster, and Heiberg, but with the revolution in technique effected by Koch the association of the lesion of the valves with microörganisms has been exhaustively obtained, and we now know that while any and every infection may be complicated with endocarditis, there are certain organisms, viz., those of rheumatic fever (as yet doubtful), pneumonia, gonorrhœa, and pyæmia, particularly liable to excite it.

General Pathology.—We still have much to learn about the conditions under which the endocardium is affected, but the following statements formulate our existing knowledge:

1. Infective endocarditis is a valvular, rarely a mural, lesion, and on the valves the closure lines are points of election, viz., on the aortic cusps a little below the free edge and on the auriculoventricular valves the auricular faces, a little distance from the margin. In the fœtus the right heart is most frequently affected, in the adult the left. Malformations as, for example, the edge of an imperforate septum, and valves which have sclerotic changes are especially prone to be attacked.

2. Most frequently an incident in septicæmia, it is not always possible to say whence the infection has been derived. In almost any one of the ordinary febrile diseases endocarditis may be a complication, but it is particularly during childhood that we meet with it, and above all others in the rheumatic affections. The tonsils are probably the portals of entry for the microörganisms in this group, and also in the not infrequent cases in which we meet with endocarditis without recognizable cause.

[1] *Philosophical Transactions*, No. 229.

3. Certain bacteria are much more prone to excite endocarditis than others. The streptococci and staphylococci (with which may be included provisionally the "micrococcus rheumaticus"), the pneumococcus, and the gonococcus, are the chief endocarditis-producing organisms. The typhoid bacillus, the tubercle bacillus, the organisms of plague, cholera, influenza, smallpox, typhus fever, measles, scarlet fever, dysentery, glanders, and Malta fever are much less prone to affect the valves. Even in an acute infection, typhoid fever, for example, when endocarditis does occur, it is not necessarily due to the special organism, but may be a secondary infection with streptococci or staphylococci. So far as we know, the protozoa do not themselves excite an endocarditis.

4. The liability to infection of the valves does not depend upon (*a*) the number of organisms circulating in the blood. In typhoid fever, in lobar pneumonia, in certain cases of septicæmia, there may be the most intense blood infection for weeks without endocarditis. (*b*) Virulence of the organism plays an important part. The most intense local infections are met with in the virulent septicæmias, gonorrhœa, etc. (*c*) The bacteria of certain diseases excite only the mildest type of the disease. In rheumatic fever and in chorea the local lesion is itself trifling and rarely associated with destructive changes in the valves. And yet these are the very organisms which have a special predilection for the cardiac valves. (*d*) We do not know what determines the settlement of the organisms on special valves or on special portions. The liability of the right heart in foetal life has been attributed by Rokitansky to the much greater frequency of malformations; by Virchow to the difference in intra- and extra-uterine life in the work and blood pressure of the two sides; by Rosenbach to the more favorable conditions for growth of organisms, depending on the oxygen content of the blood in the two sides at these different periods. This latter view supposes a sensitiveness to deficiency of oxygen or richness of carbonic acid which has not been proved for the organisms which excite endocarditis.

5. The studies of Rosenbach, Ribbert, Wyssokowitsch, Prudden, and others[1] have shown that experimental lesions of the valves if made with proper precautions are not followed by endocarditis, but if done with unclean instruments, or if after the injury cultures of suitable organisms are injected into the blood, an inflammation follows. The injection of cultures alone is, as a rule, negative so far as the valves are concerned; but Poynton and Paine, Cole, and others have shown that endocarditis may be caused by the injection of organisms belonging to the streptococcus class and the one which is believed to be the excitant of rheumatic fever. The writer does not know that a valvulitis has been caused by any other organisms apart from preceding injury to the valve. Ribbert has shown that by injecting staphylococcus emulsion containing coarse potato particles, the mitral and tricuspid valves, but not the aortic, are affected. He thinks that the fine particles injure the endothelium at the lines of contact and permit the micrococci to gain entrance, or they may be forced in by pressure.

6. While the general belief is that the microörganisms settle directly upon the valves from the blood current, Koster suggested that the peculiar localization of the lesion might be due to embolism. From the vascularization of the valves this does not seem very likely, although Orth and Wyler suggest

[1] Analyzed by Thorel in *Lubarsch und Ostertag's Ergebnisse*, 9th Jahrgang.

that in certain cases of recurring endocarditis in an old sclerotic valve it might be possible, as they contain many large and wide vessels.

7. Strain and tension have a definite importance in connection with endocarditis. The more common involvement of the mitral and aortic valves in extra-uterine life may here find its explanation, and the more frequent implication of the large anterior segment of the mitral. The aortic segments are of practically the same texture, etc., as the pulmonic, but they show much earlier signs of wear and tear in the form of slight thickenings and atheromatous changes. The lines of election on both the arterial and the atrioventricular valves correspond to the very points which bear the greatest strain and on which, if anywhere, the endothelium would first suffer.

8. The unsolved problems of endocarditis are: (a) The reason for the localization of the lesions. (b) The conditions which enable microörganisms to settle on the valves and cause inflammation—are they always local? May they not be associated with properties of the plasma, etc.? (c) Is the valvulitis ever embolic? (d) What determines the marked variations in the lesions in the rheumatic, pneumococcic, gonococcic, and streptococcic forms? What is the factor favoring ulceration? What is in favor of a chronic proliferative process? What is in favor of the simple verrucose form?

Morbid Anatomy and Etiology.—In addition to changes in the endocardium there are usually alterations in the myocardium and very often in distant organs. The endocardial lesions are three—verrucose vegetations, necrosis and ulceration, and proliferative changes leading to sclerosis—and to these three correspond the triple clinical picture, the slight symptoms of the simple form, the malignant endocarditis, and the chronic valvular lesion.

1. **Verrucose Endocarditis.**—The lesion is usually in the left heart, and more often on the mitral than on the aortic segments. The peculiar localization has already been discussed. The mural endocardium may be involved but rarely without that of the valves. The vegetations form small, bead-like structures, soft and of a grayish-white color; in other instances they are warty or cauliflower-shaped excrescences, sometimes pedunculated. The smallest vegetation consists of (a) blood plates, (b) fibrin seated upon (c) an endothelium which presents changes. Beneath some of the tiny vegetations the endothelium may appear normal, but, as a rule, it shows signs of proliferation. In stained sections microörganisms are usually, but not always, found. In a later stage at the site of attachment and in the neighborhood the fixed cells of the subendothelium show proliferation, but there is rarely any leukocytic infiltration. The cells grow into the thrombi, which gradually become organized hyaline, changes occur, and a small, nodular thickening is left. This is the common thrombo-endocarditis which we meet with in so many of the acute infections and in the bodies of persons dead of tuberculosis, cancer, etc. It is not yet certain that in all instances of this form microörganisms are present; it is possible that toxic bodies in the blood may damage the endothelium of the valves along the closure line. In the more intense forms of the disease, such as that which complicates rheumatic fever, the necrosis of the endothelium is more extensive, the vegetations much larger, and the reaction in the valve tissues much more severe. There is a striking difference in the histological picture of a *bead* of vegetation on, say, the mitral valve in a case of diabetes and the section of a *warty* vegetation in a case of rheumatic fever or chorea in a child. In the one there may be scarcely any tissue reaction; in the

other th
this for
activity
valve le
affected
two pe
larizatio
spread

2. **Ul**
may be
Of 209
valves a
valves i
the hea
lesions:
of the te
the aor
valve c
diphthe
ated or
occur,
cusps l
smooth
of these
the bas
may be
of the l
tococci
in whic
the ao
hemorr
hand, i
(b) C
the va
ulcerat
frequen
is com
and he
tions a
beyond
while i
hilus o
(c) A
chorda
occur,
are en
edges o
The m
with st
salts.
endoca

other the valve changes are intense. And herein lies the great danger in this form of endocarditis, since in direct proportion to their extent and activity is the liability to the secondary progressive tissue changes in the valve leading to contraction, thickening, and insufficiency. On valves affected in this way verrucose endocarditis is very common, and presents two peculiarities—the vegetations show more rapid changes, as the vascularization of the valve is greater, and there is a greater danger of widespread necrosis and ulceration.

2. **Ulcerative, Vegetative, and Necrotic Lesions.**— Both sides of the heart may be affected, the right in larger proportion than in simple endocarditis. Of 209 cases, aortic and mitral valves were affected together in 41, aortic valves alone in 53, mitral valves alone in 77, tricuspid in 19, pulmonary valves in 15, heart walls in 33, and in 9 cases the valves of the right side of the heart were affected alone. Macroscopically there are three types of lesions: (a) Ulcerative, causing extensive destruction of the endocardium, of the texture of the valve, or even forming a deep ulcer which may perforate the aortic ring or the septum. Often it is only a superficial erosion of the valve covered with a gray, diphtheritic-looking membrane, hence the term diphtheritic applied to this form; or an aortic or mitral cusp may be perforated or a valve aneurism is formed. The most extensive destruction may occur, or a segment is eroded completely; in one instance two of the aortic cusps had completely disappeared to the line of attachment, which was smooth, while the third segment was more than half destroyed. In some of these severe ulcerative forms there are very few vegetations. When upon the base of a mitral leaflet or near the aortic or pulmonic ring the lesion may be deep and destructive, forming what is called acute perforative ulcer of the heart. This type is most frequently the result of infection with streptococci or other pus organisms. The process may be very acute; in a case in which a large ulcer penetrated deeply into the muscular substance below the aortic ring the entire illness was within ten days. Septic emboli, hemorrhage, and suppuration are frequent with this form. On the other hand, it may last several months and without acute symptoms.

(b) Globose, grayish-yellow or greenish-gray vegetations projecting from the valves, often having a fungoid aspect and without much superficial ulceration, but with great necrotic destruction of valve tissue, leading frequently to perforation. Seen in pneumonia and in gonorrhœa this type is common, and while there may be high fever and septic features, emboli and hemorrhages are not so frequent. When of any duration, the vegetations are not infrequently encrusted with lime salts. The process may extend beyond the valves. In one case there were mycotic aneurisms of the aorta, while in another they extended along the pulmonary artery almost to the hilus of the lung.

(c) A proliferative form characterized by outgrowths from the valves, the chordæ tendineæ, and the mural endocardium. In all varieties vegetations occur, but in certain of the severer infections they are larger and the valves are encrusted with firm, yellowish masses, often hanging in tags from their edges or coating the chordæ tendineæ, some of which may be eroded through. The mitral orifice may resemble the mouth of a miniature cave surrounded with stalactites, and the tendinous cords resemble twigs encrusted with lime salts. They are solid structures, not friable, intimately united with the endocardium, and the whole thickness of the valve may be involved at the

attachment. In long-standing cases the vegetations may be very large, dry, hard, yellow, and without adherent thrombi.

Portals of Entry of the Infection.—Practically in all cases the micro-organisms gain entrance through the skin or mucous membranes. In the important group of cases in which the endocarditis is secondary to bone lesions the primary source of the infection, although often obscure, has been through one or other of these channels.

Mucous Membrane.—(a) *Alimentary Canal.*—This is the most common portal of infection. In the mouth alveolar abscess and the necrotic changes associated with bad teeth are occasional causes. Pyorrhœa alveolaris, an almost universal malady after middle age, is rarely a cause of endocarditis. Possibly some of the unexplained cases may be due to it. The *tonsils*, the mycotic hot beds, are responsible for a great many cases, and if, as is now commonly believed, the infection of acute rheumatic fever is here nurtured, they take the first rank as sources of infection. Certainly from them may be cultivated at any time the very organisms most prone to excite endocarditis. Not many cases are met with in connection with affections of the œsophagus or stomach. Ulceration of the intestines, typhoid, tuberculous, or dysenteric, may be complicated with endocarditis. A very important group occurs in connection with infections of the bile passages. Appendicitis is a rare cause.

(b) *Genito-urinary.*—Gonorrhœa, abscess of the prostate, chronic cystitis, and suppurative processes in the kidneys are common sources. Postpartum infection contributes an important group of cases.

(c) *Respiratory Tract.*—Among primary foci may be mentioned suppuration in the nose and adjacent sinuses, affections of the larynx and trachea, and occasionally bronchiectasis. Infection of the valves is a common complication of pneumonia, while pleural suppuration is a rare cause.

Skin.—Many of the severest forms follow local skin infections—post-mortem wounds, an accidental cut or prick during an operation, or the most trivial trauma may be the portal of entry. As a rule, in these severe infections following skin lesions, the endocarditis plays a secondary part. The picture is that of an intense septicæmia. The primary wound may be slight and may have healed before the severe symptoms are manifested. The writer saw such an instance in 1903, and although endocarditis was suspected and the blood was for weeks swarming with organisms, there were no physical signs to indicate the extensive lesions found postmortem. Many of the worst cases are in association with these comparatively slight infections of the fingers, as in one remarkable instance, in which a stalwart young fellow with an old mitral lesion, following the cleansing and cutting of his nails by a "manicure," had paronychia, which excited a malignant endocarditis, of which he died. Erysipelas may be complicated with severe endocarditis.

Primary Endocarditis.—A primary endocarditis, the result of injury or of cold, has been described. It is not always possible to determine that the valve lesion is really secondary. In one of the most acute cases of ulcerative endocarditis in the writer's series no primary source of infection was found, but the tonsils were not examined, and it is not possible to exclude all foci. A small spot of necrosis of the jaw, an insignificant joint lesion in a child, a small area of bronchopneumonia, a prostatic abscess the size of a pea, may be the source. The so-called endocarditis from cold is probably always rheu-

matic and of tonsillar origin, and it may occur in the febrile attacks of children as the result of slight and even overlooked tonsillitis.

Practically all cases of endocarditis may be regarded as secondary to an existing infection.

Endocarditis as a Terminal Infection.—In the hearts of persons dead of chronic affections of all sorts—tuberculosis, dysentery, gout, cancer, chronic nephritis, arteriosclerosis, diabetes, chronic affections of the nervous system— it is common to find on the mitral valves, less often on the aortic, tiny beads of vegetation festooning the segments in the usual situation. In these very small soft structures it is not always easy to determine the presence of micro-organisms, and it has been urged that chemical poisons may be responsible for the primary change in the endothelium of the valve. Of the whole group of terminal infections, pleurisies, pericarditis, enteritis, etc., this is the mildest, as the endocarditis rarely produces any symptoms, and is never responsible for the final event.

Rheumatic Infections.—All other causes sink into insignificance before the endocarditis-producing poison of this motley group. The researches described by Poynton in the article upon "Rheumatic Fever"[1] have brought us nearer the solution of one of the most important problems in pathology. The precise germ may not yet have been settled, but the evidence suggests that the group of disorders to which the name rheumatic is applied depends upon infection with organisms related to the streptococcus group. The examination of the vegetations in rheumatic affections has been made in many cases, and a variety of organisms has been described. A full discussion of the subject is given by Bulloch.[2] The reader is referred to the section by Poynton for a description of the organisms which have been found.

Portal of Entry of the Germs.—Opinion has centred of late years upon the tonsils as the chief source of the infection for the following reasons: (a) The widespread, almost universal involvement of these structures in young children; (b) the demonstration in them of the very organisms which have been isolated from the lesions of rheumatic fever; (c) the clinical association of tonsillitis and arthritis; (d) the frequency of tonsillitis as a link in the rheumatic chain in young children; (e) the beneficial results which have followed removal of these structures in persons subject to recurring attacks of arthritis. There are still many points to be carefully considered. Tonsillar infection is universal in childhood, while rheumatic infection, although common, only occurs in a comparatively small proportion of children. But the same holds good with many "facultative" infections which we carry about. Only a few get pneumonia of those who harbor the pneumococci; not all take typhoid fever who carry the bacilli; many have foci of tuberculosis who never become tuberculous, and it is quite possible that in the tonsils, the crypts of which are natural culture tubes, many harbor the germs of the rheumatic affections of whom only a few show the positive manifestations. Invasion is a question of lessened resistance, lowered phagocytic power. Localization, whether in the joints, the nervous system, the skin or elsewhere, depends on circumstances of which we are as yet profoundly ignorant; and the same must be confessed of the precise circumstances which determine the occurrence of endocarditis in any individual case.

[1] This work, Vol. II, Chapter XXV.
[2] Vol. ii, part i, of the new edition of Allbutt's System.

With the following infections belonging to the rheumatic group endocarditis may be associated:

(a) *Tonsillitis.*—Many writers have called attention to the presence of valvulitis in this affection, particularly Haig-Brown[1] and the much lamented F. A. Packard.[2] It may not be possible to determine definitely the nature of a given attack of tonsillitis. The lesion may be slight and readily overlooked, or there may be nothing more than a diffuse reddening with œdema and relaxation of the fauces. Many of the obscure febrile attacks in children, lasting from five to seven days without any localizing features, are associated with a tonsillitis of a very mild character. In such an attack endocarditis may lay the foundation of subsequent valve lesion. And in how many cases of mitral disease, particularly in women, is the history negative so far as the ordinary endocarditis-producing diseases?

(b) *Arthritis.*—Of all manifestations of the rheumatic poison, this is the one with which endocarditis has been recognized as the most serious complication. In children the percentage of valve infection in rheumatic arthritis ranges from 60 to 80, in adults from 25 to 35. Of 360 patients with rheumatic fever, nearly all adults, admitted to the writer's wards at the Johns Hopkins Hospital during fifteen years, 35 per cent. showed organic valvular disease. As Bouilland stated in 1840, the rule is for endocarditis, with or without pericarditis, to occur in all cases of severe rheumatic fever. In children the endocarditis may be the chief manifestation of the infection in an arthritis so trifling as to be overlooked, a slight swelling of one ankle, a little redness of one knuckle, with a fever of only a few days' duration. It cannot be too strongly urged upon practitioners to watch with the greatest care every case of joint complaint, however slight, every manifestation, indeed, of obscure fever, in young children, since, as pointed out by Graves, the endocarditis may precede the arthritis.

(c) *Chorea.*—Sydenham's chorea is now very generally regarded as an infection very closely related to rheumatic fever. It is not improbable that it will prove to be one of the manifestations of this protean infection. The important point here is that whatever the nature of the poison may be, it is singularly prone to attack the valves of the heart. Some years ago the writer analyzed records of 73 fatal cases of chorea in the literature, and of these 62 had endocarditis. The frequency of this complication has been dwelt upon by all writers on the subject. In Thayer's recent study of 689 cases at the Johns Hopkins Hospital there were 190 cases, or 27.7 per cent., with definite valvular lesions and in 45 others, murmurs were present. The writer examined 140 children more than two years after the attack of chorea, and found that 72 presented signs of organic heart disease. Arthritis, chorea, and endocarditis form a clinical trio of every-day occurrence in children's hospitals.

(d) *Erythema.*—The rheumatic character of nodose and polymorphic erythema has not been demonstrated, but they may be considered here as having at least affinities or relations with the poison which we call rheumatic. The endocarditis which occurs in these conditions is usually simple, but the writer saw one instance of severe endocarditis in a patient with high fever, arthritis, and purpuric urticaria. Many cases of endocarditis in erythema nodosum have been reported by French writers.

---

[1] *Lancet,* 1886.   [2] *Transactions of Association of American Physicians,* 1899.

(e) *Subcutaneous Fibroid Nodules.*—The association of these with endocarditis may be stated: (1) In children they are rarely met with apart from endocarditis. (2) In an immense majority of all cases in children they are a manifestation of the rheumatic poison. (3) They may occur in other than rheumatic forms, and in some of the most extreme cases there has been no arthritis, simply the nodules and a valvulitis, almost invariably mitral. There are varieties which have a very special relationship with certain forms of endocarditis, and will be referred to later.

Character and Results of the Endocarditis in the Rheumatic Group.—In a majority of instances it is an attenuated virus, producing the common verrucose form, with vegetations a little larger and more cauliflower-like than in the terminal endocarditis. There are four dangers associated with the lesion: (1) A vegetation may break off and cause embolism, a rare event in acute simple endocarditis, more common in the ulcerative form. (2) Recurring endocarditis. Recovery takes place, but fresh crops occur from time to time. (3) Proliferative valvulitis. As already mentioned, the substance of the valve is apt to be involved and the newly formed granulation tissue cicatrizes with puckering, contraction, etc., so that the function of the valve may be damaged very quickly. Within three months of the onset of the illness the leaflets of the mitral may be so curled and folded that not a fourth of their substance remains. (4) Ulceration and destruction of the valve, while not common, occur in a considerable number of cases. There were 24 among the 209 cases analyzed from the literature. Extensive ulceration is a rare event in the endocarditis of childhood.

The special danger, the danger that makes rheumatic fever one of the most serious of all diseases, is the starting of proliferative changes in the valve substance itself, which is gradually followed by cicatrization, with stenosis and insufficiency of the valves.

The Eruptive Fevers.—In *measles* endocarditis is rare, and when it does occur is an incident or a complication, such as bronchopneumonia, and is a streptococcic or pneumococcic infection. In *scarlet fever* it is more common, and occurs in connection with the angina or arthritis. It may be severe and part of an endopericarditis of great intensity. It is rarely of the ulcerative form. In *smallpox*, with such widespread suppuration, one would suppose that endocarditis would be a frequent complication, but it is rare. A systolic murmur at the apex is common as a result of the fever and of the muscular weakness, but it usually disappears. Ulcerative lesions have been described in a few cases, but the simple form is the most common. In chickenpox, mumps, and whooping-cough, endocarditis is not often met with.

Diphtheria.—Both forms have been described, but even in the several types of the disease the valves are not often affected. In 30 autopsies upon cases of a very malignant type the writer found no valve lesions other than the little nodules which seem more common in this than in any other disease. The diphtheria bacillus has been found in the vegetations by W. T. Howard and others, both in the verrucose and the ulcerative form.

Typhoid Fever.—Among 1500 cases there were only 3 with a diagnosis of endocarditis clinically, and among 105 autopsies there were only 3 (a total of 6 in 1500 cases).[1] Typhoid bacilli have been found in the vegetations;

---

[1] McCrae, this work, Vol. II, p. 145.

clinically the complication is usually without symptoms, although in a few instances severe features have indicated the existence of an ulcerative form. It is to be remembered that many of the older cases of typhoid fever with endocarditis were probably cardiac from the outset. In *typhus fever, relapsing fever, cholera, yellow fever, Malta fever*, and *sweating sickness* endocarditis is an occasional complication.

Septicopyæmic Processes.—The most intense septicæmia may exist without endocarditis; the blood may literally swarm with streptococci or pneumococci for weeks without any affection of the valves. The lesions may be verrucose, but in this group we see the most severe types of ulceration and destruction, with embolic and septic changes in the organs. The infections of this class may be grouped as follows: (*a*) *Erysipelas*, in which the valvulitis may be of either form, but it is not a very frequent complication. (*b*) *Puerpural infections:* Many of the worst cases we meet with follow postpartum septic processes in the uterus or adnexa. Virchow figures a characteristic lesion in his well-known studies upon the subject. It is usually the ulcerative form, and often overlooked clinically in the intensity of the general infection. Eleven per cent. of the 209 instances of malignant endocarditis which the writer analyzed from the literature came in this class. Perhaps more often than in any other condition is the right heart affected. (*c*) Acute bone lesions and osteomyelitis are often complicated by ulcerative endocarditis. The cases are very numerous in the literature. (*d*) *Skin infections*, the septic wounds from whatever source, postmortem cuts or pricks, accidental infection at operation, paring a corn, etc. This is an important group and the endocarditis is usually severe. (*e*) *Miscellaneous infections:* Suppuration in the genito-urinary tract, in the liver and bile passage, abscesses in the abdomen, particularly the old peri-appendicular variety, empyema (rarely), fœtid bronchiectasis, a suppurating bronchial gland, a suppurative tonsillitis, etc.

Gonorrhœa.—Only of late years has it been recognized that one of the most common and serious forms of endocarditis was caused by the gonococcus. It is not easy to estimate the relative frequency, as the determination of the organism is not always easy. At the Johns Hopkins Hospital our attention was called to it by the work of Thayer and Blumer, who first demonstrated the gonococci in the blood. The literature is very fully given in *Lubarsch und Ostertag's Ergebnisse, Jahrgang* ix.

The valvulitis may be an incident in an early and intense gonorrhœal septicæmia, but more commonly it is a complication of the first ten weeks. A few cases have been reported as late as from the third and the fifth month after infection. It does not appear to have any special relationship with the arthritis. Women are rarely affected. The valves of the right side of the heart, and particularly the pulmonary, are perhaps more often affected in this than in any other form. While simple verrucose endocarditis may occur from which recovery takes place without much damage to the heart, this form is apt to be of great severity, associated with high fever, chills, sweats, and hemorrhages, with the embolic features of the most malignant types of endocarditis.

Tuberculosis.—Endocarditis is not very infrequent; the writer found 12 cases in 216 postmortems in the literature. G. W. Norris collected 151 cases in records of 11,000 autopsies in cases of tuberculosis. It may be (*a*) the terminal thrombo-endocarditis; (*b*) simple, warty endocarditis due to strep-

tococci or staphylococci; (c) true tuberculous endocarditis, with tubercle bacilli in vegetations which have proved infective to animals. Ulcerative forms are exceedingly rare.

Malaria.—Except as a terminal event in the cachexia, endocarditis is an exceedingly rare complication of this disease. The frequent reference in older writers was due to an error in diagnosis, particularly in connection with the more chronic form of endocarditis associated with chills and fever. Among the many hundred cases of all forms of the disease studied at the Johns Hopkins Hospital there was not an instance of endocarditis.

Influenza.—A good many cases have been reported clinically, and a few in which anatomically the influenza bacillus has been found in the vegetation, in other instances in association with streptococci or pneumococci.

Symptoms.—A majority of the cases present no symptoms. The terminal endocarditis of the chronic diseases, the slight attacks of many febrile disorders, and even the complicated valvulitis of a septicopyæmia may give no indication of their presence, either by subjective sensations or by physical signs. The cases may be considered in three groups—the simple warty endocarditis, the acute ulcerative forms, and the chronic septic endocarditis.

Simple Endocarditis.—Fever is the most important single symptom. As a rule, it is already present in the disease in which the complication occurs, as in rheumatism, pneumonia, etc., but with the onset of the valvulitis the temperature rises or changes in character. The terminal thrombo-endocarditis may be afebrile; on the other hand, the slight rise in temperature for a few days before death, not uncommon in chronic nephritis or any protracted illness, may be associated with the occurrence of vegetations in the valves. The recurring endocarditis on the old sclerotic valves of aortic or mitral insufficiency may be indicated only by a slight pyrexia. The old hospital patients with these affections return again and again with slight febrile attacks or with transient cardiac insufficiency and an elevation of temperature for a week or ten days. In several such instances sudden death has occurred, and the only lesion to account for the fever has been the beady valvulitis on the old sclerotic segments.

After all, it is in children that endocarditis is a serious affair—perhaps *the most serious single infection, responsible for almost as many deaths as all of the exanthematous affections of childhood together*—and in them fever is *the* symptom. A chill at the onset is very rare. It is not easy, nor always possible, to distinguish the fever of the primary disease from that of the complication, as for example in rheumatic fever, when the disease is at its height, a loud, systolic murmur has appeared under observation. But when the arthritis has subsided and the temperature has fallen a recurrence of the fever alone with the characteristic physical signs is the best indication that valvulitis is present.

So, too, in other affections, *e. g.*, tonsillitis, the same rule holds good. There is nothing characteristic in the fever—a daily rise of from 1° to 3°, following the diurnal range. A sweat at night is not uncommon. The temperature may keep above normal for weeks; in fact, there may be nothing but the slight elevation to indicate that anything is the matter.

Does a growth of vegetations on the valves ever take place without fever? Not often in children, although it may be possible; but in adults even the worst types may be afebrile. Headache, loss of appetite, and the usual

accompaniments of slight fever may be present. Symptoms pointing to involvement of the heart are inconstant. There may be no complaint to call attention to this organ. The *pulse* rate is increased with the fever, and in a few instances it becomes small and irregular, but there is nothing suggestive or characteristic. *Pain* about the heart is rarely complained of in the simple form occurring for the first time with rheumatic or other fever, but in the recurring endocarditis of old mitral or aortic disease, pain, even anginal in character, may occur with the febrile paroxysms. More commonly there is slight precordial distress. With pericarditis pain is more frequently met with, but the most severe endocarditis may be latent. *Palpitation* may be complained of, less often in children than in adults, and it may be associated with a transient oppression of breathing or a desire to sit up and take a deep breath. Disturbance of the skin sensations may be present—sensitiveness on pressure about the nipple or in the pectoral fold.

Physical Signs.—**Inspection.**—In children with fever the heart's action is usually forcible and the impulse is visible in the fourth and fifth interspaces, and in thin chests, even in the third. Much may be gathered from careful inspection of the precordia. The position of the apex beat, the character of the impulse, its extent and nature, indicate the state of the heart wall, and are measures to some extent of the severity of an endocarditis. As already mentioned, the little chaplet of vegetations does not represent the whole affair in endocarditis, but the heart muscle is often affected, weakened by the fever when high and still, more by a myocarditis, if present; and these changes are expressed by differences of the impulse and a slight dislocation outward of the apex beat. But it is more particularly with reference to prognosis that inspection is of value. For example, after an attack of rheumatic fever in a child, in whom an apex systolic murmur is present and persists, if when lying recumbent and straight the apex beat is within the nipple line and not forcible, we may feel confident that the damage to the heart is not serious, and even though the murmur persists there is not much if any valvular insufficiency. On the other hand, with the apex beat forcible, in and outside the nipple line, we know that serious damage has occurred and that the organ is crippled. In fact, inspection in heart disease often gives data of more value than those obtained by any other way, as they are less liable to misinterpretation.

Palpation.—Increased force and extent of the impulse are usually present, and the shock of both sounds may be felt. The shock of the second sound may be felt in the second left interspace. A thrill is very rare, but in a violently acting heart during high fever, a vibratory sensation is sometimes to be felt which simulates a thrill.

Percussion.—With involvement of the myocardium and consequent dilatation there is increase in the cardiac flatness, best appreciated by mediate percussion, upward and to the left. Increase to the right is not so easily determined. In many cases no change is to be determined. The personal equation has to be taken into account, and there are men with deft fingers and keen ears who recognize very slight alterations in the cardiac outlines.

Auscultation.—A majority of cases of acute endocarditis are on the mitral valves, and the most constant physical sign is the occurrence of a systolic murmur at the apex region. Two circumstances have to be remembered in connection with the diagnosis of endocarditis. In children and young adults with thin chests it is very common to hear a murmur at the second left

interspace, which is of no moment whatever, and in fever with a rapidly acting heart a systolic bruit is usually present. The presence of a murmur then is of itself no indication that endocarditis is present, particularly if it is loudest over the body of the heart and at the pulmonic area. The murmur that is of moment in a given case, say rheumatic fever, has the following characters: (*a*) It has come on under observation and may have developed directly from a roughness or blurring of the first sound. (*b*) It is apical, below the fourth rib, often most intense upon it, but is also loud at the apex and is transmitted as far as the midaxillary line. (*c*) Soft and whiffing in quality at first, it may change under observation and become harsher. (*d*) It is present in the recumbent, sitting, and erect postures, often most intense in the first named; and (*e*) lastly, and most important of all, it is permanent. After all the symptoms have gone it persists and may increase in intensity. These are the important features in the simple form of mitral valvulitis met with in the acute infections, particularly in rheumatic fever. It is important to bear in mind that in a considerable proportion of all cases the condition is latent, and it may be accidentally discovered weeks after the original illness that the child has a valve lesion.

Infection of the aortic segments is much less common and, except in adults, is rarely met with alone. It is still more difficult to recognize. A systolic bruit at the base is very common in febrile states, and there is nothing to distinguish the murmur of rapid action and of altered blood states, etc., from that of a valvulitis. Only after convalescence may the persistency of the murmur, the increased vigor of the apex beat, and the slight extension of the cardiac dulness determine the diagnosis.

Simple endocarditis of the valves of the right side of the heart is of rare occurrence and still more rarely recognized.

Termination.—(1) The vegetations may disappear completely and leave no damage. Probably this is the case only with the slighter forms of thrombo-endocarditis, in which it may be shown histologically that there is little or no change in the valve tissue itself. (2) The vegetations themselves may gradually disappear, but the condition has been one of infiltration of the delicate membrane, and there is permanent damage caused by the shrinking and thickening of the tissues in a chronic, progressive valvulitis. (3) The vegetations increase in luxuriance, and the infiltration of the tissue leads to necrosis and ulceration. This is comparatively rare, as in only 24 cases of the writer's series did ulcerative endocarditis occur in rheumatic fever, and which may reasonably be supposed to have followed directly upon the simple form. (4) And, lastly, a fragment of vegetation may be whipped off, with the result of embolism in one of the arteries of the brain, the liver, the spleen, etc.—a comparatively rare event in the simple endocarditis of the fevers, but common enough in the recurring form on old sclerotic valves.

Complications.—Sturges very correctly insisted that a majority of the cases are best described as *carditis*, so frequently are the epicardium and the substance of the heart involved. Pericarditis is very common, particularly in rheumatic fever. Sibson[1] found 54 instances of pericarditis among 161 cases of endocarditis. As a rule, it is readily recognized by the presence of the characteristic rub, and is usually of the simple form without much effusion. Myocarditis is an almost constant accompaniment of endocarditis,

---

[1] Reynolds' *System of Medicine*, vol. iii.

more particularly the rheumatic form. The feebleness of the pulse, the cardiac irregularity, the precordial distress, and the dyspnœa are features associated with this complication. Very rare complications are acute aortitis and rupture of one of the chordæ tendineæ. Of other complications, pleurisy and pneumonia are most common, particularly in the rheumatic cases.

Malignant Endocarditis.—It may be questioned whether it is worth while to consider the protean aspects of this infection under diseases of the heart, since the manifestations are those of septicopyæmia; and in a great majority of all the cases the features of the general infection dominate the picture. The clinical features are much influenced by the character of the infecting organism. The pus producers present a picture of severe and rapid pyæmia, with chills, fever, suppurative infarcts, and hemorrhages, symptoms which are associated with ulcerative lesions and numerous septic emboli. In the non-suppurative forms, the features, as a rule, are less intense, the cardiac symptoms more marked, and the picture is that of a septicæmia, as indicated by high and irregular fever. But there is no end to the diversity of the symptoms, and it does not seem possible to make always a separation between the suppurative and the non-suppurative varieties. Writers have been in the habit of grouping the cases according to the dominance of certain symptoms: (1) *The pyæmic form:* In this there is usually the well-marked local infection (an external wound, the septic uterus, an acute necrosis), but in other instances there is no definite focal lesion. Chills, sweats, high fever, progressive anæmia, wasting, with embolic features such as hemorrhages, bloody urine, pain over the spleen with enlargement of the organ, in some cases blocking of the larger vessels causing hemiplegia, or, in the large arteries of the limbs, gangrene, are the important symptoms. The heart features in this group are very variable. They may be marked—a loud murmur may develop under observation, and increase in intensity, changing in quality, and there are signs of dilatation of the heart. Or, under observation in the course of a few days an aortic diastolic murmur may arise. Under these circumstances, with a local lesion or in a *postpartum* case the recognition is easy enough. But in another group of cases the cardiac features are those of the ordinary intense febrile state—a mitral or a basic systolic murmur, not of great intensity and presenting no special characteristics. And lastly, with the most extensive valvulitis there may be neither symptoms nor physical signs pointing to the heart. (2) *Typhoid group:* Absence of detectable local focus of infection, irregular fever, delirium, dry tongue, occasional chills, perhaps diarrhœa, suggest the diagnosis of typhoid fever. Many of the severer forms of pneumococcic and gonococcic endocarditis are of this type. Embolic features are not so common, but there may be the same difficulty in determining whether the heart is really involved or not. It is in this group of cases particularly that the blood cultures are of the greatest value, and the evidences obtained from lumbar puncture. But even the most skilful diagnosticians may be in doubt, and it may not be possible to say anything more than that a condition of septicæmia is present. The illness lasts for from three weeks to three months, and the diagnosis may be made clear at any time by an embolic accident. Sometimes the whole picture is that of a meningitis. Even when no exudation is present, the headache, the progressive stupor, the cutaneous hyperæsthesia, and the rigidity of the neck may strongly suggest it. It is to be remembered that in the pneumococcic form, and in others,

too, meningitis is by no means a rare complication, and in several instances in which this complication occurred early it led to an erroneous diagnosis. Practically these two types, the pyæmic and the typhoid, correspond to the two divisions of the suppurative and non-suppurative lesions.

A very interesting group of cases, the only one in which the diagnosis is easily recognized, is that to which Bramwell gave the name of (3) *cardiac group*, but which may be well called the *recurrent form*. In this the patient with chronic valve disease, mitral or aortic, begins to have irregular fever and an evening exacerbation of two or three degrees, an increase, perhaps, in his cardiac symptoms, and then embolic phenomena occur. The spleen enlarges and is tender, or there is pain in the back with bloody urine, or a sudden hemiplegia or a peripheral embolism may occur with gangrene. Such cases are very common, and while in some the process is acute, in others the symptoms may last for weeks or even months. These

FIG. 2

Temperature curve in a severe attack of endocarditis

are the cases, too, in which after the severest symptoms recovery may take place. The chart given here shows the temperature record of such an attack in a man with mitral stenosis, who was under the writer's care on and off for many years and who had several attacks of severe endocarditis, from which he recovered. This form, in which the patient has successive attack, in the intervals of which he is afebrile and fairly well, is common enough as an incident in old cardiac lesions.

An *afebrile form* has been described, and we must recognize that a chronic septicæmia may be present associated with endocarditis in which there is little or no fever. Even the very severe type with marked toxæmia may be afebrile. Such a case has been reported by O'Donovan, of Baltimore, and lately a most distinguished London physician, himself a keen student of heart diseases, succumbed to an endocarditis lasting several months, practically afebrile, and without special cardiac symptoms.

Chronic Septic Endocarditis.—In reviewing the literature for the Gulstonian lectures on Endocarditis (1885), the writer was impressed by the protracted histories given by such keen observers as Wilks and Bristow. The chills, often recurring with great regularity, had suggested in these cases the existence of malaria. Bristow's case lasted for more than five months. Since then the writer has had a series of remarkable cases of what may be called the chronic septic endocarditis, in which the condition has persisted from periods ranging from four months to a year. Two of these were reported in the *Practitioner*, 1903. The main features are: (*a*) The presence of an old valvular lesion, aortic or mitral. An important point is the absence of any special change in the condition of the heart. In one patient, who had been under personal observation for a mitral insufficiency for fifteen years, at the end of a period of five months of daily fever (and nothing else) the condition of the heart was very much such as it had been years before, and yet the autopsy showed most extensive vegetative endocarditis. (*b*) Fever, which may be and often is the only symptom, with a daily rise of from 2° to 3° degrees. The chart shows an up-and-down septic temperature. Occasionally there are chills, but there may be fever of even a year's duration without any rigors. (*c*) Emboli are rare, but toward the close there may be high fever, petechiæ, and profuse sweats. Painful subcutaneous nodules of a peculiar form may be present, not exactly like the fibroid nodules of rheumatic fever, but rather resembling minute emboli of the skin. The spots are painful, reddish, slightly raised, and disappear in a day or two. (*d*) Anatomically the valves are found laden with vegetations, and the chordæ tendineæ are encrusted and often eroded. Infarcts are found in the spleen and kidney, but suppuration is not present. Pneumococci, streptococci, and staphylococci have been found in the vegetations. The cases appear to be more common in private than in hospital practice. The infection may persist for from three to four months to a year. In one of the cases reported, and of which the writer has a complete temperature chart, the fever lasted within two days of a year. In another the patient had a daily rise of temperature from the first week in December to September 16, nearly ten months.

Diagnosis.—There are two great groups of cases in the severer types. In the one endocarditis is only an incident in a general disease, and there may be no question of diagnosis, as nothing whatever in symptoms or physical signs may suggest endocarditis. It is surprising, indeed, in how many cases, particularly in pneumonia and in streptococcus septicæmia, the cardiac state is latent. The important points in the diagnosis are: the existence of a septic focus and a septic state, as indicated by the temperature, the blood cultures, etc.; the presence of petechiæ and embolic features, and the symptoms and physical signs pointing to a valvular lesion. Where the septic element dominates, the endocarditis is usually overlooked. When the cardiovascular features are well marked the diagnosis is usually made.

In the second great group, in which the vegetations form the focus of a chronic septicæmia, the diagnosis is by no means easy. The patients are the subjects of an old although often overlooked and well-compensated valve lesion. The fever begins insidiously, and for weeks the case may be treated as one of typhoid fever or the beginning of tuberculosis. Formerly malaria was suspected, but nowadays that is easy to exclude. Week after week, month after month, the daily rise of temperature may be the only feature,

and, indeed, the patient may feel pretty well and be up and about for many weeks. The heart may present little or no change. An old apex systolic murmur indicating a mitral insufficiency may remain much the same. There may be very little enlargement of the heart. In the instance of aortic insufficiency the physical signs, as a rule, are more striking, the enlargement of the heart greater, and altogether the cardiac side of the case is more in evidence. So little change may there be in the state of the heart that on some occasions the writer had difficulty in persuading the attendant physicians of the serious nature of the cases until embolic features occurred.

Prophylaxis.—Much could be done to lessen the number of cases of rheumatic fever, of chorea, and of endocarditis if we attacked more vigorously and more systematically the enlarged tonsils of children. Here is the point toward which our efforts should be directed. A child subject to recurring attacks of tonsillitis, or with marked adenoids, should have the tonsils or adenoids thoroughly removed. Other measures of local treatment simply trifle with what is always a very dangerous condition. Physicians should be on the alert at the first indication of arthritis in the child to insist on absolute rest and to push the salicylates actively.

Treatment.—At the outset it may be questioned whether in endocarditis any measures are at our disposal worthy of the name of treatment. He must, indeed, have keen optimism who believes that we have any drug capable of influencing the state of the vegetations, the proliferative changes in the valve substance, or the mycotic destruction of the segments. In a case of simple endocarditis, particularly in rheumatic fever, the essentials in treatment may be briefly stated: Protracted rest which favors the restitution of the valve to its normal state. Probably the very slight warty growths may disappear without leaving any valvular thickening, but when there is infiltration of the tissue of the valve itself, sclerosis is an inevitable sequence. It seems absurd to talk about rest to structures which seventy or more times in the minute have to bear the full pressure of a ventricular systole, but it is relative rest if we diminish by one-third at least the amount of stress and strain which the mitral segments have to bear. This may be done by keeping the child at rest in bed. To be of any service it should be over a period of at least three months from the date of the fever.

Iodide of potassium may be given in moderate doses, in recognition of its control over vascular metabolism, a point which has been well brought out in these recent experiments upon experimental arteriosclerosis. Caton, of Liverpool, strongly recommends the application of small blisters over the heart. The writer has used these persistently in many cases, but is not able to say that any satisfactory results were evident. When there is distress about the heart, or palpitation, and particularly if pericarditis is present, an ice-bag may be used. When we can cultivate the organism of rheumatic fever and prepare vaccines, there may be some hope of mitigating and lessening the ravages of one of the most serious diseases of childhood.

The severer types of endocarditis are at present, in the majority of cases, entirely beyond our control. The treatment is that of septicæmia. In all cases with blood cultures an attempt should be made to determine exactly the infecting organism. A vaccine should then be prepared and used. The ordinary antistreptococcus serum which the writer has used in many cases has not proved successful in a single instance. There are instances, however, reported in which it has been successful.

And yet the condition is not always hopeless. As is well known, cases of severe sepsis, more particularly puerperal, may recover, and there are a good many instances in which, with all the features of very severe endocarditis, recovery has followed. J. B. Herrick has collected a series of such cases,[1] and he has given anatomical evidence of the healing of serious ulcerative lesions of the valve. Recovery may follow in the gonorrhœal and in the pneumococcus forms, although this favorable termination is rare.

[1] *Transactions of the Association of American Physicians*, vol. xvii.

CHAPTER VII.

DISEASES OF THE VALVES OF THE HEART.

By WILLIAM OSLER, M.D., F.R.S.,

AND

ALEXANDER G. GIBSON, M.B., M.R.C.P.

INTRODUCTION.

General Etiology and Morbid Anatomy.—Acquired valvular defects are the sequence of acute endocarditis or the result of a primary fibrosis. In both cases the effect is the same—a deformity, puckering, and adhesion of the valves, leading to insufficiency or stenosis, or to both combined. Chronic disease of the valves of the heart, then, is a question almost exclusively of valvular fibrosis.

In about 50 per cent. of all the cases this sclerosis is a sequence of acute endocarditis. Among 670 cases of chronic heart disease at the Leipsic clinic, 58.5 per cent. followed acute rheumatism (Romberg). Other acute diseases of childhood are responsible for a certain number of cases, while in a not inconsiderable proportion, particularly of mitral cases, no etiological factor can be determined. In the other great group there is a primary degenerative change in the valve of very much the same nature as arteriosclerosis. There is a senile form which follows the ordinary wear and tear of life. All conditions which keep up permanent high tension lead to thickening and puckering of the aortic and mitral segments; while certain poisons, alcohol, tobacco, and syphilis, may cause primary sclerotic changes in the valves, just as they do in the arteries. The morbid anatomy of chronic valvular fibrosis is very characteristic. In the early stages the edges of the valves are a little thickened and may present nodular bodies, the remnants of organized vegetations. In the aortic segments the corpora Arantii enlarge, the edges thicken, the substance of the valve loses its translucency, and along the line of attachment to the aorta there is opaque sclerosis. In the auriculo-ventricular valves these early changes are seen just within the margin, and here it is not uncommon to find swellings of a grayish red, somewhat infiltrated appearance, almost identical with the similar structures on the intima of the aorta in arteriosclerosis. Even early there may be seen yellow or opaque white subintimal fatty degenerated areas. As the sclerotic changes increase, the fibrous tissue contracts and produces thickening and deformity of the segment, the edges of which become round, curled, and incapable of that delicate apposition necessary for perfect closure. A sigmoid valve, for instance, may be narrowed one-fourth or even one-third across its face, the most extreme grade of insufficiency being induced without any special deformity and without any narrowing of the arterial orifice. In the auriculo-ventricular segments a simple process of thickening and curling of the edges

(205)

of the valves, inducing a failure to close without forming any obstruction to the normal course of the blood flow, is less common. Still, we meet with instances at the mitral orifice, particularly in children, in which the edges of the valves are curled and thickened, so that there is extreme insufficiency without any material narrowing of the orifice. More frequently, as the disease advances, the chordæ tendineæ become thickened, first at the valvular ends and then along their course. The edges of the valves at their angles are gradually drawn together and there is a narrowing of the orifice, leading in the aorta to more or less stenosis, and in the left auriculo-ventricular orifice—the two sites most frequently involved—to constriction.

Finally, in the sclerotic and necrotic tissues, lime salts are deposited and may even reach the deeper structures of the fibrous rings, so that the entire valve becomes a dense calcareous mass with scarcely a remnant of normal tissue. The chordæ tendineæ may gradually become shortened, greatly thickened, and in extreme cases the papillary muscles are implanted directly upon the sclerotic and deformed valve. The apices of the papillary muscles usually show marked fibroid change.

Incidence of Involvement of the Valves.—In the collected statistics of Parrot the mitral orifice was involved in 621 cases, the aortic in 380, the tricuspid in 46, and the pulmonary in 11.

Mortality.—The death rate in England and Wales from circulatory disease is 1.66 per 1000. In 1905, 242,276 males, 265,454 females died of diseases of the circulatory system. When one considers that a very large proportion of these cases have their origin in rheumatic fever, we see what an important role this disease plays among the acute infections. The larger number of females is probably owing to the fact that rheumatism and chorea are more common among them.

Age Incidence.—Fully one-half of the cases of valvular disease of the heart occur in young persons. Up to the fifth year children are not very liable to valvular disease, but from the fifth to the tenth a great many cases of chorea and the milder types of rheumatism lay the foundation for subsequent sclerotic changes. Doubtless, many cases of mitral disease owe their origin to the slight valvulitis arising in the course of a tonsillitis. Between the tenth and fifteenth years there is an ever-increasing liability. From this time onward the endocarditic valve lesions diminish. During the adult period from the twentieth to the thirtieth year the maximum number of cases of cardiac breakdown occur—37.16 per cent. in Romberg's Leipsic statistics. In the fourth decade a considerable number of the endocarditic cases drop out and the special sclerotic forms begin to appear, more particularly the syphilitic and those associated with the toxic types of sclerosis. Through the fifth, sixth, and seventh decades there is a progressively diminishing incidence. The figures in Romberg's statistics were for the fifth decade, 12.69 per cent.; for the sixth, 9.10 per cent.; for the seventh, 4.33 per cent.; and for the eighth, 1.05 per cent.

Effects of the Valve Lesions.—The general influence on the work of the heart may be briefly stated as follows: The sclerosis induces insufficiency or stenosis, separately or in combination. Narrowing retards the normal outflow; insufficiency permits a certain reflux of blood, with the effect of dilatation of the chamber behind the affected valve. In the former case the chamber has a difficulty in expelling its contents through the narrow orifice; in the latter the chamber is overfilled by blood flowing into it from an improper

source, as, for instance, in mitral insufficiency, when the left auricle receives a double current from the pulmonary veins and from the left ventricle.

The heart is fully prepared to meet the ordinary grades of dilatation which constantly arise during the extra calls of exertion, when, as in the course of a fever, its muscle has been enfeebled. At the end of a hundred yards' race, a man has his right chambers greatly dilated and his reserve cardiac power worked to its full capacity, but when the exercise is stopped the heart still goes on beating rapidly and forcibly for some time, for the reason that the cavities are dilated and an extra force has to be expended to make the circulation adequate. The extra tension at the beginning of systole being absent, the dilatation diminishes, the activity called forth by extra stretching of the cardiac muscle abates, and the circulation resumes its normal state. Supposing, however, as in valvular disease, the dilatation of a cavity is permanent, then the constant extra stimulation of the heart required to keep the circulation properly maintained calls forth hypertrophy (see article on Hypertrophy) to combat this extra constant demand upon the heart's resources. When the inception of valvular disease is slow, as from sclerotic changes, the increased activity of heart muscle calling forth a gradual hypertrophy is able to avert any lack of compensation until the valvular deficiency oversteps the limits which increased activity and hypertrophy can oppose. On the other hand, if the valvular defect occurs rapidly, then compensation is disturbed in proportion to the magnitude of the deficiency and its rate of onset, and the heart remains uncompensated until hypertrophy has time to develop. To appreciate its nature the process may be graphically shown in the accompanying diagrams, in which the perpendicular lines represent the power of the work of heart. While the muscle in the healthy heart (Fig. 13 a) has at its disposal the maximal force, $a\ c$, it carries on its work under ordinary circumstances (when the body is at rest) with the force $a\ b$; and $b\ c$ is the reserve by means of which the heart accommodates itself to greater exertion.

With a gross valvular lesion the force needed to do the ordinary work (at rest) becomes very much increased (Fig. 13 b). But in spite of this enormous call for force, insufficiency of the heart muscle does not necessarily result, for the working force required is still within the limits of the maximal power of the heart, $a_1\ b_1$ being less than $a\ c$. The muscle accommodates itself to the new conditions by making its reserve mobile. But this condition could not be permanently maintained, for there is nothing left for emergencies but the small reserve force $b_1\ y$. Even when at rest the heart would be using continuously almost its maximal power. Any slight exertion requiring more extra force than that represented by the small value $b_1\ y$ (say the effort required in walking or on going up stairs) would bring the heart to the limit of its working power and palpitation and dyspnœa would appear. The increased exertion leads now to the putting on of yet more muscle, enabling the heart the better to meet the added calls on its strength, and with this the extreme limit of cardiac action is raised, and instead of this being at y, it now reaches c_1, provided there is no interference with the nutrition of the heart muscle.

To what extent the various degress of valvular insufficiency call forth an increase in reserve power is difficult to decide. It is probable that with a slight lesion the limit at first is not beyond what it would be in a similar normal heart under the same conditions, but when the requirements of the heart, with the body at rest, increase so as to approach the limit of the reserve power, we may infer that the total cardiac capacity is increased in proportion,

because, unless absolute rest of the body, and probably also of mind, is maintained, any movement and any excitement increases the work of the heart and widens the upper limit of cardiac capacity.

The property of the heart whereby at times greater work can be sustained than when the organ is at rest has an important bearing on the course and the treatment of organic lesions. *Per se*, a valvular lesion if slight may affect but little, if at all, the limits to which cardiac action can be pushed; in other words, a person with a well-marked valvular lesion sometimes endures without any outward symptoms of excessive distress the most arduous trials of endurance. This is in agreement with the results of Hasenfeld's experiments, which demonstrate that the limits of cardiac endurance in rabbits with lesions of the aortic valves are hardly if at all lessened as compared with a normal rabbit. But it must not be supposed that a person with valvular disease can undergo with impunity as arduous, continuous exercise as a person with a normal heart. Because, first, the total work required of such a heart at the height of the exertion is far above that asked of the normal heart under similar circumstances; secondly, valvular lesions in man, especially those from rheumatism, hardly ever leave the muscle in the same state as before, so that less work can be got out of it and the inevitable dilatation leads to a yet further increase in the heart's requirements at rest.

For present purposes we may divide the functional capacity of the heart into two parts, first, that which the organ expends when the body is at rest, and, secondly, the reserve, that capacity which enables the heart to overstep and to increase the limits of this activity. This reserve, a function of cardiac muscle alone, is well marked in youth and increased up to adult age and thereafter diminishes; it is also affected by any interference with cardiac muscle, such as infections, intoxications, malnutrition. In all valvular lesions these rest and reserve capacities should receive consideration. In the early periods the heart's work should be well within the rest limit, so as to throw as little strain as possible on the affected valves and allow healing to take place. When this is accomplished, exercise should be so regulated that the reserve is not called upon too suddenly or too freely, while at the same time the limits of cardiac response are gradually widened. If we condemn a person with valvular disease to live always at or about his rest limits, we may tend to retard the growth of his cardiac reserve. On the other hand, it would invite an attack of cardiac failure to ask him to do an arduous piece of work, or if he had to undergo a serious infection. In valvular disease, although an increased amount of work is demanded of the heart, with the body at rest, the full reserve should, if possible—the part from *b* to *c* in the diagram— be developed and maintained in young persons in whom normally these limits are easily extended by daily exercise. There is no reason why a lad with valvular disease should not in a modified degree undergo the same training as a healthy one. In persons who have arrived at an age when cardiac muscle begins to degenerate the greatest care must be taken. In compensated lesions, exercise of the heart, *i. e.*, work over and above the rest limit, is usually beneficial, but a thorough survey of the patient's cardiac condition should be made from time to time, and the effects of this exercise carefully studied. A heart which undergoes increased exertion gets an hypertrophy of work (see section on Hypertrophy), enlarging in all its parts and the weight increasing. But although the cavities enlarge somewhat, they do so probably in some (as yet unknown) proportion to the increase in
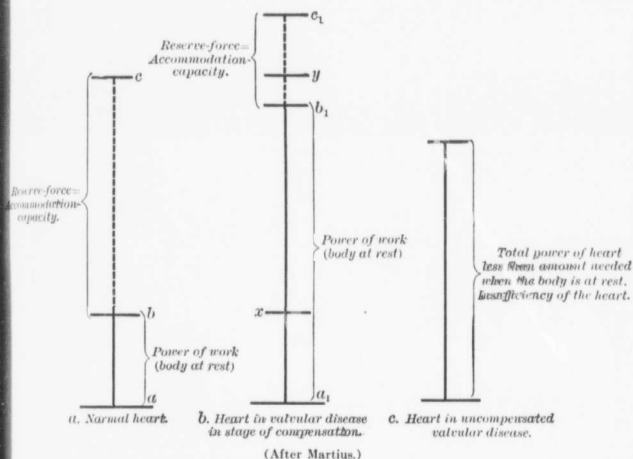
Reserve-force accommodation capacity.

the bulk of the muscle. On the other hand, hypertrophy that follows a
valvular deficiency results from the enlargement of a cavity beyond the normal
limits to allow of accommodation. The compensation by which an extra
amount of blood is forwarded is the expression of the amount of blood
in the cavity. Without such hypertrophy the circulation would not be
adequately maintained even at rest. The hypertrophy of valvular disease is
to be compared accurately with that from overexertion, due in both to a
dilatation of one or more cardiac cavities. If a valvular deficiency could be
made good, we should expect, as in the treatment of hearts overstrained as
the result of exercise, a return of the organ to normal bulk, for no other
reason than that the cavity has again resumed its normal, or nearly its normal,
size at the beginning of systole.

FIG. 13

a. Normal heart.   *b. Heart in valvular disease in stage of compensation.*   *c. Heart in uncompensated valvular disease.*

(After Martius.)

No doubt the capacity of the heart to hypertrophy in valvular disease is
limited by the extent to which the hypertrophy of work can be attained, and
such a result in an aged person is not so easily compensated as in a younger
one, and the greater the insufficiency the less chance there is to increase the
limits of cardiac reserve by hypertrophy.

Turning now to the disturbance of compensation, it is to be borne in
mind that any heart, normal or diseased, may become insufficient whenever
the call for work exceeds the maximal capacity. The liability to such dis-
turbance will depend, above all, upon the accommodation limits of the heart,
the less the width of the latter, the easier will it be to go beyond the heart's
efficiency. A comparison of diagrams *a* and *b* (Fig. 13) will immediately
make it clear that the heart in valvular disease will much earlier become

insufficient than the heart of a healthy person. If the heart muscle be compelled to do maximal or nearly maximal work for a long time it becomes exhausted; or, to be more specific, the mechanism by which extra work is called forth from the heart, namely, stimulation of the heart muscle by stretching, and reflexly by the sympathetic nerves from underfilling of the peripheral vessels, fails to act further; the muscle now becomes more stretched, blood supply is interfered with, and the circulation becomes insufficient at that point. In valvular disease, on account of its small amount of reserve force, the heart has to do maximal or nearly maximal work far more frequently than does the normal heart. By stretching of its walls or interference from myocardial degeneration or disease, its power falls below the amount necessary to carry on the work of the heart when the body is at rest, or it may cease to be sufficient even for this. The reserve force gained through the compensatory process may be entirely lost (Fig. 13 c). On the

Fig. 14
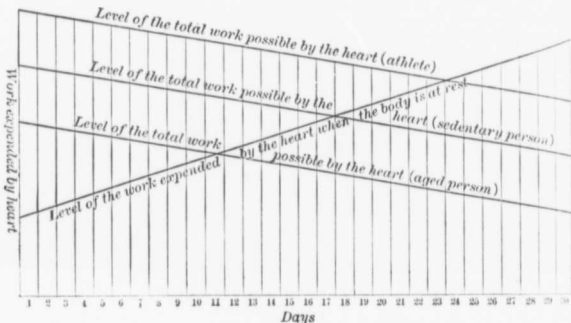
Diagram to illustrate the effects of a gradually increasing valvular lesion with a gradual impairment of the heart muscle, such as probably occurs in malignant endocarditis in persons with different amounts of cardiac reserve. Heart failure occurs when the lines indicating the level of total work cross the line indicating the amount of work required from the heart at rest.

other hand, the insufficiency of the valve at fault may make demands on the heart up to such a point that it approaches and oversteps the upper limit of cardiac accommodation. In the first case, if the loss of reserve force is only temporary, i. e., if the demands on the heart are lessened by rest, or if the muscle can be allowed to recover, the condition is spoken of as a "disturbance of compensation." The term decompensation or "loss of compensation" is reserved for the condition in which the disturbance is permanent. The accompanying diagrams (Figs. 14 and 15) will make clear the foregoing suggestions as to the course of events occurring in valvular lesions.

The schema of Martius (Fig. 16) enables one to understand the relation of the pathological phenomena to the normal cardiac cycle. The contraction of the ventricle takes an appreciable period of time, seven-hundredths of a second (a—b) to overcome the strong arterial pressure which keeps the aortic (and pulmonary) doors tightly shut. This closure time is the only brief

period in the cycle in which both the auriculo-ventricular and the semilunar valves are closed, the former as a result of the beginning of the systole, the

FIG. 15
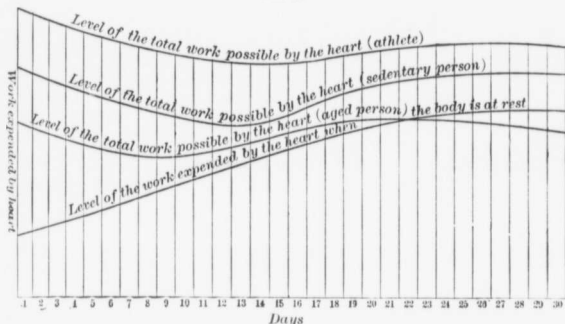
Diagram to illustrate the probable effects of a valve lesion on an athlete, a sedentary person, and an aged person. There is supposed to be a slight early impairment of the cardiac muscle, as is indicated in the descent of the lines indicating the level of total possible heart-work; this is followed by a slight rise which is called forth by the approach of the line indicating the work of the heart at rest. In the aged person the capacity for hypertrophy is least and is not sufficient to oppose the effects of the valvular lesion, and where the two lines cross the heart becomes uncompensated.

FIG. 16
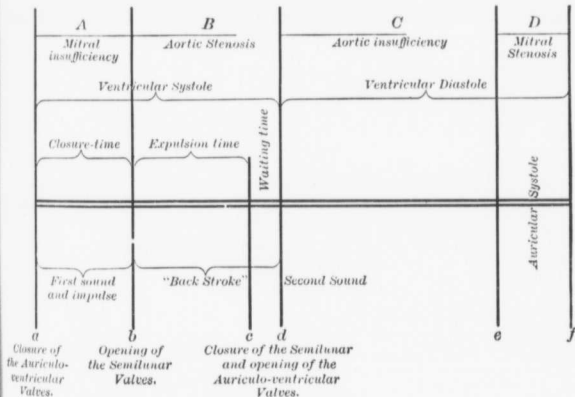
(After Martius.)

latter until the intraventricular has overcome the aortic pressure. With this closure time correspond the first sound and the heart beat. In the second period of the ventricular systole the blood is driven into the arteries, the expulsion time (b—c)—and this corresponds with the beginning of the aortic pulse. During this there may be seen at the apex in a forcibly beating heart the "back stroke," as Hope called it. Following the expulsion time there is a brief period—waiting time (c—d)—before the diastole begins. Clinically the murmur of mitral insufficiency (a) coincides, at any rate in its beginning, with closure time, the murmur of aortic stenosis with the expulsion time. The semilunar valves close at the moment when the ventricles begin to relax (d), and with this coincides the second sound. Immediately after this the auriculo-ventricular valves open. The murmur of aortic insufficiency (c) is heard through the first part of the diastole, sometimes more, while the murmur of mitral stenosis D corresponds with the latter part of the diastole of the ventricles and with the systole of the auricles D.

In view of the importance for purposes of diagnosis of their proper appreciation, it is necessary from time to time to analyze our views of the heart sounds in the light of recent work. We have long been in the habit of looking upon the normal heart sounds as consisting of two only, a first

FIG. 17

The heart sounds are represented at 1, 2 and 3.   (From Einthoven.)

corresponding with and produced by the contraction of the ventricle, and a second sound produced by the tension of the aortic and pulmonary valves. It is probable, however, in view of work by Einthoven[1] and A. G. Gibson,[2] that we must henceforth consider the normal heart sounds as three in number. Gibson, working at the jugular pulse in normal young adults, describes a wave which occurs about half a second after the beginning of the ventricular systole, after the closure of the semilunar valves, and before the auricular contraction. In the cases in which this wave was found it was possible to hear, localized at the apex, a low-pitched clear sound with no harshness or suspicion of a murmur, recalling in type, but not in pitch, the second sound as heard in fat persons. The sound is not easy to hear, and with the most careful attention can only be heard in a proportion of diastolic intervals, the sound being more audible in those cardiac cycles which occur in the interval between expiration and the succeeding inspiration. In striking confirmation of this observation is one of Einthoven's, who has recorded graphically by means of his string galvanometer a third heart sound occurring in a normal young adult without suspicion of cardiac disease. Einthoven's tracings (Fig. 17) bear out Gibson's observation that the sound is not constantly audible, and the amplitude of

[1] Ein dritter Herzton, Arch. f. ges. Phys., Bonn, 1907, cxx, 31.
[2] Lancet, London, 1907, ii, 1380.

the graphic record suggests that, except to skilled ears, the sound is inaudible. The causation of this sound, and probably also of the wave in the jugular pulse, is to be sought in the conditions of the ventricle during the diastolic intervals. On the opening of the auriculo-ventricular valves at the beginning of diastole blood flows into the ventricle from the auricle. After a certain time eddies are formed underneath the valve cusps, and when the ventricle is nearly full they float up sufficiently to close the opening. If, now, this inrush occurs a little more violently than normal, the valves would be closed quickly and some tension put upon them, sufficient probably to give an audible sound. These phenomena may be observed in a sheep's heart by cutting off the auricle and dropping water from a few inches through the auriculo-ventricular opening. The explanation of the sound must, however, be looked upon as hypothetical. That the sound is present can hardly be doubted in view of Einthoven's records, and the necessity for bearing it in mind in the complex conditions of valvular disease is apparent. Clinicians have long been aware of the reduplication of the second sound heard at the apex of the heart only, such, for instance, as in very early mitral disease; and it is probable that this third sound, which we must now consider an integral part of the audible action of the heart, is the same as the so-called reduplicated second sound heard only at the apex. In early mitral stenosis with a slightly increased diastolic pressure in the right ventricle, if the explanation given of this sound is correct, the conditions favorable to the production of such a sound would be increased. Hypothesis should, however, not be pushed farther at present, but it is to be insisted that the normal sound should be taken into account in the diagnosis of early mitral stenosis and probably also in the explanation of all the conditions giving rise to an audible sound in the diastolic period of the heart.

INSUFFICIENCY OF THE AORTIC VALVES.

History.—Cowper,[1] a well-known English anatomist (1666–1709), appears to have been the first to appreciate the significance of insufficiency of the aortic valves. In a paper on "Ossification or Petrification of the Coats of the Arteries, Particularly of the Great Artery," he describes the case of a man, aged thirty years, in whom he found "the valves somewhat thicker and not so pliable as naturally, and did not adequately apply to each other, as in Fig. 4, *a a a*" (referring to an admirable figure of the normal valve closed), "whence it happened sometimes that the blood in the great artery would recoil and interrupt the heart in its systole." The enormous hypertropy and dilatation are described and their significance discussed very intelligently, but he does not describe (as has been stated) the characteristic pulse.

Vieussens, a **Montpellier** Professor, 1641–1716, whose name is perpetuated in a "valve," published a work on the structure and the causes of the natural movement of the heart (Toulouse, 1715), in which he reported the case of a man, aged thirty-five years, who had violent action of the heart and a pulse that struck the end of the fingers with extraordinary force. He found the left ventricle greatly dilated, the walls hard, and the semilunar valves much diseased, the edges rough and calcified, so that their extremities were not

[1] *Philosophical Transactions*, May, 1705, No. 299.

able to approach each other and retain in the aorta the blood that had been propelled by the ventricle, so that part of the blood fell back into it.

Hodgkin, the celebrated Guy's Hospital pathologist, in an excellent paper,[1] recognized the importance of what he called *retroversion of the valves of the aorta*. He described very well the characters of the murmur, stating that it was double, continuing in the diastole as well as in the systole, and also the peculiar jerking of the pulse.

In a paper on "Permanent Patency of the Mouth of the Aorta, or Inadequacy of the Aortic Valves,"[2] Corrigan contributed the first really elaborate paper on the subject, and while we must acknowledge that Cowper, Vieussens, and Hodgkin recognized the disease, it is no injustice that the name of the distinguished Dublin physician should be specially connected with it. He thought the condition could be caused by rupture or by curling of the segments or by dilatation of the mouth of the aorta, so that the valves become inadequate. He recognized the double bruit over the aorta and the visible pulsation in the superficial arteries. One of his patients heard this double sound distinctly in his own person, and referred it to a rushing of blood to and from the heart. Corrigan also recognized that certain of the cases were very readily mistaken for aneurism.

Etiology and Morbid Anatomy.—The sigmoid valves guarding the aortic orifice become insufficient under many different conditions, which are important to recognize, particularly as they have a bearing on prognosis.

The frequency of the disease varies in different localities and in different hospitals. Where the patients are from the working classes in large manufacturing centres, and in seaport towns where syphilis prevails, the number of cases is very large. On the other hand, in hospitals with a large proportion of children aortic insufficiency is relatively rare.

One of the most carefully compiled set of figures are those from the Edinburgh Infirmary.[3] Of 2368 cases with cardiac lesions, valvular disease occurred in 80.8 per cent. (1914 cases); 7.3 per cent. of these 1914 cases were aortic insufficiency alone and 17.6 per cent. aortic insufficiency with mitral disease. Barié gives the proportion at 37 per cent. It is the most common form of aortic valvular disease. The ratio between stenosis and insufficiency is very variously given, owing to the fact that the recognition of the former is not nearly so easy, as in many instances the diagnosis of stenosis has rested simply on the presence of a basic systolic murmur. But in hospital practice the senior author would say that aortic insufficiency was ten times as numerous. In his private consultation work in fifteen years the proportion of insufficiency to stenosis cases was 7 to 1.

Age.—It is a comparatively rare affection in childhood, and is most common in men in the fifth and sixth decades. The form following endocarditis occurs at an earlier age, and is met with in children and young adults. A luetic form is met with in comparatively young men. The arteriosclerotic occurs most frequently between the ages of forty and sixty.

At least five groups of cases may be distinguished according to their mode of origin.

1. **Endocarditic.**—The acute infections with which endocarditis is associated attack the aortic and mitral valves with varying frequency. Rheumatic

[1] *London Medical Gazette*, 1829.
[2] *Edinburgh Medical and Surgical Journal*, 1832.
[3] Gillespie, *Edinburgh Hospital Reports*, 1898, vol v. p. 31.

fever and chorea have a special predilection for the mitral segments. The ordinary septic types attack aortic and mitral valves alike. The severe pneumococcic and gonococcic forms are perhaps seen more frequently on the aortic segments. The ordinary endocarditis of rheumatic fever in children, even when it attacks the aortic valves, does not, as a rule, leave them incompetent. The chaplets of little vegetations may disappear without leaving much, if any, damage. In other cases the edge of one or of two valves is thickened, slightly curled, so that they do not come into close apposition during diastole, and in consequence there is a slight leak. In yet a third group of cases endocarditis has been more severe. The substance of the valve itself has been involved. The segments become adherent, calcification takes place in the hyaline and necrotic tissue, so that the aortic orifice is itself narrowed and there is a combination of stenosis and insufficiency. Sometimes, as a result of the endocarditis, one valve only is affected and a rigid calcified spur remains which prevents the proper closure of the valve. The distinguishing features of the endocarditis group are: the earlier age, the absence of involvement of the root of the aorta so that the coronary arteries are unimpaired, and the greater frequency of the combination of narrowing with stenosis, particularly in young persons. There is a very acute endocarditic aortic insufficiency coming on in the course of a severe rheumatic endocarditis or in the ulcerative forms in septicæmia, pneumonia, and gonorrhœa. Within a week, even within three or four days, the signs of aortic insufficiency may be well marked. In the rheumatic cases recovery may take place, but in the septic forms a malignant endocarditis is apt to develop.

2. **Arteriosclerotic.**—In this, by far the most important form, the insufficiency is part of a widespread arteriosclerosis or of a lesion limited to the root of the aorta. The segments really behave as portions of the aorta, and are involved with it in the degenerative changes. After forty, the aortic segments always show slight signs of wear and tear, and in hard drinkers and hard workers with arteriosclerosis the segments become involved also. The exceedingly delicate texture is lost, the edges curl, and the segments thicken, become foreshortened and so unable to come into close apposition during diastole. So slight is the alteration in some cases that the valves look almost normal, or there may be shortening of only one segment. The surface of the valves may be perfectly smooth, without calcifications or adhesions between the segment, so that there is no narrowing of the orifice. There has been in the valve a simple progressive sclerosis. With this a varying degree of involvement of the arch of the aorta and of the vessels generally is associated; sometimes the arch is in an advanced state of endarteritis deformans, greatly dilated, and even aneurismal. But in other instances the valves themselves show relatively more disease than the aorta. The orifices of the coronary arteries are involved, usually narrowed by the endarteritis, or the branches of the vessels themselves may be diseased. This is the common type met with in hardworking men between forty and sixty in whom there has been no history of rheumatism but the common factors responsible for arteriosclerosis.

Two other varieties may be placed in this category. The luetic form of aortic insufficiency occurs in young men usually within two or three years from the date of infection. It is associated with a syphilitic mesarteritis of the root of the aorta, which may directly implicate the adjoining segments.

It comes on with severe pain, frequently anginal in character. The insufficiency gradually develops under observation. Sudden death may occur from the involvement of the coronary arteries. In other instances, with appropriate treatment, the condition improves and the case finally settles into one of chronic aortic insufficiency. A parasyphilitic variety is seen in connection with locomotor ataxia. This is probably a degenerative form due to the slow action of toxins, but it may occur in the tabes in comparatively young men who have no widespread arterial degeneration. A senile type of aortic insufficiency is not very infrequent. Met with in men over seventy it is due to a gradual thickening, calcification, and adhesion between the segments, so that there is narrowing of the orifice and slight permanent insufficiency.

3. **Relative Insufficiency.**—Corrigan recognized this in his original paper, and stated that without any organic lesion of the segments, insufficiency might be caused by dilatation of the aortic orifice. Discussion has taken place as to the existence of this form. While rare, there can be no question of its occurrence. Beneke showed that the circumference of the aortic orifice and the aorta just above it increase slightly as age advances, no doubt owing to loss of the elasticity. The cases of this variety have marked dilatation of the aorta, often with extreme endarteritis deformans, and the sigmoid valves a little thickened at the corpora Arantii and along the free border, but without reduction of the closure surface of the valve.

4. **Rupture of the Valve.**—This accident rarely happens to a healthy valve, but it has been quite frequently met with in disease following the strain of a sudden exertion upon segments already diseased or the seat of endocarditis. Still more often it has followed a trauma, a kick from a horse on the chest, or a fall. One or two valves may be involved. It is more frequent in the aortic than in the other valves. Of 72 observations collected by Dreyfus, 46 were of the aortic segments.

5. **Aortic Insufficiency.**—A considerable number of cases of aortic insufficiency are due to congenital malformation of the segments resulting in a fusion of two of the cusps, and almost invariably those behind which the coronary arteries are given off. By no means an infrequent condition, of 17 cases, all of which presented sclerotic changes, the majority had had during life the clinical features of chronic heart disease. The cases are not always congenital, and the mode of production has been discussed by Dr. Maude Abbott in the section on Congenital Diseases of the Heart.

Pathological Physiology.—The prevalent views of the condition of the heart and bloodvessels in aortic regurgitation require some modification. It is commonly held that with a defect in the valves a large amount of blood flows back into the ventricle from the aorta, and that the distention thus produced in diastole has a greater tendency than normal to distend the chamber. But Stewart[1] has shown that the quantity regurgitated, except in very marked degrees of the condition, is not more than a small fraction of the total amount of blood in the ventricle. The effects of the regurgitation is to counterbalance the negative pressure present in the chamber immediately after systole and to put a positive pressure in the ventricle in all periods of diastole. The effect of this positive pressure is to cause an

---

[1] *Archives of Internal Medicine*, Chicago, 1908, i, No. 1.

increased tone of the ventricular muscle, as can be shown by comparing the volume curves of the heart in the normal animal and after the production of regurgitation. The probable explanation of this is that the cardiac muscle in aortic regurgitation is "overloaded," for Stewart has determined that, as in an overloaded frog's muscle, the summit of the curve occurs after that of the normal. He shows, moreover, that the collapsing pulse is not due to regurgitation into the left ventricle, but to a reflex dilatation of the peripheral arterioles from stimulation of the ventricular wall by the increased pressure. In some of his experiments, when the operation failed to produce the lesion of the aortic valve, nevertheless, as a result of touching the ventricular wall, the typical features of aortic regurgitation were evident in the records. Stewart explains this reflex as the normal means of preventing the effects of undue pressure in the cavities of the heart. The collapsing pulse in experimental animals is changed to one that is more normal by increasing the peripheral constriction, as, for instance, by compressing the abdominal aorta or by injecting adrenalin; and this is confirmed by finding that compression of the vascular area peripheral to the radial artery in a case of pure aortic regurgitation produces the same result. This fact, the low peripheral resistance in aortic regurgitation, is probably the reason for the frequent presence of capillary and sometimes even venous pulsation.

The Corrigan pulse is more marked when the radial artery is felt with the arm held vertical. This is probably not due to the accentuation of regurgitation, but to the diminished venous pressure and consequent greater capillary flow; for if in this position the veins be constricted, the collapsing pulse tends to disappear. A slowing of the heart beat of itself is probably not harmful if tonus is well maintained, because the volume curves in experimental animals show no greater filling of the ventricle during vagus stimulation than before. The harmful effect of digitalis in certain cases of aortic regurgitation is due not so much to the retardation of the rate of the heart as to the peripheral constriction opposing the vasodilatation which is calculated to relieve the heart.

The blood pressure in aortic regurgitation shows very constant features in experimental animals. The systolic blood pressure remains the same within very narrow limits, the diastolic is invariably lessened, and therefore the pulse pressure, or the difference between them, is increased. This is not borne out by clinical examination in man. The minimum pressure is, as a rule, lower than normal, but the maximum pressure is often much higher. In some cases the increase in the maximum pressure is to be accounted for by the arteriosclerosis, so common in the sclerotic type of aortic insufficiency; but in some cases it may be due to an hypertrophy of the ventricle, which is present in disease, but which was not present in the experimental animal.

To the extra amount of blood which the left ventricle holds at the end of diastole is due (from increased stretching) the hypertrophy which follows aortic regurgitation. If the insufficiency is small, then perhaps the cavity is not dilated sufficiently to give any change in the bulk of the left ventricle; hence occasionally a slight amount of aortic regurgitation may be present without any obvious enlargement of the heart (Krehl). When slight regurgitation is present, even though hypertrophy is marked, compensation may be maintained for many years, as may be seen in aortic regurgitation from rheumatic endocarditis. In a pure valvular lesion, which can, however,

seldom be supposed in rheumatic cases,[1] the limits of cardiac reserve power, as has been shown by Romberg and Hasenfeld,[2] are little if at all lowered.

Symptoms.—These are best considered under certain groups of cases:

1. **Latent.**—It is surprising how often in the routine examination one meets with aortic insufficiency that has never caused any symptoms. Even in quite young men with no history of rheumatic fever the condition may be detected accidentally, as in the examination for life insurance. Such patients may continue for years doing the ordinary work of life without the slightest inconvenience. A physician consulted me (W. O.) in whom the late Dr. Donaldson, of Baltimore, an expert auscultator, had recognized aortic insufficiency thirty-five years previously. After a very arduous life it had begun to trouble him, and he had slight attacks of angina pectoris.

2. **Acute Aortic Insufficiency.**—In rheumatic fever, in septic conditions, and following a trauma acute insufficiency may arise. The general features of endocarditis are usually present, fever, sweats, etc. There may be nothing to attract attention to the heart itself. Palpitation or tumultuous action may be complained of, and occasional pain. As the condition grows worse there may be attacks of oppression of breathing, and even dyspnœa, but it is surprising, even in severe cases of ulcerative endocarditis, how slight may be the symptoms pointing to the heart. The physical signs are usually well marked—the rapid, forcible action, the throbbing vessels, and, under observation, the signs of insufficiency may increase. In some of the rheumatic cases it may be months before the compensation is established and before the patient is able to get up and move about comfortably and take exercise without shortness of breath. Even in cases that look the most hopeless, with extreme insufficiency and widespread tumultuous action of the heart, the severe features may gradually subside. One friend, of whose life, indeed, we despaired in 1884, in his second attack of rheumatic fever, survived and practised medicine for nearly twenty years. In other cases the acute insufficiency results from rapid destruction of the valve segments in a septic endocarditis, and the picture and course are those presented by this disease.

Some of the cases of the syphilitic aortic insufficiency come in this category. The patients are young men, and within a year or two of the primary infection, usually with the symptoms of angina pectoris, the aortic insufficiency develops in connection with a localized arteritis at the root of the aorta. The symptoms may disappear with antisyphilitic treatment, but the senior writer has not met with an instance in which the murmur of aortic insufficiency has been lost.

3. **Cases with Broken Compensation.**—For years before the breakdown occurs the patient may present a suspicious pallor of the face, the so-called aortic facies. Pronounced vertigo, or on exertion a ringing in the ears, may recur at intervals for months. Shortness of breath on exertion, attacks of nocturnal dyspnœa, uneasy fluttering sensation about the heart, or attacks of palpitation may initiate the breakdown. The pulse becomes somewhat rapid, is feebler, and sometimes irregular; the respirations increase; there are signs of congestion at the bases of the lungs, the liver may be enlarged, and the signs of venous stasis gradually develop; there may be slight œdema of the feet, but general anasarca is rare. The breakdown may be associated with

---

[1] See Aschoff and Tawara, *Grundlagen der Herzschwache*, Jena, 1906.
[2] *Arch. f. Exp. Path.*, Leipsic, xxxix, 333.

attacks of cardiac pain, anginal in character. Some of the old hospital patients are admitted ten, fifteen, or even twenty times, always with the same symptoms, shortness of breath, cough, signs of engorgement at the bases of the lungs, albuminuria, and perhaps slight œdema of the feet. In some cases there is marked anæmia. Dyspeptic symptoms are common, and the attack may begin with nausea and vomiting, which may remain troublesome features throughout. Mental symptoms are perhaps more commonly met with in aortic insufficiency than in any other form of heart disease. Delusions may occur even without any loss of compensation. More frequently with the breakdown, the patient begins to lose his mental control, and all sorts of delusions arise, particularly relating to time and place. In the endocarditic form, seen most frequently in young people and often in combination with a mitral lesion, the clinical picture may be that of a slight gradual asystole with venous stasis and dropsy.

Fever, when present, usually indicates either a recurring endocarditis of the sclerotic valves or the presence of a complication.

Physical Signs.—Inspection.—Aortic insufficiency is the only valvular lesion which we can recognize at sight. There is no other condition with which so distinctive a type of throbbing of the arteries is associated. The beating of the carotids above the collar, the visible throbbing in the peripheral arteries, such as the radials and the temporals, and, on ophthalmoscopic examination, the retinal arteries. The peculiar jerk of the foot when the knee is crossed may suggest the diagnosis. Even the head may jerk with each systole. There are one or two conditions which simulate it, which will be referred to later.

Heart.—In children and in young persons the precordia may bulge. In the arteriosclerotic variety there is rarely any deformity of the chest. As the left ventricle reaches a very large size the apex beat is dislocated downward and outward and is usually in the sixth interspace, sometimes in the seventh, and an inch or even two inches outside the nipple line. With full compensation it is regular, forcible, often punctuate, but when the dilatation is extreme and the muscle begins to fail, the impulse is diffuse, often wavy. Although the heart is so large, and, as seen by the fluoroscope, so low, it is very rare that pulsation occurs beneath the costal border in the nipple line. Localized pulsation may be present at the ensiform cartilage and there may be a diffuse impulse extending up the left of the sternum. In children the action of the heart may be very tumultuous. In ordinary cases no pulsation is visible at the base, but with extreme anæmia or when the insufficiency has been rapidly produced, as in ulcerative endocarditis, there may be remarkable pulsations over the aorta and extending into the neck and along the course of the subclavian arteries. These are the cases in which, as Corrigan observed, the diagnosis of aneurism is usually made. And it is often difficult not to make such a diagnosis when one sees a definite impulse in the second or third right interspace, a violent throbbing in the suprasternal notch, and the whole front of the chest shaken with each systole.

Arteries.—As already mentioned, by inspection of the arteries alone the diagnosis may often be made. The subclavians and carotids throb violently, and there may be a visible pulsating tumor above the sternal notch. The brachials are visible, sinuous in their course, and with each systole they expand rapidly and as quickly collapse. Similar large pulsations may be seen in the radials and the temporals and even in some of the smaller vessels.

In no other state do we see such widespread and peculiar throbbing in the peripheral arteries. Occasionally this diffuse vascular impulse is evident in the solid organs, as the liver and spleen, in which a pulsation may be felt, and the whole pharyngeal region may throb visibly and change in color with each systole. The beating in the retinal arteries may be very forcible and even be distressing to the patient.

Capillaries.—The capillary pulse, first pointed out by Quincke, is seen in a great majority of cases. It may be looked for on the nails, or a line may be drawn on the skin, or it is well seen by the pressure on a bit of glass upon the lip. The finger nail is a very satisfactory locality to see it, but it requires good eyes and always good light. Occasionally it is present in a very remarkable form. The palms of the hand blush with each systole and become pale in diastole. Held up against the light the change in color of the skin may be visible six or eight feet away.

Veins.—Pulsation in the cervical veins is common, but it may be difficult to distinguish from the communicated throbbing of the violently beating carotids. The superficial veins are often very full, and it is one of three or four conditions in which pulsation is common particularly in the back of the hand and in the veins of the arm.

Palpation.—Depending upon the stage of the disease, the cardiac impulse is felt to be forcible, punctuate, heaving at the apex, or, when compensation fails, widespread, wavy, and diffuse. The whole front of the chest may be lifted during systole of the huge heart. The shock of the sounds at the apex is occasionally felt. A systolic thrill is rare at the apex. A thrill is sometimes present with the qualities of the mitral presystolic thrill, and it may even terminate abruptly in a first sound. In the endocarditic type of the disease, with the associated stenosis, a thrill is not uncommon at the base, more commonly systolic, but sometimes double. A very marked diastolic thrill may be caused by a calcified spur in the valve.

The arteries feel large and are very commonly sclerotic. From the character of the pulse alone the diagnosis may be often made. Even the handshake may suggest the lesion, or as in the story told of Opoltzer, the characteristic quality may be perceived by touching the foot of a patient as he rests in bed. The pulse beat (pulsus celer) is sudden, forcible, and then drops immediately, resembling the beat of a water-hammer (water-hammer pulse). The abrupt shock-like sensation communicated to the finger is followed by a sudden collapse—hence the name collapsing pulse. By elevating and grasping the arm about the middle, the palm of the hands toward the radial and ulnar arteries, the jerking quality is best perceived. It may be felt in the finger tips and even in the toes. The hand laid upon the dorsum of the foot may feel it with great distinctness. With anæmia it becomes very marked. The pulse is regular, except during certain complications and toward the close when the heart muscle fails. The sphygmographic tracing is very characteristic—a straight and high line of ascension showing the abrupt and forcible distention of the artery, a rapid line of descent forming a very acute angle with the upstroke. The carotid and radial pulse is stated by some to be retarded, particularly by P. Chapman,[1] who has made an interesting study of this point.

A thrill may sometimes be felt over the larger vessels. At the root of the

[1] *Lancet,* 1898, ii.

neck the arteries may feel very voluminous, and even in diastole may be so distended, particularly in young persons, that the diagnosis of aneurism is made.

Auscultation.—A diastolic murmur is heard at the base of the heart, of maximum intensity over the sternum opposite the second or third interspace, sometimes at the left border of the sternum at the third or fourth costal cartilage. Authors differ very much in assigning the point of maximum intensity to this murmur. The French, particularly, place it at the right border of the sternum. The truth is it varies greatly in different cases. In

Fig. 18
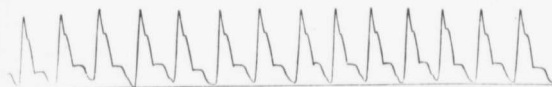
Aortic regurgitation. The pulse tracing shows a rapid rise and fall.

the endocarditic form and when stenosis is present the murmur may be most intense at what is known as the aortic cartilage. In the arteriosclerotic form, particularly when the murmur is soft, the maximum is more commonly at the left border of the sternum in the third or even the fourth interspace. The variation has been thought to depend upon the position of the insufficient segment. No murmur may be present to the right of the sternum in the situation at which one usually listens. The murmur may be so soft as to be readily overlooked, or it may only be rendered audible by exertion. A diastolic murmur may disappear under observation, or it may change

Fig. 19

Aortic regurgitation. The pulse tracing shows the effect of arteriosclerosis on the collapsing pulse, the fall being rendered much less sudden because of the increase in the peripheral pressure.

its character. In a few cases, though insufficiency is present, a diastolic murmur is not heard. In personal experience this has been very rare, but it may occur in the arteriosclerotic form. On several occasions the senior author heard a soft diastolic murmur, when postmortem the valves by the water test appeared to be competent; but in these cases the segments were a little sclerotic, and there may have been dilatation of the aortic ring.

The quality of the diastolic murmur varies greatly in different cases. It may be a soft long-drawn murmur, only just audible, or an intense blowing murmur, while in other cases it has a musical quality. In a majority of the

cases there is a double murmur; in the endocarditic form the systolic is usually rough and rasping in quality, in the arteriosclerotic it is soft. A systolic bruit is not always present. The normal aortic second sound may be audible, but in a majority of cases it disappears altogether. The murmur is propagated down the sternum, and may even be intense at the ensiform cartilage. As a rule, it is not audible beyond the left parasternal line at the level of the fifth rib. In the common cases of the arteriosclerotic form it is not heard up the sternum or in the vessels of the neck. When there is dilatation of the aorta and much roughening of the intima, the diastolic murmur may be well heard at the base of the sternum and in both carotids. So also the loud rough systolic murmur in connection with aortic stenosis may be transmitted upward.

Change in posture does not, as a rule, make very great difference, except intensifying the murmur. Occasionally the alteration from recumbent to erect position may bring out a musical quality.

A systolic murmur of mitral insufficiency is present with the combined aortic and mitral lesions in the endocarditic group, particularly in children; in the arteriosclerotic group when the mitral segments are themselves curled and shortened and with great dilatation of the ventricle when relative insufficiency of the valve occurs. In many cases no apex systolic murmur is present.

The Apex Diastolic Murmur (the Flint Murmur).—In a majority of cases of aortic insufficiency, as the stethoscope is passed along the fifth rib just beyond the parasternal line, a change is noticed in the character of the murmur during diastole. The soft blowing character is lost, and as the nipple line is approached a murmur is heard with a rumbling, purring quality, at once suggestive of the well-known one heard in mitral stenosis. Austin Flint, who first described this murmur, was astonished to find at the postmortem on two cases in which it was present that mitral stenosis did not exist. It has been studied with great care by numerous observers, and for many years at the Johns Hopkins Hospital our attention was specially directed to it in connection with the very rich material at our disposal. The results have been published in a paper by Thayer.[1] The murmur is common, being heard in slight grades in a majority of cases. It is apical in situation, usually above and to the inner side of the maximum apex beat. It is often very localized. It may occur throughout the entire diastole or through the terminal portion, being purely presystolic, or in some instances it is distinctly mid-diastolic. The striking feature is its rumbling and vibratory quality, such as is so distinctive in the presystolic murmur of mitral stenosis. Sometimes there is a crescendo character, and it may terminate abruptly in a sharp snapping first sound. When to these features are added a thrill and a shock of the first sound felt on palpation, it is not surprising that the diagnosis of mitral stenosis is made. Time and again under these circumstances we have discussed the possibility of the existence of mitral stenosis, every cardiac physical sign of which was present. This difficulty is apt to occur in young persons with the endocarditic form, in whom the possibility is always present of the involvement of both orifices. In the arteriosclerotic form and in the subjects of syphilis the chances are always against

[1] *American Journal of the Medical Sciences*, 1901, cxxii, p. 538

mitral
compel

Ause
diastoli
mur is
murmur
not tra
over th
a short
feebler
latter i
particu

Diag
not one
collapsi
is the c
throbbi
nosis w
base is
valves
disease.
dilated,
someti
this lesi
which v
aortic.
no mon
murmur
disease
insuffici
venous
been de
assigned
on the
and to
murmur

Rupt
pain, tu
bruit.
It is ass
drink, l
cases oc
infection
and the
connect
is usuall
atherom
insuffici
systolic

Speci
ciency i

mitral stenosis, even with a combination of physical signs which almost compel the diagnosis.

Auscultation of the Arteries.—Along the subclavians and carotids the diastolic murmur may sometimes be heard. Occasionally the double murmur is transmitted. As a rule, in the arteriosclerotic form the diastolic murmur is not heard above the level of the second costal cartilage, and is not transmitted into the arteries. The most characteristic phenomenon over the larger arteries, particularly the femoral, is the "pistol-shot" sound, a short, sharp systolic shock, and, as Traube pointed out, a second sound feebler than the first, co-incident with the diastole of the artery. The latter is not always heard. With very slight compression of the artery, particularly at the femoral, a double murmur is heard—Durosiez's sign.

Diagnosis.—No heart affection is so easy to recognize, and there is not one less frequently overlooked. The diastolic murmur, and the visible collapsing pulse are pathognomonic. The mistake most likely to arise is the one mentioned by Corrigan in his original paper, namely, the diffuse throbbing of the aorta and the large vessels suggest aneurism. The diagnosis will be considered under that section. A diastolic murmur at the base is heard in several other conditions. Insufficiency of the pulmonary valves occurs in a few instances in connection with long-standing mitral disease. The conus arteriosus and the ring of the pulmonary artery are dilated, and there is relative insufficiency of the valve. The murmur is sometimes called after Graham Steell, who has called special attention to this lesion. It is more often diagnosed than existent. In several cases in which we thought it to be present in young persons the lesion proved to be aortic. The situation in the left intercostal space close to the sternum is of no moment whatever, as this is a common situation for the aortic systolic murmur. The two important points really are the existence of old mitral disease and the absence of the characteristic vascular phenomena of aortic insufficiency. A diastolic murmur heard over the sternum may be of venous origin, and is met with particularly in Graves' disease. Cases have been described, too, in young persons in whom no definite cause could be assigned. Some of these cases may have been due to pressure of glands on the veins. Occasionally the cardiopulmonary murmurs are diastolic, and to this class in all probability belong the so-called transitory diastolic murmurs which are reported at intervals in the literature.

Rupture of the valve is indicated by a sudden onset after exertion, with pain, tumultuous action of the heart, and a loud, perhaps musical, diastolic bruit. The arteriosclerotic form is rare under thirty-five years of age. It is associated with signs of arterial disease, and the etiological factors are drink, hard work, and the stress and strain of life, or syphilis. Endocarditic cases occur in the young with a history of rheumatism or of some severe infection. More frequently than in any other form the orifice is narrowed, and there is a loud, rasping, systolic bruit. Relative insufficiency occurs in connection with dilatation of the aorta or with aneurism. The murmur is usually soft, and it may be heard high on the sternum, and with extreme atheroma a systolic murmur is usually present. In very old persons the insufficiency and stenosis are usually combined, and there is a rasping systolic murmur with a thrill.

Special Features and Accidents of the Disease.—Aortic insufficiency is a disease of accidents and surprises. Sudden manifestations may

occur after a long period of latency. Among these the following are the most important: (1) The sclerotic aortic valves may be attacked by endocarditis, which may assume the ulcerative form. (2) In the sclerotic variety, in which the root of the arch and the coronary arteries are very apt to be involved, angina pectoris is a common event, and death may occur in the first attack. In the syphilitic form recurring attacks may precede the insufficiency, the process of which may be gradually traced. (3) Sudden death is more common in aortic insufficiency than in any other valvular disease. It may occur while the patient is at rest, even while asleep; more frequently it follows a sudden exertion or a violent emotion. While it may be due to acute dilatation, it is more probable that in a considerable proportion of the cases the coronary arteries are involved and there is a sudden interference with the circulation of blood in the heart muscle itself. (4) Embolism is not so common as in mitral disease. A vegetation growing on the sclerotic valves may be dislodged and plug a cerebral vessel, or a calcified fragment or an atheromatous flake may become detached and pass to the brain or to one of the peripheral arteries. In one instance the formation of a popliteal aneurism followed the dislocation of a fragment from the valve, which had been associated for years with a musical diastolic murmur. Following the accident the quality of the murmur changed entirely.

Prognosis.— Recovery is stated to occur, even by observers so careful as Potain, Leyden, and Gerhardt. Personally, the senior writer has never seen a case in which the diastolic murmur has disappeared, although in several syphilitic patients it has become very much less definite. It does not seem likely, as has been suggested, that when only one valve is affected the other two could enlarge and so compensate for the defect. The prognosis varies with the different varieties. The endocarditic is the most hopeful, except in young children with a combined mitral lesion; but in young men compensation may be perfect, and for years there may be no symptoms. After an active life the patient may reach a good old age. Recurrent endocarditis, the chronic septic form or the rheumatic variety, may attack the valves, but such a patient may go through serious illness, even severe rheumatic infections, and recover with a useful heart. In the syphilitic form the prognosis is bad, unless an early diagnosis is made and prompt treatment given. In the arteriosclerotic form, which comes on after the fortieth year, the prognosis is bad, as the root of the aorta and the orifices and the trunks of the coronary vessels are apt to be involved, so that the nutrition of the heart is soon interfered with. These are patients in whom sudden death is apt to occur.

Both in the young and in the aged, moderate stenosis lends a rather more favorable prognosis to the condition. Combined with mitral insufficiency, due to disease of the valve, the outlook is not so good. In adults slight relative insufficiency of the mitral is a favorable feature.

STENOSIS OF THE AORTIC ORIFICE.

This is the rarest of all forms of valvular disease, and usually with it is associated some grade of insufficiency.

Incidence.— In the Edinburgh Infirmary Statistics it occurred alone in 40 cases out of 1914, and in 152 cases with another lesion. Among 670 cases

of valvular disease Romberg found only 28, among which there were only 17 without simultaneous disease of other valves.

Etiology and Morbid Anatomy.—As a rule, the process is chronic, but in a few cases one meets with an acute stenosis due to the growth of very luxuriant vegetations on the valves. There are two great types of the disease, the endocarditic and the arteriosclerotic.

Following endocarditis from any cause, but more particularly from rheumatic fever, the vegetations organize, the edges of the valve thicken, become adherent, sclerotic, and finally calcareous. The segments may be infiltrated with lime salts, and even the aortic ring itself, the whole forming a rigid, calcified mass perforated at one spot by a rounded, oval, or linear orifice. Very varying degrees of involvement of the segments are met with. As a rule, they are greatly deformed, but sometimes only the margins are diseased and the narrowing results from the calcified nodular outgrowths. Indeed, Rendu, quoted by Barié, reports a case in which the narrowing was due to an enormous hypertrophy of the nodules of Arantius. The degree of stenosis is very variable, and may reach a remarkable grade, so that the orifice is not more than a few millimeters in diameter. Insufficiency is always present, the degree depending on the size of the orifice. Of course, when there is calcification and rigidity, there is no possibility of closure of the orifice during diastole. In this endocarditic form the aorta itself is not involved. The mitral valve is almost always affected, but in a certain number of the cases the aortic alone is attacked.

In the arteriosclerotic type the lesion of the valve is part of a widespread arterial degeneration. In men at the middle period of life the sclerosis is not often associated with stenosis. Occasionally there is a slight grade, but one may examine anatomically 25 or 30 cases in succession of sclerosis of the aortic valves without any narrowing of the orifice. In a few cases the edges of the valves coalesce and some narrowing results from atheromatous changes with calcification. The most characteristic form of arteriosclerotic stenosis is seen in elderly persons. It comes on insidiously, and may attain a very pronounced grade without causing any symptoms. In a special variety, described by Norman Chevers, the stenosis does not involve the ring, but the infundibulum or the part below it. This usually follows an extension of a chronic mitral fibrosis.

The heart is enlarged, sometimes very greatly, but rarely reaching the size of that of pure insufficiency. Early in the disease there may be pronounced hypertrophy without much dilatation, and clinically the enlargement may not be very great. Theoretically, with an obstruction at the aortic orifice the ventricle is unable to expel the usual amount of blood into the aorta. The cavity at the beginning of diastole still contains blood, so that at the beginning of systole it is fuller than normal. This causes a greater stimulation of the muscle fibers of the walls, more pressure per unit area is exerted on the contained blood, and more is forced into the aorta through the obstruction. The stimulus of a resistance to contraction during its activity, *i. e.*, when the muscle is overloaded, causes systole to be prolonged from 7 to 30 per cent. of the normal. This differs from the conditions in aortic regurgitation, in which the systole is little if at all prolonged. In this, however, there is no extra resistance to contraction during the period of activity. If the extra force expended by the ventricle is sufficient to discharge the normal amount of blood into the aorta, the cavity is not increased in size, and with

the development of hypertrophy the circulation goes on as before. But if the stenosis is greater than can be overcome by the ventricle, or if the muscle of the ventricle is enfeebled, there is residual blood at the end of systole and the ventricular cavity is permanently enlarged. A third stage is that in which not only the ventricle but also the left auricle is overfilled at the beginning of systole. The auricle, by increasing the vigor of its contractions, may for a time be able to cope with it, but further failure may set in, leading to the same series of changes as occurs in mitral disease—congestion of the lungs, hypertrophy followed by failure of the right ventricle, venous engorgement, and œdema.

The estimation of the blood pressure in aortic stenosis shows that little if any difference exists from the normal. The number of recorded cases is, however, not great. We should expect to find that the maximum and minimum blood pressures estimated by reliable instruments were nearer one another than in a normal person.

Symptoms.—No heart lesion is more frequently latent. In the arterio-sclerotic form years may elapse before the patient experiences any discomfort. Indeed, it is one of the diseases, to use an expression of Oliver Wendell Holmes, that may promote longevity. It has helped many a man to become an octogenarian. In young persons, following endocarditis, symptoms on the part of the heart are more frequent—palpation, irregularity, distress on exertion, and the cardiac reserve is readily exhausted. It is not always easy to separate the effects of the aortic from the mitral disease if present. In old persons vertigo is a common symptom, and shortness of breath on exertion. An extraordinary degree of muscular vigor and good health may be maintained, but the capacity for exertion is greatly reduced and breathlessness follows any extra effort. Attacks of angina occur in some cases, in one of which death may take place. Many patients have a sense of oppression and distress beneath the sternum on the slightest exertion or emotion. Cardiac failure may occur with venous stasis and all the signs of cardiac dropsy. Sudden death is not very uncommon. In others, intercurrent affections, such as cystitis and a consecutive nephritis, may cause death.

Physical Signs.—*Inspection.*—In young persons the precordia may bulge and signs of hypertrophy are present. In these cases the degree of enlargement of the heart depends much more upon involvement of the mitral and the amount of insufficiency of the aortic cusps. When these are present, there may be a great deal of dilatation and a very large heart. On the other hand, with pure stenosis there may be little or no hypertrophy, and the apex beat may be dislocated a little down and out, but the organ is not greatly enlarged. On palpation the apex beat is easily felt in the fifth or sixth interspace, forcible and regular. Many years ago Traube pointed out that in a considerable number of cases the apex beat was absent.

Percussion.—Percussion shows slight increase of the cardiac dulness downward and to the left, varying with the degree of dilatation. On *palpation* a systolic thrill is felt at the base, of maximum intensity in the second right intercostal, propagated up the sternum and sometimes felt in the carotids and subclavians. On *auscultation* a loud, rough systolic murmur is heard of maximum intensity at the base. It is harsh, rough, rasping, usually protracted, in other instances high-pitched, whistling, and musical. It is propagated along the vessels of the neck and along the subclavians. It is some-

times heard with great intensity toward the apex of the heart, even when there is no mitral disease. The first sound is usually absent or very feeble. The second aortic sound is, as a rule, absent or replaced by a diastolic murmur of varying intensity and quality. Sometimes the second sound is quite well heard, but it depends on the measure of retention of the elasticity of the aortic segments. It is not probable that with uniform calcification and rigidity any sound could be produced. A peculiarity more commonly met with in aortic stenosis than any other valvular lesion is the murmur audible at a distance from the chest wall. This was noted by Stokes in the case of a politician in whom the murmur was so loud that it could be heard by his colleagues sitting about the table. Very many such cases are reported in the literature.[1] The pulse in aortic stenosis is slow, small, hard, and regular. The rate does not often fall below 60, and occasionally it is permanently at 40. In the senile cases the Stokes-Adams syndrome may be present, and syncopal attacks or epileptiform seizures occur. The pulse is small because the orifice permits of a comparatively small amount of blood, and the smallness of the beat may contrast in a striking manner with the force

FIG. 20

Aortic stenosis. The upper curve is the respiration, the lower the pulse curve. The latter shows the small amplitude and the rounded top of the primary wave.

of the cardiac pulsation. Hardness is, as a rule, associated with the sclerosis of the vessel. Sphygmographic tracings are very characteristic, and show a small pulse wave with a rounded or flattened summit with a very oblique line of ascent and almost without dicrotism.

Diagnosis.—The disease is frequently diagnosed when it does not exist. To inexperienced observers any loud murmur at the base suggests stenosis, whereas that lesion is the last to be considered. Slight roughening of the valves, roughening of the intima of the aorta, and hæmic conditions are common causes of the systolic murmurs at the aortic area. With aneurism, too, a loud murmur is occasionally present. Stenosis of the pulmonary orifice has very much the same features on palpation and auscultation, but it occurs, as a rule, in young persons, is not propagated to any extent into the vessels of the neck, and is loudest to the left of the sternum. As a rule, there is very little difficulty, if one takes into consideration the thrill and the character of the murmur in combination with the state of the heart and the pulse.

Prognosis.—In young persons it is bad, particularly with associated mitral disease. Sometimes in the pure aortic stenosis following rheumatic fever the compensation may be maintained for many years, but, as a rule, the outlook is not so good as in the late sclerotic form of insufficiency. In

[1] See Ebstein, *Deutsch. Archiv f. klin. Med.*, Band xxxviii.

any case, it is a lesion that takes many years for its formation, and many patients succumb to accidents, not to the disease itself. The most favorable cases are those in which, as a result of a slow, presenile sclerosis the orifice has been gradually narrowed. If the patient accepts the conditions, lives a peaceful, easy life, the heart lesion itself may promote longevity. For many years the senior writer followed with interest the lives of two old men with typical features of aortic stenosis. One was an Anglo-Indian who lived to be over ninety years of age. He had a very large heart and a thrill at the base which could be felt through his overcoat and was audible some distance from the chest wall. The other died at the age of ninety-two years of bladder complications. The patient was about sixty years of age when the aortic stenosis was diagnosed by Walshe.

Loss of compensation is usually the result of myocardial changes, and once gone is rarely restored.

INSUFFICIENCY OF THE MITRAL VALVES.

When from any cause the mitral segments do not close during systole of the ventricle a variable amount of blood passes back into the left auricle through the insufficient valves. This is one of the most common of all cardiac lesions. In the Edinburgh figures, already quoted, among 1914 cases there were 585 with mitral insufficiency alone, and 463 in which it was combined with another lesion, in 231 of these this being mitral stenosis.

Forms.—There are three great groups of cases, the endocarditic, the chronic sclerotic, and the relative or muscular. In a few cases the insufficiency may follow rupture of one of the segments.

Endocarditic Form.—This, the most common, is met with in young persons as a complication of the acute infections, more particularly of rheumatic fever. The general effect of endocarditis upon the valves has already been described. The special danger of the rheumatic form is owing to the fact that the segments are the seat of a productive valvulitis. In certain cases insufficiency is rapidly produced by destructive lesions which erode the chordæ tendineæ and destroy the segments, so that within a week or ten days a high grade of insufficiency is produced. In a large proportion of all cases there is no actual erosion of the valve itself, but the insufficiency is caused by a gradual shrinkage of the newly formed connective tissue in the substance of the valve. When this goes on very rapidly, as is sometimes the case, both curtains are rolled up as it were, leaving a widely open orifice. This is not nearly so common as the slower process in which the constricting cicatrization draws together the margins of the valves, so that with the insufficiency there is some grade of narrowing. The orifice may admit the thumb, or not more than the tip of the little finger. The edges are smooth, greatly thickened, often of a cartilaginous hardness, and the chordæ tendineæ are greatly thickened, shortened, and often fused together. It is quite frequent to have beads of fresh endocarditis on the margins of the thickened valves. Lime salts may be deposited and the valves and ring together form a solid calcified mass.

Arteriosclerotic Form.—In the arteriosclerotic form without any preliminary acute endocarditis the valves gradually thicken, the edges become curled, slightly shortened, the chordæ tendineæ become thickened, the orifice is

slightly narrowed, lime salts are deposited in the valves, and, as age advances, the whole valve and ring become a rigid and calcified membrane. In a slight degree sclerosis of the mitral valve is met with in all persons over sixty years of age, and is an expression of the wear and tear of work.

Relative Insufficiency.—Relative insufficiency, by far the most common form, occurs whenever dilatation of the mitral ring reaches such a grade that the normal valve segments are no longer able to close it. Known by the names of functional, muscular, or, more commonly, relative insufficiency, the most common cause is loss of tone of the muscle which surrounds the mitral ring. This occurs in many blood conditions, such as chlorosis and pernicious anæmia, in fevers, in many neurotic states, as neurasthenia, in Graves' disease, and in all cases when the dilatation of the ventricle from any cause reaches a certain grade.

Insufficiency due to rupture of the chordæ tendineæ, or of one segment, is very rare in the healthy valve, but a number of cases have been described; most frequently the chordæ tendineæ of the anterior segment are ruptured.

Symptoms and Physical Signs.—Many patients with mitral insufficiency never present any symptoms. In a still larger proportion symptoms are only present at the terminal stage of a long and silent history. The cases which give rise to symptoms earliest are those of insufficiency following the endocarditis in children, particularly in the tragic group which makes rheumatic fever so malignant an infection. Relative insufficiency in the fevers, in chlorosis, in anæmia, may never give rise to symptoms. No valvular lesion presents such diversity of features in regard to the duration and severity. There are cases in children in which the valve segments are rapidly curled and rendered so insufficient that the limits of compensation are quickly reached. On the other hand, there is no valve lesion in which we see more perfect and more enduring compensation. The marvellous manner in which the heart is able to carry on the work illustrates the remarkable response of muscle to calls made upon it very gradually. It reminds one of Montaigne's illustration of the force of custom: "He seems to me to have had a right and true apprehension of the power of custom who first invented the story of a country woman who, having accustomed herself to play with and carry from the hour of its birth a calf in her arms, and daily continuing to do so as it grew up, obtained by this custom that when grown to be a great ox she was still able to bear it."

Pathological Physiology.—Depending upon the degree of insufficiency of the valve, a variable amount of blood is forced back into the left auricle during its diastole and while it is filling from the pulmonary veins. With this extra amount of regurgitated blood the auricle reaches its normal distention sooner than previously. The pressure at the end of diastole is greater than at this period were there no valvular deficiency, the muscular fibers of the auricle are more stretched than normally, and, as we know from v. Frey's[1] experiments, the muscle is stimulated to a greater contraction. If the more powerful contractions, either immediately succeeding the lesion of the valves or ultimately by reason of hypertrophy, can force into the ventricle the normal amount plus the extra blood which was regurgitated, the circulation becomes compensated and the effects of the insufficiency do not extend farther than the left auricle. Over and above the

---

[1] *Deutsch. Arch. f. klin. Med.*, 1889, p. 358

evidence of regurgitation by auscultation, very careful percussion may give a higher pitched note at the apex of the left lung in front, and with the x-rays a marked increase in the amplitude of pulsation in the position of the left auricle may be seen.[1] A method has recently been devised by Minkowski[2] for obtaining a graphic record of the pulsation of the left auricle, and this might be of use in determining the presence of increased activity of this chamber. The left ventricle must accommodate the additional blood from the auricle, and in consequence its cavity becomes larger, its pulsations (owing to the slight stretching) more forcible, and hypertrophy of the muscular walls follows.

In the condition just described it has been assumed that the normal closure of the pulmonary veins took place during the systole of the auricle. We do not know at present how this is accomplished, but from the analogy of the right auricle, in which muscular bands are disposed to that end, we may conclude that it is affected by the same process.[3] With further dilatation of the cavity the orifices will remain open during the systole and the heightened pressure will be communicated to the blood in the pulmonary vessels. The dilatation of the auricle does not go beyond a certain point, partly because of the opening of the orifices of the pulmonary veins and partly from an increase in the connective tissue, which has been shown to accompany compensatory hypertrophy.

MacCallum and McClure,[4] in studying the effects of artificial lesions of the mitral valve in animals, have found that the pressure in the systemic arteries falls markedly, that in the left auricle rises, and that in the pulmonary artery may rise or fall; a high degree of insufficiency produces a fall of pressure in both the systemic and pulmonary systems; in slight insufficiency it usually rises. Whatever the pressure, the lungs invariably contain a larger amount of blood, for it has been shown that the venous pressure falls with a fall in the arterial pressure. The depletion of the systemic arteries is made up either by a constriction of the peripheral vessels, or by an increase in the volume of the blood. In the case of a small deficiency of the mitral valve the ventricle enlarges to receive the normal amount of blood from the auricle plus a portion of that regurgitated, and rejects into the aorta something less than the normal amount. If the ventricle has sufficient power to eject all the blood poured into it, the circulation becomes compensated; if, on the other hand, the power of the ventricle fails, it dilates.

In what way the hypertrophy of the right ventricle helps is an open question. MacCallum and McClure have shown that, so far as the pressure is concerned, the lung capillaries may be looked upon almost as a rigid tube, for the pulsations of the left ventricle are transmitted directly to the pulmonary artery and with such little loss of time that the pressure wave of the left ventricle is opposed to the action of the right ventricle during the systole.

A mitral insufficiency compensated for ordinary conditions by the right ventricle may continue for a long period of years. If this chamber fails

[1] Abstract in *München med. Woch.*, 1907, p. 849. See also Bonniger, *Deutsch. med. Woch.*, 1907, p. 333.

[2] *Deutsch. med. Woch.*, 1906, xxxii, p. 1248.

Keith describes a very probable method of closure of the orifices of the great veins into the right auricle, *Lancet*, 1904, i, p. 555.

[4] *Johns Hopkins Hospital Bulletin*, 1906, xvii, 260.

either from increasing deficiency of the mitral valve or from changes in its muscle, the tricuspid valve becomes incompetent. The right auricle becomes dilated and hypertrophied. The orifices of the veins are no longer closed during systole, and finally the pressure from the right ventricle is communicated to the venous system which becomes engorged. With great insufficiency of the mitral valve considerable pressure is communicated during systole to the auricle, whose walls probably become so stretched that the muscular fibers are injured and the contractions become very feeble. The increased pressure in the auricle and pulmonary bloodvessels gives rise to the thickened endocardium, so frequently seen in the former, and atheroma in the latter. In the first stage the left ventricle hypertrophies as a result of the increased pressure and compensatory dilatation at the end of diastole, caused by a more vigorous left auricle. Even with failure of the left auricle the pressure in it communicated from the right ventricle is sufficient to maintain the filling of the left ventricle, the hypertrophy of which may keep pace with the further dilatation, and it may become very large and thick. Under these conditions the normal filling of the arteries would be maintained, but with failure of the hypertrophy and loss of the contractile power of the muscle, the arteries become improperly filled and the blood pressure tends to fall. With the lessened blood pressure comes an increase in the rate of the pulse. The cause of the irregularity of the pulse in mitral disease is unknown; possibly it is due to the same condition as that suggested by Mackenzie in mitral stenosis.

Little that is definite can be said of the blood pressure in mitral regurgitation. The condition of the pulse is no evidence of the height of the pressure estimated by clinical instruments, for cases are recorded with a blood pressure of 140 mm. Hg., in which the pulse was scarcely to be felt. Hensen[1] does not agree with v. Basch, who says that the blood pressure in mitral disease is low, for oftentimes, according to his observations, it is distinctly above the average. With any irregularity of the pulse the maximum blood pressure varies much, sometimes being only a little over 100 mm., at other times reaching 140 mm. or more. The feebleness of the pulse in mitral disease, when the pressure is high, may be due to peripheral constriction of small arteries to compensate for the underfilling of the arterial system, but of these peripheral mechanisms we have little knowledge.

Symptoms.—The symptoms may be divided into two groups. While compensation is still good there are many minor manifestations, as the pain and breathlessness on exertion. When the insufficiency is extreme, the patients have a bluish tint of the cheeks and ears, giving the very suggestive appearance, the "mitral facies." The hands and feet may be blue, and in very long-standing cases the fingers may be clubbed.

Occasionally in children the degree of cyanosis reaches that met with in congenital heart disease, but it is never so extreme as in the cases of adhesive pericarditis with great hypertrophy of the heart and proliferative perihepatitis and peritonitis. Breathlessness on extra exertion may persist for years. These patients are especially liable to bronchitis in the winter. One of the most remarkable features is the recurrence, over long periods of years, of hæmoptysis. In Philadelphia the senior writer saw frequently a physician who had had his first attack of hæmoptysis during the Civil War.

[1] *Deutsch. Arch. f. klin. Med.*, 1900, lxvii, p. 512.

Tuberculosis was then suspected, but a mitral lesion was discovered. On and off during twenty-five years he had had attacks of quite sharp hemoptysis, sometimes with great relief. He had a greatly enlarged heart and a rasping apex systolic murmur audible all over his chest.

Broken compensation or decompensation may set in abruptly following any extra exertion, a severe mental shock or a protracted illness. Palpitation, which objectively may have existed for years, becomes evident and distressing to the patient. The shortness of breath increases. The patient wakens at night, perhaps abruptly in a paroxysm of shortness of breath, or there may be distressing "sleep starts," in which, just as he is dropping asleep, he wakens gasping as though his heart had stopped. The most distressing single feature is the oppression in the chest associated with the breathing. The slightest exertion brings it on, and the patient may at last be unable to move from his bed, or the dyspnœa may continue even when he is at rest. Very soon the signs of venous stasis are present. There is œdema of the feet, which gradually extends upward; the abdomen begins to swell, the liver is enlarged, and there is a slight jaundiced tint to the skin. The anasarca becomes extreme and the serous sacs may become dropsical. The urine is scanty and albuminous, and contains tube casts and sometimes blood corpuscles. The patient is restless, often sleepless at night, and there is anorexia and sometimes vomiting. With judicious treatment, even with rest alone, the attack may pass off and months, or even years, may elapse before a breakdown occurs. Only too frequently it happens that once compensation has been broken, the patient is very liable to subsequent attacks.

Among special features which may be mentioned are embolism, either from a clot in the left auricle or from a vegetation on the edge of the thickened valves. A remarkable thrombosis may occur in the distended veins, particularly in the jugular or in the brachials. There was one extraordinary case at the Johns Hopkins Hospital—a woman who was under our care for many years. She had half a dozen attacks of thrombosis in different parts of the body.

A remarkable feature of these very chronic cases of mitral insufficiency is the recurrent hydrothorax, which may be the only feature of the disease. It is most common on the right side, possibly due to compression of the azygos veins. It may be the only feature, and there are instances in which the patient has been up and about, and able to attend to his work, but has had to have the right pleura tapped every week or even at shorter intervals. Perhaps the most extraordinary case on record of this kind is reported by W. T. Gibb, of New York; a physician with combined aortic and mitral disease was tapped 311 times in 580 days, but was able to be up and about and do almost anything until two days before his death.

The hepatic symptoms of heart disease are met with in the most typical forms in mitral insufficiency. With the establishment of tricuspid insufficiency there is a swelling of the organ, the edge of which may be felt a hand's breadth or more below the costal border. On careful inspection diffuse pulsation may be seen, and the organ may be felt to swell with each systolic impulse. A slight tinge of jaundice is common. In the long-standing cases the liver becomes greatly enlarged, the connective tissue increases and the state of cardiac cirrhosis is gradually produced. The organ is large, smooth, and hard, with rounded edges. In very protracted

cases shrinkage may occur. In an interesting group of cases for a year or more toward the close, the features are entirely hepatic and the patients come under observation with recurring ascites, which may require tapping every few weeks. This accumulation of fluid in the peritoneum may be the only form of dropsy present. While it is not always possible to exclude the influence of alcohol, yet there are cases in which the cirrhosis seems to be altogether a late effect of the stasis.

Physical Signs.—Inspection.—In children the precordia may bulge and there is usually a very large area of visible pulsation, undulatory along the left sternal border with a more definite apex beat in the fifth or sixth, sometimes the seventh interspace. There may be visible pulsation to the right of the sternum and a marked impulse in the second and third left interspace. Frequently the whole front of the chest throbs visibly, and in mitral insufficiency we see more widespread impulse than in any other cardiac condition. The visible heart beat may extend from one anterior axillary line to the other. The impulse is usually very strong at the ensiform cartilage, and the heart may be so depressed and enlarged that there is a forcible, punctuate impulse of the right ventricle below the left costal border in the parasternal or even the nipple line. In the arteriosclerotic type in elderly persons with very slight hypertrophy of the left ventricle the impulse may be scarcely visible. In very long-standing cases the apex beat may be far out, even in the midaxillary line. In relative insufficiency the impulse may be scarcely visible, and may be only a little if at all to the left of the nipple line.

The veins at the root of the neck are usually full, and there are the pulsations which will be more fully described in connection with tricuspid insufficiency. In the stage of decompensation, at the jugular bulb, just above the right sternoclavicular joint, there may be a large ovoid tumor as big as an egg.

Palpation.—The degree of shock will depend upon the extent and force of the cardiac impulse which may be very strong and heaving. A systolic thrill at the apex region and transmitted into the axilla, is not so common as the presystolic in mitral stenosis, but in the long-standing cases in adults it may be very rough and rasping. The shock of a first sound is rarely to be felt, but the shock of the second may be widely diffused.

Inspection and palpation are the only safe guides in estimating the organic character of mitral insufficiency; if the apex beat is dislocated outward and very forcible, we may be certain that there is an actual lesion present.

Percussion.—The cardiac dulness is increased, particularly in a lateral direction, and may extend far to the right, reaching even to beyond the parasternal or nipple lines. The upper limit may be at the second rib and in extreme cases far to the left, even to the midaxillary line. Not even in the cor bovinum of aortic insufficiency do we find, particularly in children, such an extended area of cardiac flatness.

Auscultation.—A murmur accompanying or obliterating the first sound, of maximum intensity at the apex, and transmitted toward the axilla is the most distinctive single physical sign of insufficiency of the mitral segments. Its quality may vary from a soft blowing to a loud, harsh, rasping murmur; or it may have a distinctly musical quality, which is perhaps more frequently heard with mitral insufficiency than in any other lesions. The point of maximum intensity is, as a rule, at the apex or a little inside it.

At times it is heard loudly along the right margin of the sternum and, as Naunyn pointed out, it may be even of maximum intensity at the second or third left interspace. The special direction of propagation is along the left pectoral fold into the axilla, and the murmur is often loud and distinct at the angle of the scapula. In long-standing cases with great hypertrophy the murmur may be heard all over the chest and even to the top of the head. With a murmur of any intensity the first sound is usually absent, but it is very variable and in many instances of relative insufficiency the first sound is well heard. The second sound at the base is greatly accentuated, particularly to the left of the sternum over the region of the pulmonary artery. With failing compensation there may be a disappearance of the heart murmur and the condition of delirium cordis with a confusion of sounds.

The pulse in mitral insufficiency in the stage of compensation may be quite regular, but in the endocarditic group in children and in adults irregularity is almost always the rule. For years it may persist without any sign of cardiac weakness and with a normal blood pressure, and even when the pulse is very small and extremely irregular the patient may feel no inconvenience whatever.

Fig. 21

Pulse and respiration curve in mitral regurgitation (uncompensated). The pulse curve shows hyperdicrotism due to a low arterial blood pressure and marked irregularity of rhythm.

Diagnosis.—The recognition of mitral insufficiency is, as a rule, very easy, but it is not always so easy to determine the type of the disease. The endocarditic form in children accompanied with great dilatation and hypertrophy, and often with other valvular lesions, presents no difficulty. Nor in adults with the triple manifestations of a dislocated apex beat, a loud, rough, systolic murmur, and a greatly accentuated, pulmonic sound is there any real difficulty. In the hypertrophied heart of chronic Bright's disease, in myocarditis from whatever cause, and in the relative insufficiency of anaemias and toxaemias, it may be very difficult to determine whether there is an actual lesion of the valve or not. Usually the murmur in these cases is less intense, and shows marked changes in varying the posture of the patient. It may be present in the recumbent, absent in the erect position, and it may disappear entirely as the general condition improves, or as the dilatation of the heart subsides under the use of digitalis.

Prognosis.—Among valvular lesions it is at once the worst and the best. With the endocarditis of children, insufficiency may quickly reach a grade beyond the powers of compensation. On the other hand, a slowly induced insufficiency combined with a moderate degree of narrowing may become stationary, the edges of the valves calcify, the heart hypertrophy is well maintained, and the patient may live a long and useful life without any serious

discomforts. It may be said that, as a rule, in children under ten the prognosis is bad, more particularly as they are apt to have recurring attacks of rheumatism, and the condition is not so much a valvular lesion as a general carditis. The older the individual at the time of the onset of the endocarditis the better is the prospect. The arteriosclerotic variety may not diminish the expectation of life. Indeed, it often happens that the discovery of a mitral bruit, at examination for life insurance, promotes longevity. Warned to be cautious, the patient takes better care of himself and avoids so far as possible stress and strain. In the cases of relative insufficiency the prognosis depends much more on the condition with which it is associated than on the valvular leak.

STENOSIS OF THE MITRAL ORIFICE.

Etiology and Pathological Anatomy.—The disease is most frequent in females. In 80 cases noted by Duckworth, 63 were in women. Of 196 cases at Guy's Hospital collected by Samways, 107 were females. In the Edinburgh Hospital statistics of 1914 cases of valvular disease, 304 were mitral stenosis alone, 231 were mitral stenosis and insufficiency, and 26 were mitral stenosis with an aortic lesion. The stenosis is frequently not present alone and insufficiency in some grade is a very common accompaniment. In fact, it may be said that the classical malady described in text-books and monographs as mitral insufficiency is almost always associated with some degree of stenosis, while mitral stenosis, except in a few rare instances, always permits of regurgitation. Etiologically, there are three groups of cases: (1) Those which follow an acute endocarditis. This is the most common form, and it occurs in the young and particularly in young girls. Rheumatic fever is the dominant factor, and next to it chorea. Of 140 cases of chorea examined at a period of more than two years subsequent to the attack, 72 had signs of organic disease of the heart, and 24 of these presented the physical signs of mitral stenosis. Scarlet fever, measles, and whooping-cough may be responsible for a few cases. It has been claimed that tuberculosis plays a certain role, but for this there is not much evidence. As to the influence of mitral stenosis on pulmonary tuberculosis there is much difference of opinion. The studies of Tileson[1] suggest that patients with mitral disease have a relative immunity to tuberculosis, and if it be present the pulmonary disease is mild with a strong tendency to cure. In a second small group of cases the stenosis is the result of a primary sclerosis of the valve with thickening and adhesion of the edges, shrinking of the chordæ tendineæ, with widespread atheromatous changes in the substance of the valve and in the mitral ring itself. It is not always easy to determine whether or not these changes have been initiated by an endocarditis, but this group occurs at the older period of life and in men as well as in women. Newton Pitt has pointed out the frequency of association with chronic interstitial nephritis, 33 cases in 542 autopsies. Lastly, there is an important group of cases met with almost exclusively in women, in which no positive factor can be determined. The cases are usually latent, found accidentally, and the condition may persist for many years without causing any symptoms. In adult women, in whom this

[1] *Journal of the American Medical Association*, 1908, vol. l, p. 1179.

form is most common, one is almost always safe in putting the interrogative negatively—you have not had rheumatism. Some have thought that this form may be congenital, but this is unlikely, as it is rare to meet with lesions of the mitral valve during fœtal life or immediately after birth.

A functional or spasmodic stenosis of the mitral is spoken of, due either to spasm of the sphincter muscle or of the papillary muscles. The cases have been described in hysterical patients, and in anæmic and chlorotic subjects.

Anatomically, there are two forms, the pure or membranous, in which the left auriculo-ventricular ring is surrounded by a thin membrane representing the fused valve segments, perforated by a narrowed orifice which admits the tip of the little finger. The membrane is a little thickened, but it is pliable, the edges are smooth and may be readily placed in apposition, so that it is possible during life that the valve has been competent. These are the cases of what the French call *pure* mitral stenosis, and it is this form more particularly that is met with in women in whom no history of rheumatism or other etiological factors can be found. From the auricle this form presents a remarkable funnel shape. In the other variety the valve segments are greatly deformed, the chordæ tendineæ thicken, and with the irregular calcified excrescences with atheromatous plates the whole valve and ring are converted into a rigid mass, in the middle of which there is a linear slit or a rigid orifice that admits the tip of the thumb or index finger. The heart itself is not greatly enlarged, and may not weigh more than fourteen or fifteen ounces. In elderly persons the organ may, indeed, look small. The left auricle, as a rule, is greatly enlarged, and may hold several hundred cubic centimeters of fluid. Normally, the capacity in under 50 cc. Cases have been reported in which it has held 500 or even 650 cc. The appendix is usually greatly enlarged. The endocardium is very opaque, and when the dilatation is extreme the walls are very thin and fibrous. In the early stages, as Samways pointed out, the hypertrophy of the auricular walls is very marked.

The chambers on the right side are much enlarged, the ventricle contrasting in a remarkable way with its fellow; indeed, the apex of the heart may be made up entirely of the right ventricle. While this may be said to be the rule in mitral stenosis, there are some instances in which this contrast is not so striking, and the left ventricle may also be hypertrophied. The right auricle is greatly enlarged and the tricuspid orifice is much dilated.

Pathological Physiology.—Much of what has already been said of mitral regurgitation is true also of mitral stenosis. An increase of auricular pressure occurs at the end of diastole leading to stimulation and later to hypertrophy of the auricular muscles. Increase in auricular pressure from further obstruction at the valves causes such stretching of the muscle that increased action assisted by hypertrophy is not able to overcome the additional pressure. The orifices of the pulmonary veins now remain open during auricular systole, the pressure gradient in the pulmonary vessels becomes less steep and hypertrophy and increased action of the right ventricle follows as the power of the increased power required to empty the right ventricle. Mackenzie has recently put forward a view of the cause of the irregular pulse of mitral stenosis, which from both clinical and postmortem evidence is highly probable. He has noticed that when the crescendo murmur of mitral stenosis fails or is replaced by a low-pitched murmur, the irregular pulse

appears; moreover, at the same time the evidence of the contraction of the left auricle fails. In several cases that he has observed over many years, the evidence of normal regular contraction of the auricle—a wave in the jugular pulse, a wave in the cardiograph, and a presystolic crescendo murmur—has not been present with an irregular pulse, or, as Mackenzie calls this particular form of irregularity, the *disorderly* pulse, from the absence of any rhythm in its irregularity. In one case drawings of the heart compared with the normal, show enormous dilatation of both auricles. The explanation given is that the auricular muscle has become so stretched that the normal impulse stimulating the ventricle to contraction, which comes from the entry of the great veins into the right auricle, is unable to reach the ventricle owing to the condition of the muscular fibers, and that the rhythm of the heart is now governed by that part of the conducting system of fibers (Tawara's Knoten) which lies nearer the ventricle and is not under such unfavorable conditions. In mitral stenosis the left auriculo-ventricular orifice is narrowed, hence, unless the auricular muscle is particularly strong, the ventricle does not receive as much blood as it should normally. This is especially so in the severer forms of stenosis. There is, therefore, no tendency to a dilatation or hypertrophy of the walls; in fact, with less inflow into the ventricle the cavity tends to become smaller and the bulk of the muscles less. In animal experimental stenosis, produced either by constriction of the auriculo-ventricular groove by a ligature or by introducing into the auricle a distensible balloon, the pressure in the systemic arteries falls, that in the left auricles and pulmonary artery rises. The blood pressure in man is not abnormally low; in fact, the same feature as has been noticed in mitral regurgitation may be present—namely, a very small pulse with a blood pressure slightly above normal. With good compensation there is but little departure from the normal, and when irregularity sets in the maximum pressure varies considerably—in one of Hensen's cases from 105 mm. to 140 mm. Hg.

Symptoms.—Latency may be said to be the special feature of the disease. At a busy clinic not a month may pass without meeting the most typical physical signs in a person who has had no symptoms whatever. Even narrowing of a shirt-buttonhole size may be present with nothing more than slight shortness of breath on exertion. In other instances the patient for years has irregularity of the pulse and is short of breath on exertion. We must recognize a large group of cases in adults in whom the lesion is well borne for an indefinite number of years. In children it is different, particularly in the cases that follow rheumatic fever. There is very often failure of development. They remain feeble, the breath is short, they are anæmic, and there is a liability to fresh attacks of endocarditis. Many patients present for years a slight cyanosis, more particularly of the cheeks and of the ears, and are liable to have recurring attacks of bronchitis in the winter.

The symptoms of cardiac breakdown are very much the same as in other forms of valvular disease. The irregularity becomes more marked, œdema of the feet and ankles occur, the breath is short and the signs of stasis are present in the viscera. Brisk hæmoptysis may occur sometimes with relief. Among unusual symptoms is paralysis of the left recurrent laryngeal nerve by pressure of the enlarged left auricle. This, in connection with a wide area of impulse in the second, third, and fourth left interspaces may lead to the

diagnosis of aneurism. The senior writer has seen two cases of this kind, and others are reported in the literature.

Accidents in the disease are common, such as sudden attacks of congestion of the lungs and acute infarcts with hæmoptysis. Sudden death in an acute cardiac failure may occur. Embolism is very common, the embolus being either a fragment of a clot from the dilated left auricle, or more frequently a fresh vegetation is whipped off from the orifice of the valve and plugs the left Sylvian artery, causing right hemiplegia with aphasia. In other instances there is embolism of the peripheral arteries. In rare cases widespread thrombosis may occur.

Physical Signs.—Inspection.—Nothing may be noticed. The apex beat may be in the normal situation and the precordia does not suggest a valve lesion. The heart, indeed, may appear to be smaller than normal. In other cases the apex beat is moved an inch or two to the left, the impulse is more forcible and there is marked pulsation in the parasternal line and the lower sternum. In children the precordia usually bulges and there is marked pulsation in the interspaces along the left margin of the sternum from the second to the fifth or sixth. In advanced cases the pulsation of the enormously enlarged heart may be seen to the right of the sternum, but in pure mitral stenosis the hypertrophy of the heart rarely reaches the degree seen in insufficiency.

Palpation.—In a considerable proportion of all cases, when the lesion is well compensated, the diagnosis may be made by palpation alone. At the apex is felt a purring thrill—the *frémissement cataire*. It is limited in area, rarely felt above the fourth rib, most marked during expiration, occasionally only brought out after exertion. Coinciding with the diastole of the ventricle, it may be felt to extend throughout the whole period, or it is only in the latter part, rising crescendo-like toward the end and terminating in the sudden, sharp shock of the first sound. The localization, the occurrence in diastole, the purring, vibratory quality, and the abrupt termination in the first sound, form a quartet of signs that rarely lead us astray. As the disease advances and a stage of decompensation is reached the thrill may disappear.

Percussion.—In the early stages there may be no increase in the area of cardiac dulness. With the increase of the left auricle, the flatness to the left may be increased, but the great enlargement is in the right ventricle with extension of the dulness to the right of the sternum. The absolute cardiac flatness reaches high on account of the enlargement of the conus arteriosus. The great dilatation of the left auricle may compress the upper lobe of the lung, and the area of deep dulness may be much increased upward in the third and fourth interspaces. But the auricle itself rarely comes in contact with the chest wall. This enlargement of the auricle is well seen with the fluoroscope.

Auscultation.—In compensated cases there is heard in diastole a rumbling, vibratory, or purring murmur, usually increasing in intensity and terminating abruptly in a loud, snapping, first sound. The special features of the murmur of mitral stenosis are: (1) Its limitation: the bell of the stethoscope may cover the region in which it is heard. (2) The quality: vibratory, grating, or a low, echoing rumble; with the exception of the rare instances of tricuspid stenosis, this quality of murmur is only heard at the mitral orifice. (3) The sharp, valvular, first sound. There are many modifications and changes.

In the early stages of the disease there may be nothing more than a slight echoing rumble, and it is only on exertion that the characteristic murmur is brought out. Its position in diastole is variable. It may occupy the entire period, rising crescendo-like toward the close. It may be purely presystolic, occupying only the terminal portion and running directly up to the sharp valvular first sound. In other cases it is mid-diastolic, and the perceptible short interval separates it from the first sound. No other murmur may be present. A very soft systolic may be heard in some cases, with very slight extent of propagation. When decompensation is present the typical presystolic murmur may disappear and a loud systolic is heard.

The state of the sounds of the heart in mitral stenosis are of exceptional interest. As already mentioned, the shock of the first sound is extraordinarily forcible. Except in certain neurotic states, no such snapping sound is felt at the apex. On auscultation, too, it is remarkably intense, and instead of a dull, thudding sound, it is of a flapping, valvular, even of an amphoric, ringing quality. So intense may it be that we meet here one of the few conditions in which the heart sounds are audible at a distance from the chest wall. It is common enough to hear the first sound a few inches away, but twice it has happened in my experience to hear a clear, bell-like first sound as I sat at the bedside of the patient. In one case Dr. Blake, of Baltimore, measured the distance, and found it a little over six feet. Naturally, this

FIG. 22

Pulse tracing. Mitral stenosis.

loud, ringing sound is propagated to the back. The second sound may be well heard at the apex, sharp and accentuated, increasing greatly in intensity as the stethoscope is passed toward the second left interspace. Here it is often reduplicated. In later stages the second sound may disappear at the apex, while it is loudly audible at the base. In the stage of decompensation, with great irregularity and dilatation of the heart, the characteristic physical signs may disappear. Time and again the diagnosis of mitral stenosis is made for the clinician by the pathologist. A week's rest in bed with the use of digitalis may serve to bring back a presystolic murmur. In other instances a murmur of typical quality and a first sound of amphoric timbre may disappear and be replaced by a loud mitral systolic. An acute illness, a period of debility from any cause, may cause the murmur to become very feeble or even to disappear. In such instances there may be nothing but a faint diastolic rumble, which is changed into a more definite murmur on exertion.

In uncomplicated cases no murmurs are heard at the aortic area. The first sound is usually very feeble in comparison with the second.

Diagnosis.—No valve lesion is more readily recognized than mitral stenosis. One has always to bear in mind that when the terminal stage is reached, and the patients are admitted with delirium cordis, the murmur is no longer present, and the diagnosis may be perhaps only suggested by the sex of the patient and by the fact that there is a somewhat snapping first sound. A murmur with the same quality during diastole at the apex

is heard in aortic insufficiency, known as the Flint murmur, and has already been discussed. In tricuspid stenosis a rumbling presystolic murmur is heard of maximum intensity over the body of the heart. In the conditions in which the senior writer has heard it, mitral stenosis has always been present as well. And lastly, in a considerable number of cases of pericardial adhesion a rumbling apical murmur is heard in diastole. It rarely has the peculiar limited localization nor does it end in a snapping first sound.

TRICUSPID INSUFFICIENCY.

Etiology.—There are two groups of cases, one the result of organic disease of the valve cusps, the other relative or functional incompetence from dilatation of the tricuspid ring due to lack of tone (muscular insufficiency) in the right ventricle.

1. Organic disease follows rupture, endocarditis, or a chronic fibrosis of the segments. (*a*) Rupture of the valves or of the chordæ tendineæ may follow a blow on the chest or an excessive effort. (*b*) The endocarditic form occurs in the acute infections, more particularly rheumatic fever. (*c*) The etiology and appearance of fibrosis of the tricuspid valves are similar to those of the mitral.

Because of the lessened strain put upon the tricuspid valve in adult life, inflammation and degeneration of its leaflets are much less frequent than in the mitral valve. Probably also because of the greater tension which has to be borne during fœtal life, the relative frequency of endocarditis in the right and left sides is reversed. Congenital endocarditis is almost always confined to the right side of the heart. In adult life affections of the tricuspid are rare. By far the most frequent cause is rheumatic fever, and when present on the right side endocarditis is, in the majority of cases, associated with the same process of the mitral valve, of the aortic valve, or of both. In addition, affections of the valve have been determined to be due to the pneumococcus, gonococcus, tubercle bacillus, streptococcus, and typhoid bacillus. Gummatous change of the valves has been described. As a sequence of other valvular disease, mitral or aortic, degenerative changes may cause insufficiency. Malignant disease is extremely rare.

2. Relative insufficiency arises in a large number of conditions. The fibrous ring which surrounds and supports the auriculo-ventricular orifice is liable to become stretched, and at the same time the muscle of the ventricle suffers distention. This means a larger orifice for the valves to close, and as the chordæ tendineæ cannot elongate, the orifice remains open, its cusps not being able to meet in close apposition. It is a question whether the inability of the muscle to lessen the ventricular cavity to its normal size in systole does not play a large if not the chief part, for if at the height of systole the cavity were no larger, it is conceivable that even with a dilated ring no regurgitation might occur; but if with a dilated ventricle the degree to which the ventricle can contract be lessened, then the cavity is fuller at the end of systolic than normal and the valve cusps are not properly approximated.

The important part played by the muscle of the ventricle was put forward in a masterly way by T. Wilkinson King[1] in 1837, and the following

[1] Safety Valve Action in the Right Ventricle of the Human Heart, *Guy's Hospital Reports*, London, 1837, ii, 104.

account which he gives of the anatomical relations of the tricuspid valve and its connection needs no revision. "The right auriculo-ventricular opening is oval; and to its circumference the membrane of the tricuspid valve has attachment without any distinct interruption; whilst its floating border depending into the ventricle is deeply fissured, so as to form three or more scalloped or angular curtains. And it appears from careful examination that the united areas of these valvular portions are scarcely more than equal to the mean extent of the oval opening. One of these curtains (which, not being movable, I have called fixed) occupies the left margin of the aperture in apposition with the solid wall, from which arise all the cords that serve to secure the free edges and ventricular surface of the fixed curtain. These cords are of such a length as scarcely to allow the curtain to rise into the plane of the oval opening in the natural play of the valve, and being destitute of muscular columns, cannot by any possibility set the valve in motion, or serve any other purpose than that of preventing too great a reflex of the curtain itself. A second curtain (the anterior) is attached at the anterior and right edge of the opening, having one free border forward and another backward in the ventricle. Each border has its proper set of cords: the anterior or upper set having their insertion into a mere nipple of muscle on the solid wall in the direction of the pulmonary artery; and the inferior or posterior are as invariably collected with numerous others into the summit of a muscular column whose base is inserted into the thin right or yielding wall of the ventricle near its centre, where also is attached, almost as regularly, another muscular band which stretches across the cavity between the two walls. This band may have an average length of six or seven lines and a circumference of three or four. It seems calculated to limit distention, and therefore I have called it the moderator band of distention. The third curtain or fold of the valve (the right) is situated on the right side of the aperture posteriorly, and has little or no connection with the inner or left edge of the opening. In extent and figure it varies considerably, and it rarely forms one single scallop, but is frequently fissured so as to form two or three, more or less complete. Its cords are accordingly arranged in two or more sets, the greater part of which are attached by the intervention of muscular columns to the outer yielding wall at a considerable distance from the solid wall, and usually without any transverse bridge or moderator band.

"The construction . . . I have described in connection with the yielding, *i.e.*, the outer wall of the ventricle, constitutes the main peculiarity of arrangement and action in the tricuspid valve, the great extent, thinness, and feebleness of the yielding wall rendering it liable to the distending influence of venous accumulation in various degrees; the curtains being three, and each one tethered to that part of the ventricular parietes immediately beneath itself (but most extensively to the yielding wall), by the intervention of columns whose passive effect is to produce a retraction of the curtains in proportion to the distention, and whose active contractions serve under dilatation to augment the valvular retraction, or rather to maintain it at its height during the imperfect systole . . . and further, the orifice itself, depending on the yielding wall, may admit of some relaxation and thus assist to produce regurgitation."

Following these anatomical observations, King performed several experiments on human hearts in which no disease could be detected. By putting pressure into the left ventricle, it was easy to effect a complete and adequate

closure of the mitral valve, and only with very considerable pressure did the escape of water into the auricle occur. In the right ventricle, however, no position of the heart and no variation of the conditions were sufficient to prevent the escape of a tape-like stream of water into the right auricle, unless the walls of the ventricle were at the same time compressed by the hand. King suggested the effect of cardiac tonicity on the production of a complete valvular ring, and demonstrated it by showing in a heart, in which rigor mortis appeared after removal, that the deficiency of the valve became almost negligible.

Relative tricuspid insufficiency, therefore, is really one caused by affections interfering with the muscle of the right ventricle, and its causes may be summarized as follows:

(a) Mechanical dilatation, due to an increase in pressure in the ventricle at the beginning of systole, may be caused by overexertion, asphyxia, and abnormal fixation of the chest wall, as in some forms of labor. Other causes are those which oppose an obstruction in the pulmonary circulation—chronic bronchitis, sclerosis of the lung arteries, bronchiectasis, chronic fibroid disease of the lungs and pleura, and disease of the mitral valve. The ease with which this dilatation is brought about may be shown by the fact that by holding the breath for one minute the right border of the heart, as determined by deep percussion, travels to the right at least one inch.

(b) Dilatation of the right ventricle, the result of a failure in muscular nutrition, is observed in all forms of local cardiac disease, myocarditis, pericarditis, and gummata of the heart. Of general diseases, the most important are malnutrition, as in diabetes, cachexia from neoplasms, debility from atonic conditions of the stomach, and in the anæmias, especially in pernicious anæmia. Prolonged and high fever tends to an enfeeblement of the cardiac muscle and to insufficiency of the tricuspid valve.

Pathological Physiology.—*Mutatis mutandis*, what has been said of mitral regurgitation applies here. With insufficiency the first stress is thrown upon the right auricle, which, by hypertrophy and compensatory dilatation, opposes a mechanism against the effects of regurgitation. When the regurgitation becomes greater and the cavity of the auricle has to dilate to such an extent that it cannot exert sufficient force on the contained blood, the muscle bands by which the orifices of the veins are closed during systole are stretched and become ineffective. There is then during systole of the ventricle a continuous column of liquid from the ventricle into the veins without the opposition of any valvular mechanism. It is obvious, then, that the condition of the blood in the venous system from the clinical aspect is of considerable importance. With very few exceptions, a jugular pulse may be seen in every normal person, if not in the upright, in the recumbent position, or with the head slightly lower than the feet, when the veins of the neck become fuller and pulsation can be observed. In fat persons it may be extremely difficult to detect, but even in these a tracing can be obtained. With little practice, with or without the aid of tracings, three waves can be detected in the supraclavicular triangle under proper conditions as regards light. First, a wave appearing slightly before the impulse of the heart at the apex beat, due to the pulsation of the right auricle; secondly, a wave which is synchronous with the beat in the carotid artery, as felt higher up in the neck; and thirdly, a wave occurring immediately after systole of the ventricle (the ventricular wave). The significance of this last wave is not certain.

Mackenzie has shown, by tracings of this pulsation taken in numerous cases of heart disease, that when the right side of the heart is at fault, as in failure from mitral disease, a change often comes over the jugular pulse in which the auricular wave diminishes or disappears and the ventricular wave increases in size and occurs earlier in relation to the ventricular output than in normal cases.

The transition is shown diagrammatically in Fig. 23. When the alteration is fully developed there is only one large wave in the jugular pulse, which for the most part is ventricular in time. Mackenzie calls this form of venous pulse the "ventricular" form, and has taken it to mean tricuspid regurgitation. This view has recently received striking confirmation by Rihl,[1] who, by making an artificial lesion of the tricuspid valves in rabbits, finds that according to the severity of the lesion there are two sharply defined forms: first, that in which the regurgitation is slight and the venous pulse shows no change from the normal; and, secondly, that in which the venous pulse is of the ventricular form. We must suppose that in the former condition the auricle of itself can compensate for the regurgitation without undue stretching of its walls by the regurgitated blood. This is confirmed by finding that in these less severe forms, stimulation of the vagus, the beginning of asphyxia, and so on, which in the normal animal are without effect on the jugular pulse, in the mutilated animal, produce a ventricular venous pulse. The effects of experimental tricuspid insufficiency in rabbits have been investigated by Stadler,[2] who finds a dilatation and hypertrophy of the right auricle and ventricle and some diminution in the weight of the left ventricle compared with normal rabbits. This corresponds with the observation made in the rare cases in man in which the tricuspid valve alone is affected.

Fig. 23

Diagram to show the transition from the normal venous pulse to the ventricular form, i. e., in tricuspid insufficiency. I, is the normal venous pulse from which the c wave, occurring between a and v, probably due to the carotid artery, has been omitted; a, auricular wave; v, ventricular wave, whose significance in the normal venous pulse is doubtful. E, period of outflow into the pulmonary artery. (After Mackenzie.)

Morbid Anatomy.—The heart in pure tricuspid insufficiency has certain distinctive features. The right auricle is dilated and globular, the right ventricle is more prominent and fuller than normal, and appears to be creeping round the left ventricle. The amount of distention of the right auricle and ventricle depends on the rapidity of onset of the lesion or whether organic disease is present in the valves, the condition of the muscular walls, and so on. The best example of a pure functional tricuspid insufficiency is
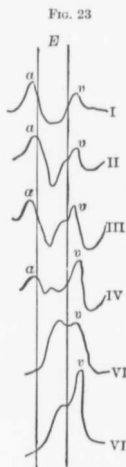
[1] Verhandlungen des Congresses f. innere Medizin, 1907.
[2] Deutsch. Arch. f. klin. Med., 1905, lxxxiii, p. 71.

to be seen in death from asphyxia, in which the right heart, especially the auricle, is enormously dilated. When organic disease of the valve is present, the ventricle and auricle have had time in part to oppose a certain amount of hypertrophy against the valvular defect, consequently in the organic cases the enlargement is not so great and is made up of hypertrophied muscular wall in addition to the dilated cavity.

The proof of insufficiency of the valve is easily made by directing a stream of water from the auricle into the ventricles and then pressing the right ventricle with the palm of the hand, avoiding any pressure that will cause an approximation of the attachments of the chordæ tendineæ to their insertion on the valve cusps. If the valve is incompetent, a stream of water will regurgitate into the auricle. The condition of the valve in relative or functional insufficiency is normal, the cusps being thin and the chordæ tendineæ not thickened or shortened. In the case of organic insufficiency the state of the valve will vary according to the cause. The valve may have been ruptured either by effort or by a blow. A recent endocarditis takes the form of small excrescences or larger irregular masses attached to the valves. If, on the other hand, there is chronic fibrosis, the cusps are thickened, glistening white or yellowish, and the chordæ tendineæ thickened and shortened. The mural endocardium in the chronically dilated cavity is always thicker than normal. On account of the pressure to which they have been subjected, the veins opening into the right auricle are dilated, their walls are slightly thicker than normal, and this thickening extends into the jugular and the subhepatic veins.

The liver, spleen, and kidneys all show the chronic cardiac congestion described under mitral disease; in fact, these appearances in the two diseases are due to the failure of the right side of the heart. The lungs in experimental animals are dry and bloodless, and the same has been noted in pure cases of tricuspid insufficiency in man.

Symptoms.—The chief complaint of the patient is breathlessness on exertion, and if the lesion is uncompensated there is quickened breathing or orthopnœa, even at rest. The slightest exertion causes dyspnœa and a sudden sense of oppression in the chest. In advanced cases orthopnœa is marked. Pain is not a prominent symptom. It most frequently occurs in relation with an enlarged liver whose capsule is stretched, and consequently the pain is felt on the right side of the abdomen. The digestion is always faulty and the appetite is lessened or absent. Distention of the abdomen, either in relation to meals or not, is common, relieved sometimes by eructations or by purgatives. Œdema of the legs and feet sets in early and is of the usual type, being less evident after a night's rest in bed. Ascites may be present even before any œdema occurs.

Physical Signs.—The facies of the patient with marked regurgitation is one of intense cyanosis. The whole surface of the skin is a livid blue color, the extremities, such as the ears, the tip of the nose, and the fingers being of a deeper color than the rest of the skin. The lips are a violet blue. The sclerotics are darker than normal and of a subicteric tint. The visible veins, such as those of the temple, neck, arms, and chest, are dilated and prominent. If noticed carefully, two types of pulsation may be distinguished in those of the neck: first, rhythmical emptying and filling; secondly, pulsations synchronous with the heart beats, best seen in the right supra-clavicular triangle outside the sternomastoid, over the spot where the external

and internal jugular veins enter into the subclavian. In fact, the jugular sinus may be so dilated as to form a rounded swelling just above the clavicle. The pulsations may extend over the veins of the shoulders and mammary regions and down the superficial veins of the arm and the elbow. Inspection may show a large area of precordial pulsation, especially noticed over the lower end of the sternum and in the epigastrium. In cases with a marked pulsation in the jugular veins, pulsation in the liver can usually both be felt and mechanically recorded.

The apex beat is diffuse and extends outward to the left as far as the nipple line or farther into the left axilla. On palpation sometimes a light systolic shock may be perceived. On determining the limits of pulsation the area is found to lie over the lower end of the sternum and along a strip stretching from the sternum to the apex beat, an area corresponding to the right ventricle. On percussion the transverse dulness is increased and stretches more to the right than normal. Schwartz has recently suggested that the deep cardiac dulness in relative tricuspid insufficiency extends farther to the right than in organic deficiency of the valve, and he suggests that dulness extending beyond three fingers' breadth to the right of the sternum—it sometimes extends as far out as the right nipple line—should be regarded as almost certainly due to relative tricuspid insufficiency, because the stretching of the ventricular muscle must be great in order to produce insufficiency. Relative tricuspid insufficiency can easily be demonstrated on a healthy person if the breath be held for about one minute. If the right border of the cardiac dulness be percussed out before the experiment, it will be found immediately after holding the breath for that time to have extended outward for about one inch.

On auscultation a systolic murmur can usually be detected in the cardiac area. It may be rough, especially if the insufficiency is the result of endocarditis. On the other hand, if the insufficiency is relative, it is faint and delicate. Tricuspid systolic murmurs are more superficial than mitral; their pitch is higher and their duration longer. The point of maximum intensity is over the sternum and to the left rather than to the right. It may, however, be heard on the right of the sternum, which can hardly ever be done in mitral insufficiency.[1] The x-rays, as has been pointed out by Bonninger,[2] may be used as a means of distinguishing certain heart lesions. In a case of pure tricuspid insufficiency the maximum pulsation is toward the right border of the heart, and the extended pulsation of the left auricular region, so characteristic of mitral failure, is absent.

Diagnosis.—From a careful observation of the jugular pulsation in the neck and careful auscultation over the precordia, there is seldom much doubt as to the presence or absence of tricuspid regurgitation. The veins of the neck show in proportion to the deficiency of the valve a pulsation which is synchronous with the ventricular systole. If by observation the time of the most prominent wave is not easy to determine, then a tracing of the pulsation, especially if combined with an apex tracing, will determine exactly the time of the jugular pulsation. To distinguish the murmur of mitral regurgitation from that of tricuspid regurgitation is by no means always easy. Mitral systolic murmurs may be loudest at almost any point to the

---

[1] Heitler, *Deutsch. med. Woch.*, 1897, p. 106.
[2] *Deutsch. med. Woch.*, 1907, p. 333.

left of the sternal border below the second interspace; less frequently they have their maximum intensity over the ensiform process. The tricuspid murmurs are soft, blowing, rarely rough, more superficial, shorter, and usually higher in pitch. The loudest can be heard over the entire sternal area, generally plainest opposite the fourth interspace, and more distinct over the middle and left half than toward the right side of the sternum. Less frequently they are heard best over the lower half of the sternum. The conduction of the murmur may be either to the right or to the left, to the left better than to the right. Faint murmurs are not heard above the third rib.

It is important to determine whether the incompetence is relative, due to stretching, or from organic change in the valves. The following points are suggested by Schwartz:[1] With a positive venous pulse and a percussion dulness of the right border of the heart not extending beyond three fingers' breadth to the right of the right sternal edge, an organic lesion of the tricuspid is the more probable. If, on the other hand, the right cardiac dulness extends farther to the right than three fingers' breath, a relative insufficiency is more probable, because the valves are insufficient by the stretching of the muscle, which may be so great as to make the right border extend by percussion to the right mammillary line. Another important point is that in organic insufficiency after the reëstablishment of compensation the positive venous pulse remains, while in relative insufficiency the positive venous pulse is replaced by one in which the auricular wave becomes more prominent.

Prognosis.—In those cases in which the deficiency is due to organic disease the prognosis is always grave, for only very rarely is it unaccompanied by disease elsewhere in the heart and because any failure of the right ventricle is immediately followed by symptoms of heart failure. In relative tricuspid insufficiency the prognosis depends more on that of the cause of the insufficiency than on the valvular defect itself.

TRICUSPID STENOSIS.

Etiology.—Tricuspid stenosis, a chronic disease due to fibrosis of the valve, may follow an infective process or be the result of a primary degeneration of the tissue. The character of the infection is often doubtful, and we are therefore driven to examine clinical in conjunction with postmortem records. Leudet, in 1888, collected a series of 114 cases. Herrick, in 1897, added 40 cases. Newton Pitt, in 1899, collected from the records of Guy's Hospital a total of 87 cases out of 12,000 postmortem examinations, and Wardrop Griffith, in 1903, studied 19 cases from the portmortem records of the Leeds Infirmary and the specimens in Yorkshire College Museum. In a majority of cases rheumatic fever was the most important single factor. In the 173 cases of Leudet, Herrick, and Griffith, 59 had a definite history of rheumatism or chorea, i. e., 34.9 per cent. In Newton Pitt's series the percentage is much greater, 62.06 per cent.; and if the cases with a history of vague rheumatic pains be admitted, the proportion becomes somewhat larger. Of other infections causing tricuspid stenosis we have no certain

[1] *Verein f. innere Medizin*, Abstract in *Deutsch. med. Woch.*, 1903, v, p. 318.

knowledge. Syphilis is mentioned as an antecedent in one of Griffith's cases. Two cases have been reported in which a pedunculated ball-like tumor projected down from the auricle and partially occluded the tricuspid valve.

Females are affected much more frequently than males; in a total of 260 cases collected by Leudet, Herrick, Pitt, and Griffith, 179 were females, 63 were males, and in 15 the sex was not mentioned. The age incidence at death is well shown from Pitt's series of cases: between eleven and twenty years, 16 cases; between twenty-one and thirty years, 31 cases; between thirty-one and forty years, 22 cases; between forty-one and fifty years, 10 cases; between fifty-one and sixty years, 3 cases; between sixty-one and seventy years, 2 cases.

The association of other cardiac lesions is a special feature in tricuspid stenosis; thus, in the 173 cases collected by Leudet, Herrick, and Griffith, the following valvular lesions were found: stenosis of the tricuspid valve alone in 12 cases; stenosis of the tricuspid valve with mitral stenosis in 97 cases; with pulmonary stenosis in 3 cases, with lesions of the aortic and mitral valves in 58 cases, and with lesions of the mitral and pulmonary valves in 3 cases.

Pathological Physiology.—A pure stenosis gradually increasing in degree causes an overfilling of the right auricle, and by stretching the muscle of the auricular wall, this leads to more vigorous contractions and is followed by hypertrophy of its muscular wall. As the stenosis increases, the auricle, even although hypertrophied, will not be able to empty its contents during systole, and consequently the cavity enlarges. The closure of the veins which open into the right auricle is probably effected by the muscular bands, especially those which lie around the venous openings. In the dilated auricle these are unable to contract properly and in the veins remain open. Consequently, at each auricular systole a regurgitant wave, presystolic in time, travels up and distends the vein. The hypertrophy causes a greater wave than normal. With increase in the stenosis the auricle tends to become so dilated that its power, even although hypertrophied, is inadequate to expel more than a fraction of the blood into the ventricle. The auricular pulsation then fails, and with it the transmitted pulsation in the jugular veins. These two conditions correspond to two types observed clinically: first, the cases in which there is jugular pulsation in turgid veins, auricular in time; secondly, the cases in which, although the veins are turgid, no pulsation can be observed in them.

Morbid Anatomy.—The general appearance of the body is the same as that in death from chronic mitral disease with anasarca. The cyanotic tint is more marked than in other cardiac lesions. The pericardium has been found adherent. As tricuspid stenosis is so often associated with mitral stenosis, it is not always easy to say which anatomical features correspond purely to the former. If the heart be stuffed before being opened, the chief feature is a marked enlargement of the right auricle associated with a dilatation and a thickening of the walls of the superior vena cava and its branches. This dilatation may be sufficient to do away completely with the function of the valves, so that there is a continuous cavity from the venous system to the right auricle. This is well shown in one recorded case in which there was a continuous clot extending from the right auricle into the veins of the neck. The state of the right auricle depends upon the conditions of the circulation at the time of death; if this has occurred while the

auricle by hypertrophic increase has been capable of propelling blood through the constricted orifice, the cavity of the auricle is large and its walls thickened by more layers of muscle fibers. But if the patient has lived a stage farther, the cavity is dilated and the wall of the auricle very much thinned, so much so that in areas as much as 5 cm. across, the auricular wall is composed of epicardium and endocardium alone. The rest of the muscular tissue of the auricle is proportionately thinned in these cases. The endocardium of the auricle, in consequence of continued back pressure, undergoes increasing thickening, and at death is much less transparent than in a normal right auricle. The tricuspid orifice is narrowed in different cases to different degrees; cases have been reported in which it scarcely admitted the little finger. The three cusps are so welded together and thickened that they are indistinguishable, except by comparison with their relations to the papillary muscles. The chordæ tendineæ are thickened and shortened. Other appearances have been described. In the case reported by Gairdner the orifice was blocked by a fibrinous ball attached to a point on the auricular wall. In another case reported by Philip,[1] large recent vegetations filled up the cavity. The right ventricle showed some enlargement of its cavity and thickening of its walls. In almost all accurately recorded cases some degree of mitral stenosis has been present.

The condition of the lungs varies, and in this regard also we cannot distinguish the effects of a tricuspid stenosis from those of a mitral stenosis. They are sometimes found to be dry on section, with only a small amount of hypostatic congestion at the bases and no marked œdema, sometimes markedly œdematous and congested with pneumonic consolidation at the bases, or with hemorrhagic infarcts. The liver, although presenting the appearance of chronic stasis, is not always enlarged; in fact, some livers have been distinctly below the average size (Stow's case). The edges are rounded, as would be expected from the chronic overfilling with blood under pulsation; the capsule is thickened, and on section the organ drips with very dark blood, showing a surface with the features of the "nutmeg" liver. A notable feature is the increase in connective tissue. Perihepatitis has been present.

Symptoms.—That a considerable degree of stenosis may not be productive of symptoms is shown by the history, reported by Gairdner, of a man who was under observation for ten years, led an active life during that time, and died at the end of the period from pneumonia. The symptoms of tricuspid stenosis are in the main very similar to those of tricuspid insufficiency, but they present certain important differences. Cyanosis may be present for a year or even longer before any other sign of cardiac failure. It is not of a very pronounced grade, nor so marked as that seen in extreme degrees of congenital heart disease, but is often sufficient to give trouble to the patient and to give occasion to remarks. A patient who was observed by Hirtz and Lemaire for two years was called by his fellows "l'homme bleu" without any suspicion of heart disease being present. Breathlessness is the most frequent complaint; it is more marked and comes on sooner than in lesions of the left side of the heart. Even very slight exertion, such as walking, may bring on severe dyspnœa. Other symptoms of heart failure differ in no respect from those in left-sided lesions, such as œdema, ascites, pain

[1] *Edinburgh Hospital Reports*, 1893, i, 235.

in the right hypochondrium from the engorged liver, indigestion, constipation, and so forth. In certain cases anginal pain is complained of, which may pass down the left arm, occasionally down the right. It is often questionable in a given case which symptoms are due to the tricuspid stenosis and which to the frequently associated mitral stenosis. Gairdner's patient complained of the jugular pulsation in the neck. All patients in whom the cyanosis is marked complain of great susceptibility to cold. Of symptoms due to stasis in the systemic veins, œdema, ascites, jaundice, and petechiæ are frequent. Hæmoptysis, noticed in twenty cases in Newton Pitt's series, is probably due to the mitral stenosis.

Physical Signs.—The patient, as a rule, is cyanotic, the tint being most marked in the lips, nose, ears, and hands. The veins are dilated and may be specially noticed in the lower part of the neck. The jugular bulb may be dilated to such an extent as to produce an ovoid swelling, which may or may not show pulsation. If none is visible, it may often be brought out by getting the patient to sit or stand up. An important distinction between stenosis and insufficiency of the tricuspid valve lies in the form of the jugular pulsation; in the latter the type of the jugular pulse is ventricular, *i. e.*, the most prominent wave is systolic in time; in tricuspid stenosis the largest wave is the auricular, and hence presystolic. Mackenzie has pointed out this distinction, and, further, that the liver pulsation, which is a constant feature of these cases, shows a large wave also auricular in time. The narrowing of the tricuspid orifice protects the auricle from the overdistention due to a large regurgitant stream, while the overfilling of the chamber, from a diminished outflow through the contracted orifice, serves to stimulate the auricular muscle to vigorous action and hypertrophy. The auricular pressure forced into the veins in systole often causes so great a tension in the valves at the entrance of the internal jugular vein that an audible sound, auricular in time, is heard on auscultation over this area. When fulness without any pulsation is present, there is probably a paralysis of the right auricle from overdistention.

Inspection.—As, almost without exception, there is associated mitral stenosis, it is difficult to separate the signs due to tricuspid stenosis alone. The area of pulsation is greater than normal, the apex is usually localized with difficulty and is seen farther out to the left. Some pulsation is seen in the costosternal angle.

Palpation.—A thrill presystolic, sometimes systolic, in time can be felt, the presystolic having its maximum intensity over the lower end of the sternum.

Percussion.—The cardiac dulness is increased to the right and occasionally in the upward direction.

Auscultation.—In the majority of cases recorded there has been a rough presystolic murmur, not quite so harsh as that heard in mitral stenosis. The point of maximum intensity and its area of audibility differ in different cases, but it may be said generally that the maximum point is somewhere near the lower half of the sternum, and it is propagated radially from that point. Sometimes it is heard over the entire sternum, more distinctly to the left side, sometimes over the lower half of the bone. Occasionally the murmur is heard to the right. Polycythæmia is almost constant, and, as a rule, well marked, often 8,000,000 or 9,000,000 red cells per cubic millimeter. The fingers are frequently clubbed. If there is any cardiac

failure, the urine contains albumin, and glycosuria has on rare occasions been noticed.

Diagnosis.—The reports of a large number of cases show that tricuspid stenosis may be mistaken for mitral stenosis, for tricuspid insufficiency, for congenital cyanosis, for pulmonary stenosis or deficiency of the septum of the auricles.

Considering the similarity of the symptoms in mitral and tricuspid stenosis, it is not surprising that the rarer lesion is occasionally overlooked. The points of distinction are as follows: The cyanosis in tricuspid stenosis is more marked and more constant; in mitral stenosis the cyanosis is more clearly associated with a loss of compensation and with stasis in the pulmonary vessels. If digitalis be given to a patient with mitral stenosis, the cyanosis, as a rule, lessens, but in a patient with tricuspid stenosis little if any effect can be noticed. A careful examination of the chest and neck should be made and attention paid to the following points: if the veins of the neck are full and pulsate with each auricular beat, tricuspid stenosis is more likely. In mitral stenosis with cardiac failure, insufficiency of the tricuspid would be produced and a positive, i. e., systolic, i. e., ventricular, venous pulsation would be produced. The precordia should be carefully palpated to determine the delimitations of any thrill that may be present. A presystolic thrill in the neighborhood of the apex suggests a mitral lesion; one more to the right, especially if its point of maximum intensity be felt on or near the sternum, suggests tricuspid stenosis. Careful auscultation, again, will sometimes show that a presystolic murmur present at the apex alters its character on being traced to the right toward the sternum, and with its altered character becomes more intense in that region. In a case recorded by Mackenzie the presystolic murmur produced at the tricuspid orifice could be heard over the whole of the lower two-thirds of the sternum and over a considerable area to the right.

Several cases are on record in which physicians of great experience have mistaken a tricuspid stenosis for insufficiency, even although repeated examination has been made for signs of tricuspid stenosis. It is well recognized clinically that mitral stenosis with loss of compensation may be at times difficult to recognize. This is also probably true of tricuspid stenosis. The mitral stenosis in the stage of loss of compensation is mistaken for mitral regurgitation; similarly the tricuspid stenosis with loss of compensation is mistaken for one of tricuspid regurgitation. To follow this a little farther, reference has been made in speaking of mitral stenosis to the work of Mackenzie and his suggestion that the disappearance of the presystolic mitral murmur is associated with the assumption of a disorderly rhythm and the disappearance of the auricular wave in the venous pulse. Mackenzie considers that the disorderly heart rhythm is due to the stretching of the primitive muscle tissue, increasing its excitability and causing it to act as the stimulus to the ventricular muscle instead of the normal impulse from the superior vena cava. An examination of the records shows that although in many cases a venous pulse has been noticed, recorded graphically, and proved to have an auricular wave, in others no pulsation of the veins of the neck has been seen. Cases, however, which have shown an auricular venous pulse have also had a regular pulse rhythm, a presystolic thrill, and murmur in some situation, which suggest a tricuspid rather than a mitral origin. It is suggested, then, that in those cases in which competent observers

have diagnosed tricuspid regurgitation, insufficiency alone was indicated, the symptoms of stenosis having disappeared by reason of the failure of the auricular contractions.

Prognosis.—The gravity of stenosis of the tricuspid valve depends on its association with mitral stenosis in a great number of cases. Mackenzie supposes that tricuspid stenosis is a lesion which protects the rest of the heart from the ill effects of overfilling. This view is borne out by what was noticed in Gairdner's patient, who led the life of a laborer for many years without any symptoms that were obvious to the patient. When mitral stenosis is present at the same time, the additional lesion means a much greater strain on the cardiac mechanism, and the length of life in such case would be in proportion to the gravity of the lesion on the left side of the heart. In Newton Pitt's series of 87 cases, 31 died between twenty and thirty years of age, the others in a lessening proportion in the previous and succeeding age decades.

PULMONARY INSUFFICIENCY.

From the clinical standpoint so much that has been said about pulmonary regurgitation is either unproved or as yet incapable of proof that the subject should be approached with the greatest caution, and with as clear as possible a conception of the theoretical aspects.

Structurally the pulmonary valve and its surroundings differ from those of the aortic valve in their more delicate texture, and in the adult the segments do not, as a rule, show the medial thickening about the corpora Arantii. The wall of the pulmonary artery is thinner than that of the aorta and has not the same tendency to preserve its ring structure in the absence of an internal pressure. The conus arteriosus which leads into the pulmonary is more thin-walled than the corresponding part of the left ventricle, and under increased internal pressure is probably capable of considerable dilatation. The structures in relation to the pulmonary valve are obviously directed as a whole to withstanding much less pressure than the corresponding parts of the aorta, and this is borne out by what is known regarding the relative pressures in the two sides of the heart.

G. A. Gibson has shown that in the pulmonary artery of the sheep, pressures above $14\frac{1}{2}$ inches caused a strong jet of water to escape through the pulmonary valve into the ventricle; with less than this, and down to a pressure of 9 inches of water, there was a small escape; below 9 inches the valves were competent. In the healthy human heart much fluid escaped with a pressure above 13 inches, a small amount between 13 and 8 inches, and none below that pressure. We have no direct means of estimating the pressure in man. The results of animal experiments give as the mean pressure 17.6 mm. of mercury in the cat, 12.07 mm. in the rabbit, and 29.6 mm. in the dog (Bentner). Eight inches of water is equal to about 15 mm. of mercury, so that the pressure in the pulmonary artery in man at the height of a vigorous systole of the right ventricle may cause a pressure well above that which first begins to cause insufficiency.

Etiology.—Insufficiency of the pulmonary valve may be caused by an acute endocarditis, by chronic fibrosis of the segments, or by dilatation of

the orifice at the site of their attachment. Insufficiency from acute endocarditis is seen in gonorrhœa, rheumatic fever, pneumonia, scarlet fever, pyæmia, and puerperal fever. It is remarkable that in the cases collected by Newton Pitt from the records of Guy's Hospital nearly half those in which a definite infective cause was ascertained were due to the gonococcus. An interesting form is associated with aneurism of the aorta (Newton Pitt), in which an inflammatory change in the neighborhood extends to the pulmonary artery and causes an adhesion of one or more cusps of the pulmonary valve to it. Sclerosis of the leaflets is met with in long-standing cases of mitral disease, sometimes in emphysema and chronic affection of the lungs. Rupture and deficiency in the number of the valves are rare causes of insufficiency.

Relative pulmonary insufficiency may follow long-standing obstruction in the pulmonary circulation. Our knowledge of these conditions is very scanty, but those which are most certain are left-sided valvular disease, especially mitral stenosis (Graham Steell), and general pleuritic adhesions (Rokitansky).

Morbid Anatomy.—The endocardial changes associated with pulmonary regurgitation differ in no respect from those associated with other valves. In certain cases of infective endocarditis the orifice of the pulmonary artery may be narrowed by the vegetations. The right ventricle is enlarged to a degree depending on the duration of the insufficiency. The pulmonary artery may show patches of atheroma, especially if the insufficiency has been due to an obstruction in the pulmonary circulation, as, for instance, in mitral stenosis. It by no means follows that with evidence of pulmonary regurgitation during life this can be demonstrated postmortem; it depends wholly upon whether the elastic tissue of the base of the pulmonary aorta has been damaged. The ordinary methods of testing the efficiency of the valve postmortem, namely, by pouring water into the artery in the excised heart or measuring the diameter of the pulmonary orifice, only give the efficiency in the collapsed state of the organ, and not when it is distended by blood. This is probably the reason why in mitral stenosis it is often possible to detect a diastolic murmur down the left of the sternum and yet seldom is it possible to find evidence of regurgitation postmortem.

The other organs, in death from cardiac failure in this condition, differ in no respects from "cardiac" organs in other conditions.

Symptoms.—Only when failure of the right ventricle is present do symptoms appear, cyanosis, dyspnœa, œdema, failure of appetite etc. Epistaxis has been recorded in some of the cases, and in one case (Oliver's, 1907) it caused death. Hæmoptysis from emboli in the lungs is frequent in infective cases. A third group of cases are those in which the signs of an infective process, such as puerperal septicæmia, are the most noticeable, and, unless special attention be directed to the heart, are frequently not diagnosed during life.

Physical Signs.—The precordial area of pulsation is enlarged, the apex beat is to the left of the nipple line, diffuse epigastric pulsation is visible, and frequently pulsation to the left of the sternum in the second and third interspaces and jugular pulsation is present. The cardiac dulness is increased transversely. The auscultatory signs are the most important and those upon which alone a diagnosis can be made. The murmur of pulmonary regurgitation, as a rule, is coarser than that in aortic regurgitation, often grating, and

more superficial. It is heard best down the left side of the sternum, and is propagated not along the systemic arteries, but along the left pulmonary artery. The second sound at the aortic area can usually be well heard, somewhat higher in pitch than that at the pulmonary valve, if present. It is often possible to detect pulsation in the lung vessels from the rhythmic constriction of the pulmonary alveoli; the vesicular murmur is rendered louder during ventricular systole.

Diagnosis.—In the case of pulmonary regurgitation, this is at all times difficult; the following points require special attention: (*a*) The character and situation of the murmur, its presence down the left side of the sternum and the rougher quality than that produced at the aortic valve. (*b*) The character of the pulse; Corrigan's pulse being invariably absent in pulmonary artery disease, though it should be remembered that Corrigan's pulse is not invariably present in aortic regurgitation. (*c*) The murmur of pulmonary regurgitation is increased in intensity during expiration or in expiration with a closed glottis (Valsalva's experiment). (*d*) The character of the apex beat, which in right-sided valvular disease is diffuse and displaced downward and outward.

Prognosis.—In the acute cases the outlook depends on the cause of the endocarditis. The streptococcus, gonococcus, and pneumococcus cases are usually fatal. In the more chronic forms some time is allowed for hypertrophy of the right ventricle, and not until this fails will there be signs of circulatory insufficiency. In relative insufficiency also a line of defence is present in the hypertrophy of the right ventricle; but the prognosis is associated rather with the original cause of the disease than with the pulmonary regurgitation.

PULMONARY STENOSIS.

This is an exceedingly rare acquired lesion. The congenital form is discussed in the section on congenital disease of the heart, and only the acquired form is considered here.

Etiology.—The causes are much the same as have been described in the section on aortic stenosis. (*a*) Endocarditis is the most common cause, and may occur in the course of rheumatic fever or one of the other acute infections. In some instances the vegetations are very large. (*b*) Chronic sclerotic changes may occur as at the aortic orifice, sometimes associated with endarteritis of the pulmonary artery. (*c*) Rare instances due to trauma have been recorded.

Morbid Anatomy.—The changes are much like those at the aortic orifice. In the form with endocarditis, the vegetations may be very large, and almost block the orifice. In some cases the process may be more in the conus arteriosus, and this is often due to endocarditis of the ventricular wall. In the sclerotic form the cusps are thickened, and may be adherent, forming a much narrowed orifice. Calcareous deposits may form, so that the orifice is nothing but a rigid ring, in which case the stenosis is accompanied by regurgitation.

Pathological Physiology.—Practically the same changes arise as are found in the left heart in aortic stenosis. With pure stenosis, hypertrophy of the right ventricle is the most marked early change, as by this compensation is maintained; but, when insufficiency is combined, dilatation and hyper-

trophy result. With marked stenosis there must be some decrease in the pulmonary circulation. As the right ventricle fails tricuspid insufficiency will appear.

Symptoms.—As long as the lesion is well compensated, these will be few. There may be some shortness of breath on exertion, but this is usually not marked. The same may be said of œdema and the symptoms due to venous engorgement. With loss of compensation, dyspnœa and cyanosis may both be marked, and œdema of the legs and the symptoms of passive congestion appear.

Physical Signs.—On *inspection*, the apex beat may be somewhat out to the left, and there may be quite marked heaving pulsation over the lower sternum and adjoining left costal margin, as well as in the epigastrium. If there is loss of compensation, the veins in the neck are full, and show pulsation, as described under tricuspid insufficiency. On *palpation*, a systolic thrill is usually felt at the base, sometimes over rather a wide area, or especially marked in the second left interspace. On *percussion*, the area of dulness is increased to the right. The most important signs are obtained on *auscultation*. A systolic murmur is heard, usually with its maximum in the second left interspace close to the sternum. It is sometimes propagated upward and to the left. The murmur is generally very harsh, often extends throughout systole, and seems more superficial and closer to the ear than that of aortic stenosis. It may be heard over a considerable part of the chest, but is not transmitted to the vessels in the neck. In some instances the murmur has been described as being soft. The pulmonic second sound is usually absent, or very faintly heard. A diastolic murmur is present if there be pulmonic insufficiency. The pulse does not necessarily show any change until loss of compensation occurs, when it is small, weak, and sometimes irregular. Clubbing of the fingers is sometimes present.

Diagnosis.—In this the great rarity of the lesion must be kept in mind, and it should always be the last to be considered; every other possibility should be gone over before this lesion is diagnosed, and even then it is safe to still have doubts. The murmur of aortic stenosis may cause error, but the fact of the murmur of that lesion being transmitted to the vessels of the neck is important. The pulmonary second sound is usually present in aortic stenosis and absent in pulmonary stenosis. The character of the pulse may aid, that of aortic stenosis being suggestive. Certain congenital lesions may give difficulty, especially a patent ductus arteriosus, in which the murmur is often longer, and persists after the second sound.

Perhaps the most common error is to make the diagnosis on nothing but the presence of a systolic murmur in the pulmonic area. To keep in mind how frequently a systolic murmur is heard there without any valvular disease, is to lessen the chance of the error. Among these conditions of occurrence are (*a*) anæmia, (*b*) peculiarities in the relation of the lung to the heart, (*c*) in many healthy young individuals, especially after exertion, in whom its occurrence may be difficult of explanation. In all of these the murmur is usually variable and altered, especially by change in position and respiration. The other signs of organic disease are wanting. Occasionally the murmur of mitral insufficiency is heard high up on the left side of the sternum, and may give difficulty. The other signs, and especially the accentuated second pulmonic sound, are of aid in recognizing this.

Prognosis.—This is grave, as a rule, although the rarity of the lesion does not allow of much deduction from experience. The condition of the right ventricle is most important. With any signs of its failing, the outlook is serious. One danger is the liability to pulmonary tuberculosis.

COMBINED VALVE LESIONS.

In nearly 50 per cent. of all cases the valve lesions are associated, either as a sequence, or two or more valves are affected at the same time. In the series of 1914 cases of valvular disease in the Edinburgh report, there were 230 with a double aortic lesion, 231 with a double mitral lesion, and 362 with various combinations of aortic and mitral lesions.

The same cause may act on two valves; thus, it is common in rheumatic fever in childhood to have the aortic and mitral segments attacked at the same time. Sclerosis may attack the aortic and mitral segments simultaneously. Occasionally an acute endocarditis involves the tricuspid as well as the aortic and mitral, and in a few rare instances all four valves are found affected. A common association is insufficiency of the mitral valves as a sequence of lesion of the aortic segments. This relative insufficiency occurs so soon as the dilatation of the ventricle reaches a certain grade. In long-standing cases the tricuspid valves also become insufficient, and this is also a common sequence of stenosis and insufficiency of the mitral valves. Insufficiency of the pulmonary valves may also be combined with chronic lesions of the mitral. In consequence of the heightened pressure behind the chronic mitral lesion, sclerosis of the tricuspid segments may follow with adhesion and gradual narrowing. The actual lesion of the valve is rarely pure stenosis or pure insufficiency. In the auriculo-ventricular orifices in particular, some degree of narrowing is usually present with the insufficiency. At the aortic orifices pure insufficiency of the arteriosclerotic type is comparatively frequent.

In connection with combined lesions one or two cardiac axioms are to be remembered. The rheumatic heart in children is very apt to have both valves on the left side involved. In adults, particularly in women, the lesion of the mitral is often single. In men aortic insufficiency may be the only lesion, to be followed as the heart enlarges by relative mitral insufficiency. Combined aortic stenosis and mitral insufficiency occur in a few cases of rheumatic endocarditis in young persons, and in later life is sometimes a consequence of chronic sclerotic changes.

As it is chiefly by the character of the murmurs that we estimate these combinations of valvular defect, it may be well here to speak of their indications. A diastolic murmur heard over the body of the heart with a direction of propagation down the sternum indicates insufficiency of the aortic segments. In a few rare instances insufficiency of the pulmonary valves is present. The murmurs produced during diastole at the auriculo-ventricular orifice have special characters and qualities. A pure systolic murmur heard anywhere over the body of the heart does not necessarily indicate a lesion of a valve. So numerous are the conditions under which it may occur that the single systolic bruit heard anywhere over the heart is of no moment as an indication of valve lesion. It must always be judged of in conjunction with other features. In any case the position of maximum intensity of the

murmur, the direction of the transmission, the existence of hypertrophy of the heart, or of one special chamber, must be taken into consideration. Combined diastolic and systolic murmurs give a more definite indication of lesion of a valve. Heard at the base in an adult, we may be reasonably certain that the aortic segments are involved. Heard at the apex region, the indication of mitral valve lesion is not so definite. In a case of pure aortic insufficiency the systolic murmur at the base may be caused by slight roughening of the segments or of the intima of the aorta, while at the dilated mitral orifice there may be a loud systolic and a rough rumbling presystolic (Flint murmur), and both associated with relative insufficiency. In such a case a single valve lesion is responsible for four heart murmurs. In general, it may be said that the diagnosis of combined valve lesions from murmurs alone is not very satisfactory. Much more important data are to be had from the study of the state of the individual chambers and the knowledge of the general cardiac pathology. In a child with an enlarged heart and a double murmur at apex and base we are safe in diagnosing combined aortic and mitral valve lesion. In an adult man who has not had rheumatic fever a similar combination may be produced by aortic insufficiency alone. Both in women and men mitral stenosis alone, or with insufficiency, may be the only lesion; but in cases of very long standing the valves on the right side of the heart are almost certain to be involved. As a rule, the physician is in a safer position if he limits his diagnostic ambition to two valves. Clinically when lesions of three or four valves are determined with accuracy, mortifying postmortem disclosures are not unlikely to follow.

PROPHYLAXIS OF VALVE DISEASE.

That the profession as a whole scarcely appreciates the importance of preventive measures in disease of the heart is due in part to the fact that full knowledge is not yet available and in part to the difficulty in making efficient what we already have. There died of disease of the circulatory system in England and Wales in 1905, 2716 persons under fifteen years of age. If we exclude from this list the congenital cases, we may say that a large proportion of the remainder should come within the category of preventable disease. In four directions we may work toward the lessening of the incidence of heart disease: (1) In the all-important endocarditic group of the acute infections, rheumatic fever plays the important role, and we need a more careful investigation into the conditions under which this disease prevails. Two circumstances appear to favor it. The damp, unsanitary surroundings of the poor seem to be the factor in the chronic tonsillitis and pharyngitis to which so many children are subject. More and more the profession has come to the belief that the portal of entrance of the germs of rheumatic fever is the tonsils and adjacent pharyngeal tissues. Careful attention should be paid to the state of the nose and throat. A mouth-breathing child should be regarded always as an unhealthy child, and enlarged tonsils, and adenoids should be removed. Parents and school teachers should be aroused to the great importance of the throat and nose in the well-being of the child. Damp houses should be regarded as unsanitary. Wet cellars and wet walls favor the conditions under which rheumatic fever prevails. There is no single problem of greater impor-

tance in preventive medicine than the reduction of the enormous waste of life in children in consequence of the rheumatic infection. (2) In a second group the cardiac breakdown follows overuse of the muscles. This is most often a myocardial affair, but in a considerable proportion of cases there is disease of the valve. In the large public schools, boys should be carefully examined before they are allowed to enter into running and rowing contests. In a growing heart, the developmental energies of which are taxed to the uttermost between the ages of fourteen and sixteen, it must be most hazardous to throw upon it the extra burden of providing a work hypertrophy. No matter how careful the training, no boy of fifteen runs a mile race without serious risk. Both in schools and colleges much more stringent supervision should be exercised by the authorities in the matter of athletics. In the occupations, heart disease has become less common. With the introduction of machinery and the use of the lift in the mines the liability to strain of the heart has lessened. (3) Syphilis, as a cause of heart and arterial disease, plays a very important role, and if we could ensure a more systematic and prolonged treatment of all cases, much would be done to lessen the liability to myocardial and valvular lesions, and especially to mesaortitis and aneurism. In the army and navy, more particularly, these preventive measures may be of service. Even in the community at large the proportion of individuals who have had syphilis is very large, and we all know the difficulty in ensuring proper treatment. (4) And lastly, all circumstances which lead to arteriosclerosis promote the sclerotic type of valve lesion. Hard work, alcohol, and overeating, particularly when combined with the high-pressure life, are very apt to lead to early degenerations.

Much may be done to promote the establishment of compensation and to postpone the final breakdown. In a rheumatic case with endocarditis it is to be remembered that it is not simply the vegetations, but the proliferative changes in the substance of the valve that have to be considered. The quiet life without strain and without special effort will enable a valve to heal with a minimum of damage. With the development of incompetency it may take months before the heart adjusts itself by hypertrophy to the new conditions. And the patient should be made clearly to understand the situation. It is always better to have a frank talk and explain the state of the "machine." Let it be expressed in mechanical terms, and make him understand that the difference between a healthy engine and his own is that in the former, for the ordinary purposes of life, only 25 per cent., say, of the horse-power is used, and there is a reserve of 75 per cent. to be called upon; whereas in his heart just the reverse conditions prevail, and while he may be perfectly comfortable using the 75 per cent. which he has to do for the ordinary duties of life, he has only a narrow margin of 25 per cent. for extra calls and emergencies. All circumstances that tend to depress the vitality and to lower the nutrition must be avoided, and he must be taught to adjust his life to his heart's capacity, or, in other words, to live within his cardiac income. For a young, energetic, muscular individual this is a hard lesson, and it becomes a serious problem how to adjust in proper measure exercise and diet in the varied conditions in life.

TREATMENT OF CARDIAC INSUFFICIENCY.

During the establishment of compensation certain troublesome features are apt to arise which require treatment. It is not always easy to say just how far these depend upon the hypertrophy and dilatation themselves and how far upon associated neurotic states. Not infrequently we are consulted by young men or young women between the ages of fifteen and twenty who complain of uneasy sensations about the heart with throbbing and palpitation, sighing respiration, and sometimes shortness of breath on exertion. On examination signs of slight enlargement of the heart with overaction are present. This is really the well-known irritable heart of the young, or some speak of it as the developmental hypertrophy. Sometimes it would appear as if there was a disproportion between the growth of the heart and of the body. Overexertion, particularly in schoolboys and in young collegians, cigarette smoking, masturbation, and overuse of the bicycle are sometimes causes. The outlook in these cases is usually good. They should avoid overuse of the muscles, and tobacco should be interdicted. They should be moderate in diet, and the state of the heart should be carefully watched. It is not always well to make too much of the condition. Very often the unpleasant sensations of abnormal action are quickly relieved by lessening the diet, cutting off the more starchy articles of food and anything which causes flatulency. In other instances a few doses of spirits of camphor or aromatic spirits of ammonia may be needed, but, as a rule, all that is necessary is a careful regulation of the life.

Overcompensation is a condition not infrequently met with in the early stages of valvular lesions before the heart has, so to speak, "found itself." Unpleasant throbbing, with irregular action, feelings of fulness in the head, inability to rest comfortably in the recumbent posture, are among the important symptoms, or the patient may have severe nocturnal attacks of palpitation. Very often this is not so much due to anything in the heart itself as the associated nervous state or an impoverished condition of the blood. Rest in bed for a week with careful regulation of the diet may be enough; if the heart's action is very violent, an ice-bag may be placed over the precordia for half an hour at a time. There are cases in which this unpleasant feature persists and is a source of more or less constant annoyance.

The actual valve lesion of whatever nature is very little under the control of treatment. Prolonged rest and potassium iodide influence the acute proliferative valvulitis, but we cannot replace scar tissue nor can we dissolve calcified atheromatous plaques. The whole treatment revolves about the cardiac muscle, the establishment and maintenance of compensation, the relief of the symptoms of insufficiency or decompensation, and the treatment of certain special symptoms.

1. **The Establishment and Maintenance of Compensation.**—Given a free coronary circulation, even in a state of wretched nutrition, the heart will gradually accommodate itself to the most severe valvular lesion. The hypertrophy and dilatation are not only salutary, but without them the circulation could not be maintained. As a rule, the call for additional strength comes slowly, and, as already mentioned, it is the old story of the woman who carried a calf in her arms every day, so that when it was an ox

she still could carry it. So in the slow onward progress of a valvular lesion, month by month, year by year, the daily strength becomes equal to the daily needs. One point at the onset comes up in nearly every case, Should the patient know of the existence of the disease? Most assuredly! It is impossible to carry out rational measures without his intelligent coöperation. The exceptions to this rule are very few. Occasionally a neurotic subject is upset and is frightened to perform the ordinary duties of life. One or two such instances have come under my observation, individuals who have had a perfect obsession about the heart lesion, a sort of pantophobia which has made of them wretched valetudinarians. In many cardiac conditions, however, it is neither necessary nor advantageous to tell the patient of the state of his heart. In the hypertrophy of arteriosclerosis or of chronic Bright's disease, or of a chronic pulmonary affection, no special benefit is derived from laying special stress on this feature of his case.

In the case of a young man the first thing to be considered is his calling. Very often it has been at a special examination for some service that the valve lesion has been detected. Under these circumstances he is excluded from a certain number of occupations, and he should, if possible, choose one in which the demands upon the muscles are not great. In the working-class this is, of course, a great difficulty; but, if possible, trades and occupations requiring much exposure and hard work with the muscles should be avoided. In the higher classes the professions with least strain, the clerical, the legal, and the occupations in which the work is sedentary, may be taken up. For persons with a little capital, who have not themselves to do the heavy work, gardening and small farming are very suitable.

To maintain compensation the diet should be simple, avoiding, in particular, excess of food. Often in the early stages the patients are anæmic and feeble, so that they require an abundance of good food, with plenty of milk and eggs, meat, and fresh vegetables. If there is a tendency to put on fat, the diet should be restricted in carbohydrates and the patient should not be allowed to take too much food. Beer and spirits are quite unnecessary. Moderate quantities of Bordeaux or Rhine wines may be allowed. In middle-aged men with aortic incompetency, if they have been accustomed to much spirits, a glass of whisky may be allowed at dinner. Tobacco may be used in moderation, but in young men it is best interdicted, so difficult is it to keep the use in moderation, and even two or three cigars or half a dozen cigarettes may cause irregularity. Tea and coffee may be taken in moderation, a single cup of coffee at breakfast and a cup of tea or coffee in the afternoon and another after dinner. No strict rule can be laid down about this, as even these small quantities may cause irregularity. The question of exercise is always the most important in connection with valvular disease, and it is not at all easy to reach a happy medium. It should be understood that in a great majority of well-compensated lesions moderate exercise is of advantage. Regular systematic exercise, as in walking, easy cycling, horse-back exercise, and golf, may be taken. For young men the more violent sports, such as football and hockey, should be interdicted. Golf is a particularly suitable game for young men, indeed, for men of all ages with well-compensated lesions. They should be warned, however, not to overdo it and not to play to the limit of tire, and the test of damage is the occurrence of dyspnœa or exhaustion. When outdoor exercise cannot be taken, systematic gymnastic movements may be employed. One is constantly

asked, in the case of young girls, about dancing. With a simple mitral lesion perfectly well compensated and the apex beat not very far out, it may be allowed in moderation. Each case must be decided by itself. There are many instances in which it has not been at all hurtful. Hill-climbing and walking in the Alps may be very beneficial if not pushed to an extreme. After all, the test of any exercise is the result. If the patient is helped by it, if he is not made short of breath when at rest, or if it does not cause attacks of palpitation or nocturnal dyspnœa, it may be continued. As a rule, patients with valvular lesions should not go to very high altitudes. This is a good rule, to which, however, there are many exceptions. In a well-compensated mitral lesion there may be no difficulty. On the other hand, the patient may feel a good deal of distress at any altitude above 6000 feet.

Special care should be taken of the bowels, and if there is any tendency to corpulency an occasional saline purge may be used. The skin should be kept active by a daily bath. A cold tub in the morning may be taken if there is a good reaction afterward; if not, a lukewarm bath at night. Very hot baths should be avoided. Young people should be allowed plenty of sleep, and in the early stages of well-established compensation an hour's rest in the middle of the day is helpful. It is impossible to lay down hard-and-fast rules to meet every case, but the physician should try to reach the happy medium between overanxiety and unnecessary precaution, and allowing the patient a liberty which may lead to early decompensation. "Moderation in all things" should be the motto of the patient.

Two or three special points may be referred to. The question of marriage is always a distressing one, particularly if before the onset of the lesion the patient's affections have been engaged. Everything depends upon the lesion and the stability of the compensation. In young women with simple mitral incompetency there seems to be a minimum of risk. In many such cases they become the mothers of large families without the slightest damage to the heart lesion. It is to be remembered that often a lesion reaches a stationary point and the heart is really a first-class piece of mechanism, with only 50 per cent. less reserve than in a normal one. Always in this connection the writer calls to mind a patient who has been under his observation for many years, in whom a mitral insufficiency followed rheumatic fever at sixteen. With a loud apex systolic murmur, and signs of moderate enlargement of the left ventricle, this woman has had nine children and has lived to be more than sixty years of age. The extreme mitral stenosis is not so favorable, and yet in how many instances has one seen repeated pregnancies safely carried through with quite advanced stenosis. Combined mitral and aortic disease with great enlargement of the heart and tumultuous heaving of the chest wall and slight protrusion should interdict marriage. The middle-aged Lothario who is shocked to find (perhaps as the result of a life insurance examination) before the contemplated marriage that he has an aortic insufficiency should be warned of the dangers. But these are cases in which, if the physician is wise, he will simply express an opinion on general grounds, as his specific advice is almost certain not to be taken.

In young persons special pains should be taken to prevent intercurrent diseases. In children the condition of the throat should be watched with the greatest care, and if there is the slightest enlargement of the tonsils it would be better to have them thoroughly removed. The state of the mouth should be carefully watched, bad teeth removed, and a visit to the dentist

should be paid once in three months. When possible, for a year or two after the establishment of compensation the patient should be carefully watched, and during the winter months a change of climate is most helpful—to Florida, Southern California, the South of France, Italy, Egypt, or Algiers.

2. **Treatment of Loss of Cardiac Compensation.**—At any stage in a valvular lesion or in hypertrophy and dilatation of the heart from any cause, *acute cardiac insufficiency* may arise, associated with dyspnœa, more or less cyanosis, irregular action of the heart, the gallop rhythm or embryocardia and a small rapid pulse. In typical form this is seen in the cases of arteriosclerosis, in hypertrophy and dilatation from overexertion, but it may occur in any form of valve lesion. It is the one condition in heart disease in which a venesection is advantageous. For many years now this practice has been carried out at the Johns Hopkins Hospital with the greatest benefit. In many hands it is not satisfactory, because sufficient blood is not taken. Good results are rarely seen unless as much as twenty ounces is taken. To "breathe a vein" skilfully is now almost a lost art, and to get enough blood it is sometimes necessary to bleed from both arms. Hypodermics of ether in dram doses, strychnine hypodermically in $\frac{1}{30}$ or $\frac{1}{20}$ grain (0.002 to 0.003 gm.), or digitalin, $\frac{1}{20}$ to $\frac{1}{12}$ grain (0.003 to 0.005 gm.), may also be given. Camphor, either by the mouth (the tincture in dram doses) or hypodermically, in doses of 2 grains (0.13 gm.) dissolved in olive oil, is useful. Local applications to the heart may be tried, a hot-water bag as hot as can be borne or a mustard leaf. If the case seems desperate, cardiocentesis may be practised. The needle is thrust boldly into the heart substance in the fourth or fifth interspace. Reading the successful case reported by Sloan some years ago, one cannot but feel that this measure, desperate though it seems, may occasionally be useful. The senior author has only practised it twice himself, in neither instance with any special benefit.

In a majority of instances the failure in compensation is gradual, and it takes a week or two before the signs are well established. The first and all-essential requisite is:

Rest of the body may, indeed, be the only thing necessary. Time and again, to demonstrate its importance to students, the senior author has treated patients with this measure alone, combined, perhaps, with a brisk saline purge, and within a few days the œdema of the feet disappears, the bases of the lungs become clear, and the heart's action quiet and strengthened. In many instances the chief value of a consultation has been in the insisting upon absolute rest. It is not always possible to induce a patient to go to bed, nor is it always possible for him to remain in bed. In the milder grades of cardiac breakdown the semirecumbent posture may be maintained, but it too often happens that the condition is one of orthopnœa, and there is no possible position of comfort in bed. The patient then has usually to sit up out of bed, and he is fortunate if there is available an old-fashioned "grandfather's chair" with the comfortable side pieces for the head. One of the greatest difficulties in the nursing of these cases is to get a position in which the patient may sleep comfortably. Too often, just as he drops off, the head falls and he wakens with a start. An ingenious nurse may sometimes be able to devise methods for the support of the head, but it is by no means easy. Sometimes these patients get into all sorts of remarkable attitudes. One poor fellow with a cardiac breakdown following emphysema had comfort only in the knee-elbow position. Patients may be able to sleep kneeling

at the side of the bed. One man for weeks could get relief only by leaning forward on to the back of a chair against which he rested his forehead, on which, in spite of every precaution, he had a bedsore. The greatest care should be taken of the back, but nowadays, with modern nursing, one rarely sees the terrible bedsores which were common thirty or forty years ago. Sooner or later there comes a stage when there is more or less permanent cardiac insufficiency which neither rest nor medicinal measures is able to overcome. The patient is tired of bed, and under these circumstances it is often beneficial to let him be up and about for part of the day, even if the exercise does bring on shortness of breath and increase the irregularity of the heart. In these chronic cases, when possible, the bed should be wheeled out-of-doors, or they may sit up on the couch on the veranda for part of each day, or be taken out in a wheeled chair. The question of systematic exercise will be considered in connection with the special methods of treatment.

Diet in the treatment of cardiac insufficiency is one of the most important and at the same time difficult elements in the treatment. We have all been notorious sinners in overfeeding our heart patients, particularly in the stage of broken compensation. The stomach is not only a near but a bad neighbor to the heart. With venous stasis of the gastric mucosa it is impossible to have a good gastric juice, and it is a good rule for the first few days, when the patient comes under treatment, to give a minimum quantity of food until with saline purges the overloaded viscera are relieved. A patient will get along perfectly well with the whites of six to ten eggs, flavored with lemon; this is very palatable, and in three or four of the feedings a little whisky or brandy may be given. Freshly prepared beef juice, milk diluted with lime-water or soda-water, and whey are also suitable. Not too much should be given, and when there is nausea or vomiting it will do no harm to let the patient go for twelve hours without any food in the stomach, and at intervals very hot water may be given, and if it be thought necessary, rectal enemas may be used. All prepared starchy foods are, as a rule, contra-indicated. Patients differ very much in their tastes and gastric capacities, and to a certain extent these may be humored. As soon as possible the patient should be taken off the "slops" and given solid food in small amounts; care should always be taken not to fill the stomach too much with liquids and solids at the same time. The sensible doctor will not forget that even a perfectly healthy stomach could not stand the heroic medication which we sometimes encounter, three mixtures—necessitating a dose at least every two hours, often a nocturnal pill, the nocturnal purge, the morning saline and sleeping draught at night! Too often this Arabian polypharmacy defeats the very object we have in view.

Reduction of Intake of Liquids.—It is by no means easy to decide just in what class of cases liquids should be restricted. Theoretically, the ingestion of large quantities of fluid increases greatly the work of the heart, and we know hypertrophy is caused directly by this in beer drinkers. On the other hand, there are many conditions in which it seems necessary in order to promote diuresis and sweating to give large quantities of fluids, milk, barley-water, and fluids generally. The following may be taken as indications, but they must be modified to suit the conditions. When compensation is good the patient should be careful not to take too much liquid, but the quantity of urine should not be allowed to fall below a normal limit. Such patients should not be allowed to take "cures" indiscriminately, as the drink-

ing of very large amounts of liquid may lead to pronounced embarrassment of the heart. In very stout patients with valvular or myocardial lesions the meals should be taken as dry as possible, and fixed quantities of liquid given during the day, enough to keep up the output of urine. The cases which demand reduction of the liquids are those with cardiac dilatation and venous stasis and œdema. Combined with purgatives the reduction in the total of the liquids to one and a half pints given at stated intervals, either milk and soda-water or milk and barley-water or albumin-water, may have a very beneficial effect on the dropsy and promotes the flow of urine; under these circumstances, too, the digitalis acts more favorably, as well as other remedies, such as diuretin.

Special Methods.—Certain plans of treatment have been introduced—combinations of diet, exercises, and baths.

Oertel's Method.—The late Professor Oertel, of Munich, who had a vast experience with the heart lesions of stout beer-drinking Germans, devised a method of treatment which is often most satisfactory in the weakened heart of obese persons. He sought to reduce the quantity of blood, to increase its concentration, and to diminish the amount of fat. The treatment consists in, first, the reduction in the amount of liquid. A total of about 36 ounces is allowed in the twenty-four hours, which includes the amount taken with the solid food. Baths and sweating help still further to reduce the quantity of water in the body. Secondly, the diet, which is chiefly proteid:

Morning.—Cup of coffee or tea, with a little milk, about 6 ounces altogether. Bread, 3 ounces.

Noon.—Three to 4 ounces of soup; 7 to 8 ounces of roast beef, veal, game, or poultry; salad or a light vegetable; a little fish; 1 ounce of bread or farinaceous pudding; 3 to 6 ounces of fruit for dessert. No liquids at this meal, as a rule, but in hot weather 6 ounces of light wine may be taken.

Afternoon.—Six ounces of coffee or tea, with as much water. As an indulgence an ounce of bread.

Evening.—One or 2 soft-boiled eggs; 1 ounce of bread; perhaps a small slice of cheese, salad, and fruit; 6 to 8 ounces of wine with 4 or 5 ounces of water. The third and most important are exercises, the so-called "*Terrain-cur.*" Graduated walking exercises are taken, not on the level, but uphill at various grades. A definite amount is done each day and the distance is gradually increased. Undoubtedly, at proper resorts suitable cases are greatly benefited by this plan of treatment, but it is to be borne in mind that Oertel recommended it particularly for the stout individuals with weakened heart action.

Nauheim Method.—Here the great influence is believed to be affected through the stimulating influence upon the heart of hot CO_2 saline baths combined with special muscular exercises. The precise mode of action is still under discussion, some attributing the good results to the stimulating influence of the CO_2 on the nerves of the skin; others regard the temperature of the bath as the most important element. Whatever the precise *modus operandi*, the heart is stimulated to more vigorous contraction and the area of heart dulness is diminished under observation. It has been suggested that this may be only the effect of Abraham's cardiac reflex. By reducing the temperature of the bath and increasing the concentration of the salts the heart's action is still further stimulated, and it becomes progressively

strengthened. Schott gives the following directions for the artificial baths and for their general management "Commercial bicarbonate of sodium and crude hydrochloride acid (42 per cent.) are added in equal quantities by weight to the bath water. This leaves a slight excess of the alkali, which is useful for protecting the metal bathtub and at the same time the patient's skin.

"In the beginning 100 grams of each should be added to a bath of about 250 liters of water, and this quantity may be gradually increased until 1500 grams of each ingredient are added (250 liters or quarts are equal to about 62 gallons; 100 grams are equal to about ½ of a pound; 1500 grams, about 3 pounds). The bicarbonate of soda is first dissolved and poured into the bath water, while the hydrochloric acid is not added until everything else is ready. The acid should be poured out under the water, holding the mouth of the bottle over the bottom of the tub and gently moving it about in all directions as the acid escapes. When the bath is to be prepared in a hurry, the mouth of the bottle is held immediately below the level of the water and moved rapidly to and fro without splashing. The layer of carbon dioxide which forms above the surface of the water must be removed by fanning, the window being open. The maximum duration of the bath is twenty minutes.

"At the beginning of the treatment most patients require an occasional day of rest, on which the bath is omitted, sometimes after the first, but usually not until after the second bath. After that the number of baths given in succession without an interval of rest can soon be increased.

"As a matter of precaution the bath should always be omitted on one day of the week.

"The patient's general condition and the condition of the heart must be kept constantly under accurate supervision; the effect of the bath determines the temperature and duration of the next one." Schott lays great stress on the subjective sensations of patients who are receiving the bath treatment: "If a patient feels tired for one or two hours after the first bath and then recovers completely, he may be given the same bath on the following day; but on no account may the strength of the bath or its duration be increased. If the fatigue lasts longer than two hours, the bath should be omitted on the following day. This principle should be observed during the entire course of treatment. When a series of baths of increasing strengths have been prescribed, each bath must be regarded as a task which the patient must be able to accomplish without any subsequent fatigue before he is allowed to take up the next. If he does become unduly fatigued, the course is begun over again after a day's rest with a bath of slightly diminished strength.

"The strength of the bath should be increased as rapidly as possible until a distinct effect is obtained, carefully avoiding any excess. Unless the invigorating effect on the heart is noted immediately after the bath during the beginning of the treatment, the bath is not sufficiently strong. The pulse ought to become slower and stronger, and a distinct reduction in the size of the cardiac dulness ought to be demonstrated immediately after the bath. This reduction in the size of the dulness should always be the object aimed at, even if it does not persist the entire day." Resistance exercises are given by a trained attendant, and definite groups of muscles are systematically brought into action.

Nauheim has become a vogue, and all sorts and conditions of patients

from all parts of the world flock there, so that it is by no means easy to form an unbiased judgment on the value of the method. The senior author has been watching carefully the results in many patients who have been under treatment there. They may be divided into three groups: Scores of persons who have nothing whatever the matter with their hearts are greatly benefited by the change and the holiday. In a second large group much damage is done. For years the senior author has been in the habit of seeing victims of the Nauheim cure, many of them physicians, who have come for advice regarding the long train of troublesome symptoms of the neurotic heart. Frightened by a little irregularity, they have submitted themselves to a Nauheim "cure," and have been greatly alarmed to find that instead of improvement they have grown worse. In many neurotic women the last state has been much worse than the first. As a rule, these patients are little if at all benefited. Cases of aneurism, valvular disease in the late stages of broken compensation, arteriosclerosis with very high pressure, do not seem to have done well under this special method.

A third group, in which good results are seen, comprises the chronic myocardial cases, the fat patients with weak hearts, the cases of valvular disease with slight disturbances of compensation, but not with dropsy. The baths may be carried out at home, but the same beneficial results are rarely obtained, even in suitable cases. As so often happens in these special forms of treatment an opportunity is given for unscrupulous practitioners to impose upon patients, and the Nauheim method has not always been carried out with common-sense. A plentiful lack of judgment has characterized the treatment of many individual cases that have come under observation. One thing should be demanded of those who carry out the treatment at Nauheim or elsewhere: they should stop alarming people who have little or nothing the matter with their hearts.

Medicines which Strengthen the Heart's Action and Help to Restore Compensation.—Among these digitalis not only takes the first rank, but is in a class apart. Introduced in 1785 by William Withering,[1] one of the most distinguished of English physicians and botanists of the eighteenth century, it divides with quinine the honors of the galenical pharmacopœia. Withering's work is one of the most memorable contributions ever made to therapeutics, and the inferences which he draws from a series of 163 cases of his own and a number from his correspondents hold good today. The various forms of dropsy were, of course, not distinguished at that time, but he recognized that the most hopeful for treatment with digitalis were those with a feeble and intermitting pulse.

Evidence has been accumulating to show with much greater accuracy the effect of digitalis on the various functions of the heart.[2] *Excitability* is not a function which is affected to the same degree as the others, yet the frequent presence of *pulsus bigeminus* is evidence of a hyperexcitability of the ventricle and the production of an extrasystole in the more rhythmic parts of the ventricle. The second beat in pulsus bigeminus is never preceded by an auricular beat. On the other hand, when the heart has a disorderly rhythm,

---

[1] An account of the Foxglove, etc., Birmingham, 1785.
[2] For further reference, the reader is referred to Cushny's text-book and the following papers: Wenckebach, *Die Arhythmie des Herzens*, Leipsic, 1903; Mackenzie, New Methods of Studying Affections of the Heart, *British Medical Journal*, 1905, vol. i; Gibson, *Quarterly Journal of Medicine*, Oxford, i, 173.

such as occurs in mitral stenosis (a condition probably due to overstretching of the auricle and an inception of the heart rhythm by the ventricle), then digitalis may have the effect of allowing the auricle again to dominate the rhythm, which then becomes regular, not so much perhaps from a depression of ventricular excitability as from a diminution of the auricular dilatation and lessened interference with those parts of the auricle which normally start the beat.

The effect of digitalis on *contractility* is one of the greatest dangers of its action. The action of digitalis in producing a pulse of just half the rate of the ventricle is well known. This is due to a depression of the function of contractility, and gives rise during the earlier stages to the condition known as *pulsus alternans*. If its action is allowed to continue, it produces half the rate of beat in the arteries, the second beat being unable from its feebleness to produce a wave in the arteries. Later the second beat may be entirely suppressed even at the heart. Wenckebach's explanation is that the normal depression of contractility which follows each beat is much greater under the action of digitalis, and that when the second stimulus from the auricle reaches the ventricle the latter is only able to respond in a feeble manner.

Conductivity is a function which has been shown by Mackenzie to be markedly depressed by digitalis. When such an effect is present it takes the form of lengthening the interval, normally about one-fifth of a second, between the beginnings of the auricular and ventricular impulses. It produces exactly the same effect as gradual mechanical compression of the auriculo-ventricular bundle in the dog (Erlanger), and results in a dropping out of certain ventricular contractions; hence this is another way in which digitalis can produce an abnormally slow pulse. But in some cases digitalis does not produce an effect on conductivity, unless given in enormous doses, which points to involvement of other factors. Of the effect of digitalis on *tonicity*, there is the invariable clinical observation that it is of the greatest use when dilatation is present, and the benefit which comes from it is due to a stimulation of this special function of the heart muscle. It may be taken as a guiding rule that digitalis will not do any good unless dilatation is present. The early slowing of the heart when digitalis is administered is due to its effect on *rhythmicity*. The longer diastole allows of a much greater restitution of the other functions, especially that of contractility, and the whole cardiac mechanism is benefited.

Digitalis is indicated when the heart's action is weakened to the degree of insufficiency. Neither feebleness of action nor irregularity are in themselves indications. Not until the effects of such weakness become manifest in shortness of breath, cyanosis, or œdema is the drug indicated. As a rule, the type of valvular lesion makes no difference whatever, as the cardiac insufficiency, for which the digitalis is almost a specific, is an affair of the muscle, not of the valves. In the common triple combination characteristic of insufficiency—dyspnœa, venous stasis, and dropsy—experience has fully borne out the ninth inference of Withering, "that digitalis has a power over the motion of the heart to a degree yet unobserved in any other medicine."

In cases of acute cardiac insufficiency the good effects are not so striking, and patients admitted in a state of cyanosis and orthopnœa and embryo-cardia are much more promptly relieved by copious venesection. The results of the administration of the drug are often phenomenal. The patient, who has been in a desperate state, may within a few days be rendered com-

fortable.' Relief of the thoracic oppression and of the dyspnœa, lessening of the cyanosis, and increase in the flow of urine are the indications of beneficial action.

The contra-indications for the use of digitalis are much more numerous than the indications. Few valuable drugs are so much wasted. Neither rapidity of action nor arhyt mia are in themselves indications, unless accompanied by signs of weakness of the muscles. There are many cardiac irregularities over which digitalis has no control, and persistency of irregularity is neither a contra-indication nor an indication for its use. In many cases the signs of heart failure in mitral disease disappear under its use, while the irregularity persists. It may be said broadly to be contra-indicated in all forms of heart disease without symptoms of muscle weakness; it is contra-indicated, too, in the great majority of cases in which the patients come complaining of their heart, of irregular and violent action. Such cases are much more satisfactorily treated by attention to their digestion and the nervous condition. In states of high arterial tension digitalis is contra-indicated. One is sometimes placed in a quandary, as the paradoxical features may be presented of a dilated heart with gallop rhythm and blood pressure considerably above the normal. Under these circumstances the latter may be discounted. But in middle-aged men with permanent high tension, sclerotic vessels, and a hypertrophied left ventricle, digitalis may be directly hurtful. In angina pectoris, as a rule, the underlying conditions are not those which are modified by digitalis. In a few cases where the heart's action is feeble, gallop rhythm is present, and particularly where the angina is directly associated with a very old valve lesion, more particularly in mitral cases, digitalis may be used without risk. In aneurism the drug is not of any service, except in the rare cases when the dyspnœa and œdema are directly due to heart weakness. There is widespread belief in the profession that digitalis is contra-indicated in insufficiency of the aortic valves. In the periods of decompensation the drug more frequently fails than in corresponding mitral cases, and we more frequently see death in heart cases in aortic insufficiency during the administration of digitalis; but this is particularly in the arteriosclerotic group when the nutrition of the heart muscle is failing, and when, as so often happens, the coronary arteries are seriously involved. In a majority of instances just as good results are seen in this lesion as in mitral cases, but a little more care has to be exercised in its use.

With the common gastric disturbances of broken compensation, digitalis, as a rule, is not well borne, as it often aggravates nausea and vomiting. Under these circumstances it is much better given hypodermically as digitalin. Toxic symptoms, which are not very often met with, follow the employment of very large doses or, occasionally, the prolonged use. Nausea, vomiting, sometimes diarrhœa, with pallor of the face, feeble, rapid pulse, and diminution of the amount of urine are the special features. There are three useful indications when the patient has had enough digitalis. The pulse becomes slow, but it must be remembered that one of the characteristic actions of the drug is the production of the bigeminal pulse. The second beat may

---

[1] For the young physician there is no other reputation-producing medicine of the same rank with digitalis, and it is one of the dozen drugs the uses of which repay a lifelong study. How he uses it may be taken as a sort of indication of the therapeutic intelligence of the practitioner.

become feebler, and finally is not perceptible to the finger. It may at the same time be evident as a small beat in the tracing, and the corresponding sound may be heard at the apex. The pulse may be counted at 40 when the heart beats are 80, or at 60 when they are 120. Mackenzie, Hewlett, and others have studied this peculiar action of digitalis, which may produce a definite type of heart-block. Hewlett has reported cases which seem to show that the combination of atropine prevents this effect. The condition is common in mitral cases, and may keep up for weeks without any special risk, but it may be followed by a rapid feeble action of the heart. The second important indication is a lessening of the flow of urine. Directions should always be given to measure and record the daily quantity, as a reduction gives one of the earliest indications when the useful action of the drug on the heart and vessels has ceased; and thirdly, a progressive lowering of the blood pressure is, as a rule, an indication to stop the drug.

Mode of Administration.—The judicious practitioner will study the use of three or four preparations which have stood the test of many years and will look askance at many of the new-fangled preparations of the drug. There are four preparations which he may use with advantage.

The Tincture.—In a patient with mitral or aortic lesion, who has just begun to have shortness of breath with swelling of the feet and diminution of the amount of urine, a good plan is to give the tincture in 15 minim doses every four hours for two days. Then it may be stopped for twenty-four hours and resumed for another two or three days, and so continued at intervals. Usually within ten days or two weeks the serious symptoms have disappeared and the drug may be stopped, or continued in 5 minim doses three times a day. As a rule, the tincture answers admirably, unless the stomach is very irritable.

The *infusion* in half-ounce doses, four to six times a day, is equally efficacious, and is believed by some to be more diuretic in its action. When the stomach is irritable it is not so well borne.

Powdered digitalis is of great service, in combination with squills and mercury, a grain of each in the form of the Addison or Guy's pill. It is particularly indicated in the cardiac failure of old arteriosclerotic patients, those with chronic nephritis, and more particularly when there is swelling of the liver, ascites, and jaundice.

The so-called active principles of the digitalis, digitalin and digitoxin, have been much used. The only advantage of digitalin is that it may be given hypodermically when the stomach is irritable. To get any good effects from the ordinary digitalin (Merck) it must be given in large doses, $\frac{1}{20}$ to $\frac{1}{30}$ or even $\frac{1}{12}$ grain (0.002 to 0.003 to 0.005 gm.) every four hours, watching its effects carefully.

For how long may digitalis be used without danger? There is not much risk of cumulative action with sudden untoward manifestations. As a rule, the symptoms above referred to suggest at once that the patient has had enough. Twice the senior author has known the digitalis habit to be contracted, in which over a long period of years patients took the tincture, in one case 5 and in the other 10 minims two and even three times a day. One was a physician with aortic insufficiency, who had taken digitalis daily for more than twenty years. He had a fixed idea that without it his heart became feeble. The remarkable thing was that he never had unpleasant effects.

Substitutes for Digitalis.—There are none, but it occasionally fails and there are other remedies which have an action on the heart of the same character, but less constant and enduring. Among those strophanthus takes the first place. It may be used in the form of the tincture, of which 10 minims (0.6 cc.) may be given every three or four hours. Its constricting effect upon the smaller arteries is said to be less than digitalis. It is very often useful to keep up the action of the heart after a course of digitalis, and in children with old mitral lesions it is sometimes better borne. As a rule, it is rarely found to be efficacious when digitalis fails. Sparteine, in 1 grain doses of the sulphate, adonis vernalis, and convallaria may be sometimes useful. Camphor is much used by the Germans; caffeine and theobromine are also recommended, but in failure of the heart muscle they are not of much value in comparison with the preparations of digitalis. Strychnine by mouth or hypodermically in acute conditions is often of service, and may be given with the other remedies. Depending on the condition, it may be given in doses of $\frac{1}{60}$ to $\frac{1}{20}$ grain (0.001 to 0.003 gm.).

3. **Treatment of Special Symptoms.**— Cardiac dropsy is usually relieved by the digitalis. When resistant, it forms one of the most difficult symptoms to overcome. The use of the saline laxative, particularly the salts given by May's method in concentrated form early in the morning, the compound jalap powder, or calomel purges, are very helpful. To promote sweating, hot baths, either the very hot tub, the steam bath, or the hot-air bath, may be tried cautiously. On the whole, it may be said that this is not so satisfactory in cardiac as in renal dropsy, and it is sometimes very difficult to get a profuse action of the skin. The hydrothorax and the ascites may require tapping. If the anasarca of the legs becomes very great, the skin may be punctured either with the small Southey's trocar, or small incisions may be made in several places on the legs. Dressed with gauze and thick layers of sterilized cotton, an enormous amount of fluid may be drained away. It is, as a rule, perfectly safe when the usual precautions to avoid infection are taken. In milder grades of the anasarca it is very helpful to bandage the legs firmly.

Sleeplessness and Restlessness.—With failure of compensation the patient has almost always bad nights, and the question of the use of hypnotics comes up at an early date. It is well at first to try the milder forms. Paraldehyde is often very satisfactory, given in dram doses; the patients become accustomed to the unpleasant odor. Veronal or trional alone or combined with potassium bromide may be tried. When the milder hypnotics fail, as they often do, opium should be used. While it is contra-indicated with a low output of urine and the presence of a great deal of bronchial catarrh, it is perhaps next to digitalis the most favorable drug in the treatment of the heart itself. In the cardiac failure of arteriosclerosis, with the terrible nights of orthopnœa and restlessness, hypodermics of morphia give the greatest relief. We are, altogether too cautious in the use of this drug, which is of incalculable service in the severer manifestations of the disease. Given in small doses of $\frac{1}{8}$ grain (0.008 gm.) hypodermically it may be repeated in a few hours if rest is not obtained. In children paregoric is very helpful, and it may also be used in the attacks of nocturnal palpitation in the irritable heart.

Anæmia.—This should always be kept in mind, and if present, iron and arsenic should be given as soon as the acute cardiac features are over. Some patients are greatly helped by occasional courses of these drugs.

CHAPTER VIII.

FUNCTIONAL DISEASES OF THE HEART.

By CHARLES F. HOOVER, M.D.

THE prognostic distinction between anatomical and functional disease of the heart is not so sharply drawn as in former years. Anatomical diseases of the heart were formerly the only cardiac affections which were linked with grave prognostic significance. Functional disturbances of the cardiovascular system were in former years not associated in the minds of medical men with heart death. Our present conception of functional disease of the heart is not at all inconsistent with the ultimate death of the heart. Even in heart death following organic disease we are now becoming more accustomed to the conception of functional death of the heart, separate from the idea of an exhausted muscle struggling against great odds.

Attention has been directed to the failure of diastole, in contrast to the failure of systole, at death of the heart, so that this idea of heart death from disorder in the nervous impulses to the heart enters more and more into our conception of the natural history of heart diseases. Anatomical diseases of the heart may precede a functional disturbance, but, on the other hand, a functional disease of the heart may terminate in an anatomical disease. We know the persons most frequently affected by diseases of the heart muscle and vascular system are those who in early life have suffered from neurasthenia or hysteria, or by their mode of life have subjected the neurovascular system to oft-repeated insults, which, although apparently mild in their single events, have produced, collectively, final histological changes in the myocardium and aortic system. It is a common practice of physicians to console patients with the remark, "The heart is of normal size and the sounds are clear." Many of the laity have learned that such an assurance offers little consolation. We see some instances of myocardial incompetence following prolonged intense mental and emotional distress. One instance was in a woman, aged forty years, who had experienced great mental suffering on account of domestic infelicity. She had exhibited many stigmata of hysteria during the period of ten years before she came under observation. She had dilatation of both the left and right ventricles with cardiac arhythmia. There was not the slightest sign of any disease of the kidneys, heart valves, the aorta or its branches. The distribution of the blood was perfectly normal, in marked contrast to the laboring heart. There was nothing in the history of the preceding ten years on which one could base the suspicion of former venous stasis in the lungs or systemic venous system. This patient died two years later directly after the death of her only child. Unfortunately no autopsy was obtained, so the character of the myocardium could not be learned. This patient appeared to be an instance of the so-called "broken heart." In another patient with a rapid, irregular, and slightly dilated heart, there was nothing further in the physical status to account for the myocardial

(270)

warning, either quietly, or in a paroxysm of cyanosis with dyspnœa. As was said above, the embarrassment to the circulation which the lesion itself entails is not the only source of danger. Grave danger lies also in the frequent intercurrence of a malignant endocarditis, and in the fact that catarrhs, colds, and the more serious invasion of a bronchopneumonia are all apt to prove rapidly fatal. The liability of patients with pulmonary stenosis to tuberculosis, and the frequent termination by the sudden onset of cerebral complications, are other unfavorable factors. These considerations indicate the extreme gravity of the more pronounced cases, and the fact that even in the more innocent forms of congenital cardiac disease the prognosis must be framed with reserve and caution. Among the better class, where good hygiene prevails and the most suitable conditions of living can be sought, the outlook is of course better than among the children of the very poor.

Treatment.—This may be said to begin with the care of the mother during her pregnancy, for a study of the etiology clearly shows that to some unhealthy condition in the environment of the embryo or in the parental organism, rather than to an ancestral tendency toward anomalous growth, the majority of cardiac anomalies owe their origin.

The treatment of a patient suffering from congenital cardiac disease must be largely symptomatic or palliative, or directed to the preventing of complications. The indications here are to do all that is possible to facilitate the oxygenation of the blood, to avoid additional taxation of the already burdened circulation, and to shield the patient from those accidents or illnesses which will increase the pulmonary or systemic obstruction, remembering always that in the majority cyanosis first develops on the addition of some such factor to the pathological conditions produced by the lesion itself. A carefully regulated life, a plentiful supply of light, fresh air, and warmth, the maintenance of an equable bodily temperature, the avoidance of mental agitation and of undue physical exertion, rest, and quiet forms of exercise, where this last is permitted by the condition of the patient, are all essential. The diet should be carefully ordered, light and nutritious, and the often capricious appetite watched. Free action of the excretory organs, especially of the skin, should be promoted and the child kept clothed with flannel. Sudden changes in the external temperature must be avoided and, when possible, resort should be had to a warmer winter climate. Exposure to cold or wet, or to any of the causes of rheumatism, should be avoided on account of the great liability to acute endocarditis. When adult life is attained, choice of light employment which does not call for sudden or great physical exertion is important. In women child-bearing is fraught with danger.

Where cyanosis has developed, the administration of oxygen has been suggested as likely to be useful in relieving dyspnœa. Gibson, however, reports a negative result from its use in several cases. For the relief of the dyspnœic attacks diffusible stimulants, such as are used in angina, are of benefit and should be kept at hand; and in infants the hot mustard bath is useful. The frequent syncope may best be relieved by strychnine. Where failing compensation sets in, the usual treatment of rest and cardiac tonics is to be employed, and here strychnine is said to give better results than digitalis.

Thus, in a very few words, a careful hygiene and an expectant and preventive treatment may be summed up as the only available assistance that can be given. The condition does not admit of cure, but permits of amelioration and of arrest of the downward trend of the disease.

CHAPTER X.

DISEASES OF THE ARTERIES.

By WILLIAM OSLER, M.D., F.R.S.

ACUTE ARTERITIS.

Mistaking staining of the intima for inflammation, the older writers described arteritis as a common event in many diseases. In the early years of the nineteenth century Cruveilhier and others believed that it was the cause of the clotting of the blood in the vessels, and that it arose spontaneously as a complication in the fevers. Virchow took an opposite view, viz., that the thrombosis was the primary event, and the arteritis always secondary, whether the clot was embolic in origin or formed at the site from conditions of the circulation or of the blood. Of late years we have learned to recognize that the arteritis is sometimes a sequel of the clotting, sometimes due to primary changes in the vessel wall.

Secondary Arteritis.—Secondary arteritis occurs when a local infection attacks the vessel wall from without, as in abscess formation, etc.; or when the intima is injured and inflamed as a result of an infected embolus or an infected marantic thrombus. This form will be considered in connection with embolism and thrombosis, in the course of which it is an incident.

Primary Arteritis.—Primary arteritis is a rare disease, met with as a complication in the acute infections, and occasionally as an independent malady. In ordinary medical work it is most frequently seen in typhoid fever, but its rarity may be judged of from the fact that in this disease there were only 5 instances in 1500 cases at the Johns Hopkins Hospital.[1] In smallpox, scarlet fever, influenza, and pneumonia, cases have been observed. It is less common in rheumatic fever, diphtheria, yellow fever, typhus, and measles. In typhoid fever, pneumonia, and diphtheria the organisms of the disease have been found in the vessel wall. In direct infection from the blood the intima is first involved, and there may be small vegetative outgrowths such as we see on the intima of the valves, but this is rare. In other cases the infection is conveyed through the vasa vasorum, and the adventitia and media are first involved. The grades of alteration in the vessel depend upon the type and virulence of the organism. The intima alone may be affected, with the result of the formation of a thrombus; in other cases the vessel wall is acutely inflamed and there are swelling and infiltration of the neighboring tissues.

Symptoms.—The symptoms depend upon the vessels affected. In the external arteries, as in the femorals or popliteals, there is pain, often of great

[1] Details of these are given in Thayer's Jerome Cochran Lecture, *Johns Hopkins Hospital Bulletin*, 1904.

(426)

severity in the course of the vessel, spontaneous or on movement, and an increase in the fever with swelling over the vessel and sometimes redness. The pulse below is obliterated; the limb is at first pale and cold, and then gradually becomes livid at the periphery. When the femoral is obliterated, whether or not gangrene follows will depend upon the rapidity with which the vessel is blocked and the extent of the thrombus. There are cases which look threatening at first, and in a few days the signs of obstruction pass away. In other instances the process extends and both legs may become affected.

In the acute infections gangrene is only too apt to follow obstruction of the femoral artery. It is not always easy to determine whether the thrombosis results from a primary arteritis or an embolus. Suddenness of onset and the existence of conditions favorable to embolism point to the latter. There are cases in which the onset is severe, and for a few days the symptoms suggest that gangrene will follow, and then the circulation is reëstablished and color returns to the limb. Parietal thrombosis with only partial occlusion of the vessel may be present. Of our 2 cases of typhoid fever in which the femorals were affected, gangrene followed in one, in the other the condition cleared in a few days. In 1 case the brachial was involved at the bend of the elbow.

Arteritis of the internal vessels is still more rare. Of 2 of our cases in which the cerebral vessels were affected in typhoid fever, in 1 on the ninth day of the disease, in the other on the nineteenth, both proved fatal. In the arteries of the kidney, the spleen, and occasionally of the heart, a spontaneous clotting may occur as a result of inflammation in the acute infections.

Primary Multiple Arteritis.—There are instances in which in the course of a few days, without the existence of any local disease, a thromboarteritis occurs in many vessels, associated with high fever and signs of an acute infection. The writer has reported a remarkable case in a man, aged twenty years, who had had typhoid fever two years previously. He was admitted to the Philadelphia Hospital with fever, rapid pulse, diarrhœa and abdominal pain. He had thrombosis of both femorals and iliac arteries and of the lower two inches of the abdominal aorta, and of two large branches of the splenic artery. There were infarcts in the spleen and in the kidney.

Acute Aortitis.—Lesions of the aorta due to acute inflammation are exceedingly rare. The term aortitis has been used very loosely to describe conditions which are degenerative rather than inflammatory, and which come under the general category of arteriosclerosis. It is an altogether false conception of the process to speak of the degenerative plaques of the intima and the foci of medial necrosis met with so commonly in the infections as acute aortitis. The process occurs under the following conditions:

1. **Acute Vegetative Aortitis.**—In pneumonia, in rheumatic fever, and in the acute septic infections, the lining membrane of the arch may present numerous irregular vegetations identical with those on the valves. The condition is rarely if ever met with apart from aortic or mitral valvulitis. It is exceedingly rare, and the writer has not seen more than three or four instances. The outgrowths may be firm and warty in character, or a perfectly smooth intima may present a series of globose vegetations. Acute aneurism may be associated with the process. There may be half a dozen small sacs. Cases have been reported, particularly in France, in connection with rheumatic

fever.   Pneumococci and staphylococci have been found in the vegetations.

2. **Acute Mesaortitis.**—This is much more common, particularly in syphilis. Within a few weeks a localized productive aortitis occurs, largely confined to the media, but quickly involving the other coats, and leading to aneurism or to an acute dilatation of the part of the vessel affected, or to rupture with a dissecting aneurism. This is a type of aortic disease to which the term "acute aortitis" may very properly be applied, and will be dealt with under the subject of aneurism. Other varieties of acute infective mesaortitis are met with in pneumonia, rheumatic fever, and septicæmia. The infection is conveyed through the vasa vasorum and there are foci of softening, sometimes of acute suppuration, in the middle and outer walls of the artery. This may lead to localized weakening, so that the intima over the spot is split. As many as four, five, or six of these small fissures may be seen on the intima of the arch, each one leading into a little focus of softening and dilatation. Sometimes the edges of the splits are covered with luxuriant vegetations. Acute aneurism is apt to follow, which may rapidly prove fatal. To this condition, occurring in the course of an infection like rheumatic fever, the term "acute aortitis" is really applicable. There are instances in which in an aorta with perfectly smooth intima there is a small erosion like an acute ulcer, leading directly into an aneurism. The writer has reported a remarkable case, with the illustrations, in which in the lower part of a normal looking descending aorta there was a linear perforation 1.5 cms. in extent, which led directly into a small aneurismal sac which had ruptured into the œsophagus. The woman was only thirty-five. There was no endocarditis. The probability is that she had an acute mesaortitis comparable with that which may be produced in animals experimentally, and that over this small spot the intima fractured.

Symptoms.—The *symptoms* of acute aortitis are exceedingly vague. It is one of the most interesting points in comparative medical literature to read the extended description of the disease as given by French writers, and then to note the silence of American, English, and German authors on the subject. Except in syphilis, the writer has never made the diagnosis of acute aortitis; here the pain, often anginal in character, and the development, under observation, of aortic insufficiency, give decided indications of disease at the root of the aorta. In a case of acute rheumatic fever, or acute sepsis, signs indicating acute dilatation of the arch of the aorta would be suggestive. It must be borne in mind, however, that in a larger majority of cases of so-called aneurism occurring in children in connection with rheumatic fever, are instances of dynamic dilatation of the aortic arch in connection with aortic insufficiency. An abdominal aortitis is recognized by French writers, characterized by pain, throbbing, increased mobility, and a loud systolic murmur, with a relatively higher blood pressure in the femorals than normal. Clinically, the condition is quite as vague as the acute thoracic aortitis.

A special form, *tuberculous aortitis*, may be mentioned, of which a few cases have been described. In Flexner's case there was a small tuberculous nodule just below the left subclavian artery, seated directly on the intima, which everywhere else was smooth. Tubercle bacilli and giant cells were present and there were numerous tubercles in other organs.

3. **Acute Peri-aortitis.** Occasionally in suppuration in the neighborhood of the aorta, as in connection with a lymph gland in the anterior mediastinum or in suppurative processes in the abdomen, the adventitia of the aorta may be involved, and presents a focus of suppurative softening.

CHRONIC ARTERITIS. ARTERIOSCLEROSIS.

Definition.—A general disease of the arteries, characterized in the small vessels by thickening of all the coats, and in the larger by gelatinous swelling, necrosis, fatty degeneration and calcification, the processes to which the name atheroma has been given.

Sometimes the term arteriosclerosis is limited to the smaller vessels, and that of atheroma to the larger arteries. On account of the irregularities due to calcification and atheromatous erosions, the name of endarteritis deformans is given to the process in the larger arteries.

History.—An excellent account is given of the coarser changes in the aorta and large vessels by Morgagni, who describes the gelatinous thickenings, the areas of atheromatous softening, and the ossification. He recognized the frequency of sudden death in disease of the aorta. Baillie figures the two chief lesions in his well-known *Atlas* (1799), the raised, irregular protuberances of the intima and the areas of calcification or ossification. The relation of changes in the coronary arteries to angina pectoris was studied by Jenner, Fothergill, and Parry. The relation of gangrene to blocking of the arteries was recognized by Boerhaave, Munro, and Meckel. The early writers of the nineteenth century paid special attention to disease of the arteries, and Hodgson's excellent monograph appeared in 1815. The illustrations in Cruveilhier's *Atlas* have never been excelled. Virchow's study of the disease, which he called *endarteritis deformans*, brought out its relation to strain, to increased pressure and to the toxic agents.

The modern view of arteriosclerosis as a general disease dates from the papers of Gull and Sutton (1872),[1] who called the process arteriocapillary fibrosis. Though in this paper they dealt particularly with the relation of contracted kidneys to arterial changes, in their first two conclusions they clearly announce a conception of arteriosclerosis which has undergone no essential change: (1) "There is a diseased state characterized by hyaline-fibroid formation in the arteries and capillaries; (2) this morbid change is attended with atrophy of the adjacent tissues." Sutton had an extraordinarily clear idea of the whole process and of the relation of visceral lesions to the vascular conditions. Thoma in his remarkable studies widened our conception of the pathology of the process, and he demonstrated that the thickenings and knob-like excrescences on the intima represented a compensatory process following disease of the middle coat. In injecting arteriosclerotic arteries with paraffin he found that the nodular projections of the intima were pressed back, making the inner surface level and smooth, while on cross-section, instead of a bulging of the intima there was a projection outward of the media. The recent histological studies which have so profoundly modified our views of the process cannot here be discussed. The monograph of Jores (1903) and the critical summaries in the *Ergebnisse* of Lubarsch and Ostertag (1904) may be consulted.

---

[1] *Medico-Chirurgical Transactions*, 1872, vol. lv, p. 273.

The recognition of a separate type of chronic arterial disease due to syphilis, and its importance in connection with aneurism, has been brought out by the studies by Heiberg, and by Heller and his pupils. The syphilitic aortitis has special features which enable it to be recognized macroscopically and microscopically from the ordinary atheroma. Within the past few years the experimental production of arteriosclerosis has thrown a great deal of light upon the pathology of the process.

Etiology.—There are four great factors in the causation of arteriosclerosis—the normal wear and tear of life, the acute infections, the intoxications, and those combinations of circumstances which keep the blood tension high.

1. **Wear and Tear of Life.**—Among organs the bloodvessels alone enjoy no rest. Not only does a ceaseless rush of fluid pass through them at a speed of 10 inches a second, but the walls of the main pipe are subjected to a distending force of $2\frac{1}{3}$ pounds to the square inch, 60 to 80 times a minute, 80,000 to 100,000 times in the twenty-four hours. The heart has rest in diastole, but distended by the charge from the left ventricle, the arteries pass it on partly by the natural elasticity of the walls, partly by an active contraction of the muscle fibers. Like other organs they live under three great laws—use maintains and in a measure sustains structure; overuse leads to degeneration; in time they grow old, in threescore or in fourscore years the limit of their endurance is reached and they wear out.

The stability of tubing of any sort depends on the structure and on the sort of material used; and so it is with the human tubing. With a poor variety of elastic and muscular fibers in the bloodvessels, some are unable to resist the wear and tear of everyday life, and have at forty years of age arteries as old as those of others at sixty. One day, at a meeting of the American Medical Association, Dr. Henry Martin (of vaccine fame), who possessed all histrionic gifts, demonstrating samples of Esmarch's bandages, one of which, as he spoke, he broke into fragments with great ease, while another resisted all his efforts. "They look the same," he said, "and they are made of the same substance, but they are not the same, one is shoddy, the other is the genuine article." And so it is with our arteries. They look the same macroscopically and microscopically, but they differ in different individuals in the quality of the materials used and the capacity to resist the ordinary stress of life. Not only are there individuals, but whole families with "shoddy" bloodvessels. Hence the truth of the old saying attributed to Cazalis, "a man is as old as his arteries." In the building of the human body, as of chaises, there is, as the Autocrat says, "always somewhere a weakest spot," and too frequently this is in the circulatory system.

The conditions of modern life favor arteriosclerosis, as a man is apt to work his body machine at high pressure, and often takes less care of it than of his motor. The best express engine from the Baldwin works run day by day at maximum speed will not last one-tenth of the time it would do if it were not so pushed. But nowadays, with the human engine it is top-speed or nothing, and we cannot wonder that it early shows signs of hard usage. In the fourth or fifth decade, even with the best of habits in eating and drinking, the incessant strain and anxiety of public life or of business may lead to degeneration of the bloodvessels. Mental exertion is not of itself injurious, and the life of the student need not be one of great tension, but the mental exertion of the modern business man is of a different kind. Com-

petition is so keen and the environment so stimulating that, even without social or political ambitions, high pressure seems a necessity. The tragedies of life are largely arterial. Represented in the old mythology as winged, Nemesis, the goddess of the Inevitable, may still be pictured with a wheel, the wheel of life, to the ceaseless revolutions of which the circulation ministers. How often does her fatal touch call away in their prime the best and the bravest—men like the late William Pepper, whose only fault has been the unselfish abuse of the body machine!

After forty it is exceptional to examine the arteries without finding evidence of degeneration—here and there a small plaque of atheroma, an occasional streak of intimal fatty degeneration, and with this the mitral and aortic cusps may have lost just a little of their delicate tenuity. With advancing age the arteries become thicker and the atheromatous changes more marked. As a rule, in the very aged not only the smaller arteries are thickened, but the aorta and its main branches show extensive changes with calcification. Occasionally, however, a very old person may have singularly healthy bloodvessels. It is not the case, as so often quoted, that Harvey found the vessels of Parr, who lived to be one hundred and fifty-two (?), to be healthy. He does not mention them. Living quieter lives and with less stress and strain, women are not so frequently the subjects of arterial changes, and in consequence they last longer. In infants and young children arteriosclerosis occurs: (1) As occasional patches or flakes, or even calcified foci, in the vessels of the newborn. (2) In infants dying of the acute infections, streaks of fatty degeneration of the intima and foci of necrosis of the media are not uncommon. (3) Widespread arteriosclerosis of the smaller vessels may occur without nephritis and without recognizable cause. Two or three cases may occur in the same family. (4) In congenital syphilis, diffuse or localized sclerosis of the arteries may occur, sometimes early, sometimes as a late manifestation in *syphilis hereditaria tarda*. Fremont-Smith,[1] who has recently reviewed the literature of arteriosclerosis in the young, found no difficulty in collecting 144 cases.

2. **The Acute Infections.**— Of the acute infections, syphilis is the one with a special predilection for the arteries. There are changes best described as acute productive arteritis, and there are degenerative changes which come in the category of chronic arteritis. The special features of syphilitic aortitis will be described later. The lesion may be a chronic obliterative endarteritis, limited to a special group of vessels, as in the brain, the heart, or the vessels of the extremities. Extensive arteriosclerosis in infants and in children is very often syphilitic, and in the acquired disease a slow, progressive arteriosclerosis may exist in combination with other parasyphilitic manifestations. We have learned to recognize the great frequency in scarlet fever, measles, diphtheria, smallpox, and influenza, of foci of arterial degeneration. It has long been known that in typhoid fever areas of necrosis and fatty degeneration are met with in the aorta. The observations of Thayer[2] show how important are the cardiovascular relations of this disease. Of 52 postmortems at the Johns Hopkins Hospital, in which notes of the condition of the aorta were made, evidence of sclerosis were present in 30, and in 21 of these the changes looked recent. It is remarkable that out of 62 instances in which the condition

---

[1] *American Journal of the Medical Sciences*, 1908, cxxxv, p. 199.
[2] Jerome Cochran Lecture, *Johns Hopkins Hospital Bulletin*, October, 1904.

of the coronary arteries was stated, in 19 sclerotic changes were present, and in 13 of these the changes were recent. One of our House Physicians, a very vigorous man of twenty-five, died at the end of the third week of typhoid fever. There were patches of endarteritis at the root of the aorta and numerous patches of yellowish sclerosis in both coronary branches. Thayer examined 189 patients who had had typhoid fever in the hospital within fourteen years, and 40 per cent. of the persons between the ages of ten and fifty presented palpable radial arteries compared with 17.5 per cent. of a series of control cases. The change may be in connection with the higher blood pressure which he found to prevail in these patients.

At the Franz-Joseph Hospital, Vienna, Wissal examined 300 bodies of children dead of acute infections, and in 80 found signs of arteriosclerosis, usually in the form of ordinary patches in the aorta and larger branches, but the small vessels were also found involved. It is interesting to note that he found the chief changes, which were in the media, to bear a striking resemblance to those produced in experimental aortitis in animals.

Tuberculosis is another disease with which arteriosclerosis is frequently associated. It has been observed by many writers that in chronic phthisis the superficial bloodvessels are apt to be thickened. It is rare to examine a patient with tuberculosis of the lungs of more than two or three years' standing without finding thickening of the superficial arteries.

Experimental production of arteriosclerosis by the various bacterial toxins afford an explanation of this gradual production of sclerosis in the chronic infections.

3. **Intoxications.**—Of the poisons which have an important influence on the bloodvessels, some are exogenous, others endogenous. Of the special exogenous poisons, alcohol, lead, and tobacco, the first named is very generally regarded as a potent influence in causing degeneration of the bloodvessels. In man it is very difficult to separate effects of alcohol from those of other causes. Of late years there has been a strong revolt against the popular belief. In France, Lancereaux rejects the evidence entirely. R. C. Cabot holds the same opinion, and it must be confessed that it is difficult in any given case to furnish evidence that alcohol alone is the cause. For example, in a middle-aged man who has drunk freely, eaten largely, and worked hard, it is impossible to say which of these factors is responsible for the degeneration of the bloodvessels. Alcohol may act either as a direct poison, causing necrosis of certain elements of the bloodvessels, or it may be a factor in maintaining a constant and high pressure.

Tobacco is another poison about which it is very difficult to get conclusive evidence. Experimentally, it is easy to produce the most extensive degeneration of the aorta in animals with nicotine. When one considers the extraordinary quantities consumed over long periods of years by men who show no trace of vascular change, or not more than the ordinary wear and tear of life would warrant, it is difficult to believe that tobacco can have a very important influence. It rapidly raises tension and may cause spasm of the arteries, which factor may account for the cases of sudden death in young or middle-aged men in whom excessive use of tobacco has been the only etiological factor. Angina pectoris is sometimes associated with abuse of tobacco, and the influence may be, as Huchard and others believe, through inducing an arteriosclerosis of the coronary arteries.

Lead has long been known to have a very important effect upon the

bloodvessels. A slow, gradual sclerosis is common among painters and others who take a small quantity of lead into their system. There are three elements here to be considered: the direct toxic action of lead on the bloodvessels, the disturbance of metabolism which leads to gout, and the chronic interstitial nephritis, both of which are associated with high tension and favor sclerosis. Of other exogenous poisons, tea and coffee are supposed to have an influence, but it is not easy to get conclusive evidence of the connection.

Of endogenous poisons that may promote arteriosclerosis may be mentioned all the conditions of perverted metabolism, the hyperpyræmia of Francis Hare. The thickening of the arteries in gout, in diabetes, in chronic Bright's disease, in obesity, may be due to the action on the bloodvessels of poisons retained within the system.

4. **Conditions that Keep up High Blood Tension**.—The recent work of experimental arteriosclerosis, to be referred to later, shows the great importance of this factor in causing an arterial degeneration. Within limits, the pressure with which the blood circulates in the arteries varies very greatly, in order that the circulation may adapt itself to the varying conditions of life. Healthy individuals differ in the degree of the blood pressure, but one rarely finds it with the ordinary Riva-Rocci instrument above 150 mm. Hg. The pressure varies, too, at different periods of life, and as age advances the blood pressure rises. Sir Clifford Allbutt[1] has discussed this feature in a most suggestive paper. There can be no question that in many individuals the rise in pressure antedates the appearance of the arteriosclerosis. The following are some of the causes of this heightened blood pressure: (1) *Overeating:* Excess of food and drink acts in two ways, first by keeping the bloodvessels constantly distended, and secondly, in the processes of primary and secondary metabolism substances may be formed which are directly toxic. This is the condition which Francis Hare has very well described as *hyperpyræmia*, a state in which the system is damaged by products of imperfect metabolism. Of late years there has been a very general consensus of opinion on this point. The writer's attention has been repeatedly called to the frequency of arteriosclerosis in persons who have been temperate in every respect except at the table. It is well known to caterers that teetotallers eat much more than other people, and in the United States arteriosclerosis is very frequent among the well-to-do classes, who, as a rule, are abstemious so far as alcohol is concerned, but exceedingly careless and indulgent in the matter of eating. The writer's experience is fully in accord with that of Allbutt, that "one main cause of rising arterial pressure in middle life is excess of feeding, that is to say, of food in excess of work and excretion." The express engine capable of running fifty to sixty miles an hour if stoked for that purpose and put into the station yard to "shunt" empty cars will go to pieces very soon. This is what so many of us do with our engines. We supply the fuel for fifty miles an hour and run the engine at ten miles. In our bodies, as in the engine, damage is certain to follow from the accumulation of waste and the disproportion between intake, work done, and output. For the statement that meat eaters are more prone than others to arteriosclerosis we have no positive warrant, but the Indians and Japanese, who subsist chiefly on a vegetable diet, are said to be much less affected than Europeans.

[1] *Medico-Chirurgical Society's Transactions,* vol. lxxxvi.

In no way is blood pressure more surely heightened than by the persistent use of the muscles. But here, too, we must be careful not to draw hasty conclusions. A majority of laboring men have the blood pressure from 30 to 50 or 60 mm. of Hg. above that of rest during the greater part of the day. This is well within the normal limits, and cannot be hurtful. It is the very severe muscular efforts repeated over prolonged periods that damage the cardiovascular system, the conditions that produce the hypertrophy of the heart, as in miners, mountain climbers, and athletes. The difficulty here is to separate the effect of muscular effort from associated conditions of overeating, alcohol, and tobacco. The possibility has to be considered of overactivity of the adrenals, a state of hyperepinephrism, in which an increase in the amount of the internal secretion, which keeps up vascular tone, causes hypertension and finally sclerosis. So far this is a purely hypothetical conception. Much light has been thrown upon the whole question by the recent studies on experimental arteriosclerosis.

Etiologically, then, there are three great groups of arteriosclerosis: first, the involutionary, in which the degeneration is caused by the ordinary wear and tear of life, and which is as natural as gray hair and failing eyesight; secondly, the toxic group, in which the degenerations are caused directly by the poisons of acute and chronic infections and of the intoxications; thirdly, the hyperpietic group, in which the degeneration follows persistent high arterial tension. Practically in a given case of arteriosclerosis, in a man of, say, fifty-five, two or all three of these factors may be present, and it is exceedingly difficult to assign to each their relative value.

Pathology.—It is rare to find the arteries entirely free from disease. Even in children small flecks of atheroma or fatty degeneration of the intima are by no means uncommon. In the bodies of middle-aged persons some arterial degeneration is always present, and, as a rule, the older the individual the more pronounced they are. In extreme old age calcification may be a widespread process, but occasionally the vessels of persons above eighty years of age show very little atheroma.

While arteriosclerosis is a general disease, affecting, as a rule, all of the arteries, the process may be much more advanced in some vessels than in others. The arteries of the brain may be stiff and hard, while those of the abdominal organs show no change; or the vessels of the limbs may be stiff and rigid, while the intima of the arch is smooth. The coronary arteries may be extensively diseased in comparatively young persons, while there are no changes in the other vessels. As a rule, this limitation of the disease to the vessels of one organ or to a limited portion of one of the large arteries, is characteristic of syphilis; but there are instances in which this disease can be excluded with reasonable certainty.

In the larger arteries, the aorta for example, the following are the important changes: (a) Small areas of fatty degeneration of the intima, of a yellowish color, not raised. This may be the only lesion present. (b) Gelatinous-looking raised areas scattered over the intima, and seen particularly about the orifices of the arteries. They are translucent, and on section are seen to be confined to the intima. (c) Larger plaques of yellowish color due to fusion and fatty degeneration of b. (d) Calcified plaques. (e) Areas of atheromatous softening, which may project above the level of the intima, and which the old writers called atheromatous pustules. (f) Open atheromatous ulcers, usually flat and due to the breaking down of

foci of atheromatous softening. In advanced cases the inner surface of the aorta is rough and irregular from the presence of calcified plates and areas of softening. (*g*) On section of the vessel the changes are found to be chiefly in the intima, but the media is usually atrophied, sometimes with foci of necrosis and areas of calcification, sometimes of true ossification. The adventitia is thickened and indurated, but necrosis and calcification are rarely seen in it. In many instances we find all grades and phases of the process going on side by side. The artery may be dilated, and sometimes there are small aneurismal bulgings.

Experimental arteriosclerosis, which has been studied so carefully of late years by Jores, v. Gilbert and Lyon, Fischer, Pearce, Klotz, Harvey, and others, has thrown a great deal of light upon the mode of production of the disease. Inoculation with cultures may produce proliferative changes in the media with thickenings of the intima. Diphtheria toxin, on the other hand, causes degenerative lesions affecting chiefly the media and adventitia followed by calcification. The most remarkable degenerative changes follow the use of adrenalin and other agents which raise the blood pressure. Here the media is involved, necrosis of elastic and muscle fibers takes place, with fracture and splitting of the same with early calcification. Aneurisms are formed either by direct bulgings over areas of disease of the media or from splits of the intima.

Recent researches lead to the conclusion that in the ordinary type of arteriosclerosis the primary lesion is in the media, either productive or degenerative. To compensate, a reaction occurs in the intima with hyperplasia of the subendothelial connective tissue which undergoes hyaline, fatty, and calcareous changes. According to Thoma's view, this reaction of the intima is compensatory and adaptive, tending to strengthen the wall in the spots where it is weak and to restore the original lumen of the vessel.

Discussion is still active on the finer changes in the small vessels in arteriosclerosis. The controversies of the seventies, started by George Johnson, Gull and Sutton, Dickenson, and others, still rage. Where does the process begin? Is there a true hypertrophy of the muscle fibers? What is the relation of high tension (hyperpiesis) to the sclerosis? Which comes first? Is the primary mischief caused by the action of a toxin in the finer tissues of the capillaries and arteries? Or do these irritating substances cause spasm of the smaller vessels, and so raise the tension? What is the relation of the involutionary changes in the vessels in old age to those met with in younger persons? May not increased viscosity of the blood play an important role in causing high tension and arterial strain? We cannot say that any of these problems are finally settled, and the whole question is in the melting pot again in consequence of the remarkable studies on experimental arteriosclerosis. We lack definite knowledge of the finer changes in the capillaries, which are probably always involved (as Gull and Sutton believed), through which, after all, the essential processes of the circulation are carried on. As age advances the smaller vessels show definite changes, chiefly in thickening of the intima and moderate hypertrophy of the other coats. Later, degeneration occurs, fatty and necrotic, particularly in the muscle cells and in the elastic fibers of the media, and calcification is common. Alterations precisely similar to this physiological arteriosclerosis may be met with in young persons, even in children, and it is pathological only in the time of life at which it has occurred. Intimal thickening in which both the

elastic and connective tissue elements are concerned is perhaps the most constant feature in all types of arteriosclerosis. It may be out of all proportion to the changes in the media, and may narrow or obliterate the lumen of the vessels—endarteritis obliterans. This is the most important single factor in the disease, responsible for more symptoms than all the other changes put together. It may be limited to one set of vessels, as of the legs or of the heart. The cause of this intimal thickening is much discussed. Thoma regards it as compensatory, particularly in the large vessels, but even in vessels the size of the ophthalmic artery he thinks it takes place to strengthen the vessel at a point weakened by disease of the media as illustrated in his well-known figure.[1] (See Fig. 45, p. 459.) The physiological intimal thickening as age advances is believed to strengthen the vessel weakened by senile changes in the elastic and muscular elements of the media, and in the pathological forms experimental evidence is in favor of this view.

The nature of the changes in the media and adventitia are much discussed. They probably differ in the different groups of cases. In the high tension—hyperpietic—form there appears to be an early hypertrophy of the muscular elements, as was so well described by George Johnson and more recently by Savill. It is not easy to determine this histologically, and the matter is still in dispute. The cut section of an artery contracted is very different in appearance from one relaxed, and appearances are very deceptive. This has been well pointed out by Arthur V. Meigs, whose figures of cross-sections of shrunken and unshrunken arteries show how different the coats look in the two states. In the involutionary and toxic forms, necrosis of the muscle fibers and elastic elements takes place with replacement by connective tissue, fat, or lime salts, very much as occurs in the larger vessels. The medial degeneration seems really as important in the small as in the larger arteries, and in the senile type the calcified beadings follow these necrotic changes.

Symptoms.—Arteriosclerosis disturbs function in three ways: (1) Following progressive arteriosclerosis the activity of an organ lessens and there is a gradual reduction in its capacity for work. The changes of senility are largely vascular. With a reduced blood supply the organs become less and less active, atrophy slowly but progressively comes on, and they become firmer and harder. In old age every organ and tissue in the body shows changes which may be attributed to progressive arteriosclerosis. (2) When the arteriosclerosis reaches a final and obliterative stage, if in an end vessel, necrosis follows in the territory supplied, or if, as so often happens, it is in the peripheral vessels of the foot or of the hand, gangrene supervenes. (3) Arteriosclerosis renders the small arteries more prone to spasm than normal vessels. The process may sometimes be studied in the vessels of the leg. The spasm is accompanied by pain, ischæmia, and loss of function. The diminished volume of the pulse is readily perceptible, the foot becomes pale, at the same time there is pain, and, if at all widespread, there is muscular disability. These attacks of angiospasm are not necessarily associated with sclerosis. They may occur in normal vessels, as, for example, in Raynaud's disease, which affords many opportunities to study the effects of spasm, not only in the vessels of the limbs, but the transient aphasia and the mono- and hemiplegic attacks of this affection are due to loss of function in consequence of spasm of cerebral vessels. As will be mentioned shortly,

[1] *Virchow's Archiv*, Band cxi.

in speaking of the cerebral features, precisely similar attacks occur in arteriosclerosis which may be explained in the same way. These vascular crises have been introduced to do service in explanation of a whole series of phenomena, from lead colic to angina pectoris, and from cramp of the muscles to the gastric crisis of tabes. Pal, of Vienna, in his valuable monograph on *vascular crises*,[1] gives an excellent account of the whole condition. He refers to a case of great importance as illustrating the loss of function in a part caused by transient spasm. A man, aged sixty-three years, every day, or every few days, had blindness of the right eye, lasting from a minute to several hours. Wagermann, under whose care he was, found complete amaurosis with absence of pupil reaction. The ophthalmoscopic examination showed contraction of the retinal arteries and emptiness of the veins, appearances which passed off in a few minutes with restoration of normal vision.

In so widespread a disease the clinical features will depend upon the extent to which the process has involved the arteries of different organs. So remarkable are the powers of adaptation in the body that an extreme grade may be compatible with good health. It is an every-day experience to find arteriosclerosis in persons who look well, and who are able to perform the ordinary duties of life. Sudden death may be the first and only manifestation. Rupture of a bloodvessel in the brain, thrombosis of one of the coronary arteries, rupture of a small aneurism, acute dilatation of the heart—any one of these may carry off a man in whom there has never been any suspicion of an organic lesion. Natural death, euthanasia, comes through the bloodvessels. The description in Ecclesiastes of the gradual failure of the vital powers is an epitome of the clinical features of senile arteriosclerosis. The symptoms are as varied as the organs involved. But before entering into consideration of the special features, it may be well to consider arteriosclerosis as a—

General Disease.—As already stated, there may be no symptoms of ill health, and the condition may be met with in a casual examination, as for life insurance. In a man who has led a very energetic life, particularly if he has worked hard with his muscles, eaten much, and drunk hard, the palpable arteries are felt to be thickened, the blood pressure is heightened, there is an increase in the vigor of the cardiac impulse, the apex beat is a little dislocated outward, the first sound is thudding and prolonged, and the second is accentuated. Such a patient may look a very robust man. When present under the fortieth year, such features are always of serious, although not always of immediate significance, and it does not do to give, as is sometimes done, a too unfavorable prognosis. Mental and bodily vigor of exceptional degree may persist with the most pronounced arteriosclerosis. The discovery may be a most advantageous thing, as the patient may be warned to change his method of life. A man who has been racing like the Lusitania, and in constant hazard of a breakdown, may be able to keep up indefinitely when the pace is reduced to ten knots an hour. An early symptom of the general disease is a slight pallor, all the more noticeable if the individual has had previously a high color. With it there may be no actual reduction in the number of red blood corpuscles. It is a question altogether of local anæmia. A gradual loss of intellectual and bodily vigor is the most striking symptom. Within a few years a man may, as we say, age visibly and lose his intellectual

---

[1] *Gefasskrisen*, Leipsic, 1905.

keenness. The muscular energy is lessened and he is prematurely senile. Often the skin gets flabby and lax and the hair turns gray early. The condition is best expressed in those well-known lines of Oliver Wendell Holmes, describing the One Hoss Shay on the morning of its one hundredth anniversary:

> "A general flavor of mild decay,
> But nothing local. . . ."

And as in that venerable vehicle the breakdown is apt to be sudden and general. Slowly advancing, the peripheral arteries harden, the retinal vessels become more tortuous, the blood pressure rises to 150 to 200 mm. Hg., the cardiac hypertrophy becomes more marked, and the urine shows a slight amount of albumin and tube casts. Even at this stage the conditions may have been met with accidentally and the patient may be quite able to attend to his business, although conscious of failure in capacity. Very many of these patients, particularly under forty years, come to us with symptoms of neurasthenia, irritable, sleepless, and emotional.

Local Manifestations.—Nervous System.—As just mentioned, the patient may present quite early all the complex and varied manifestations of neurasthenia. In the more advanced stages of the disease the cerebrospinal features are among the most important and interesting. Headache is an early and distressing symptom, associated, as a rule, with high pressure and often promptly relieved by measures which reduce it. Usually frontal and continuous, occasionally paroxysmal and resembling migraine, many patients first consult a physician for it and the real cause may be overlooked, unless careful examination is made.

*Vertigo.—*Transient giddiness is a very common symptom and may be one of the most distressing, although it is usually quite temporary and never with the severity or associated features of Ménière's disease. It may, however, be associated with tinnitus. It is often brought on by exertion, or follows a sudden movement, and is an accompaniment of the crises of hypertension to which some patients are subject.

*Transient Monoplegias, Aphasia, and Paraplegia.—*One of the extraordinary cerebrospinal manifestations of the disease is the occurrence of attacks of transitory disturbance of function of parts of the brain or of the cord, leading to hemiplegia, monoplegia, aphasia, or even paraplegia. Years ago the writer's attention was called to these occurrences in the case of a friend and colleague, a man of about forty years, with extreme arteriosclerosis. After an attack of slight palpitation of the heart, with shortness of breath, he awoke one morning to find himself unable to speak or to use his right hand. The paralysis passed away in the course of twenty-four hours, and he regained the power of speech a little more slowly. He had a dozen or more of these transient attacks lasting a little longer than others, but with recovery so complete that he was able to resume his work. Once there was transient paraplegia, and for more than two days he was unable to walk. Headache was variable, not always present. The writer has seen a great many cases since, and has come to recognize it as a not very uncommon feature in arteriosclerosis of the cerebral vessels. The attacks are sudden and the recovery is complete. One patient had, within two years, at least twenty attacks of transient paralysis, sometimes on one side, sometimes on the other. Although not so widely recognized as it should be, the condition has been described by many writers, particularly Peabody, Edgeworth, and

others. The transitory nature, with complete recovery and the extraordinary frequency of the recurrence, put hemorrhage, embolism, and thrombosis out of the question, and the condition must be an angiospasm similar to that which produces manifestations of Raynaud's disease.

Convulsions of an epileptiform character may occur. In the absence of syphilis and of lead poisoning, convulsions occurring in middle-aged individuals should always excite the suspicion of arteriosclerosis. They are associated with high pressure, sometimes very high, and are often preceded by headache and giddiness. In Stokes-Adams disease the convulsions are attributed by some to angiospasm and arteriosclerosis of the cerebral vessels.

Progressive Dementia.—Gradual failure of the mental powers is one of the commonest symptoms of cerebral arteriosclerosis. A man begins to take less interest in his affairs, grows careless and apathetic, the memory and judgment are at fault, the facial expression is dull, and, progressing month by month, at last the psychical powers are so reduced that the individual is in a state of dementia. Apart from syphilis, in which the dementia has the well-known features of paresis, mental degeneration is not often seen as a result of arteriosclerosis in men under forty years. It is common enough as a pre-senile change in men at or about sixty years. It may be associated, too, with periods of excitement and with mental vagaries of all sorts. Rupture of the cerebral arteries leading to apoplexy and thrombosis in consequence of changes in the intima are common events in arteriosclerosis.

Cardiac.—There are three important groups of cases in which the dominant symptoms of arteriosclerosis arise from affection of the heart—the valvular, the myocardial, and the coronary.

Valvular Group.—In a considerable number of aortic and mitral valve lesions the insufficiency is due to a process in the segments identical with that which goes on in the vessels. The former is a much more important group than the latter, and a considerable proportion of all cases of aortic insufficiency in men belong to it. These forms will be considered in the section on valvular disease of the heart.

Myocardial.—In general arteriosclerosis gradual failure of the hypertrophied cardiac muscle is a common and serious event, leading to the characteristic clinical picture of dilatation and progressive asystole. After a period in which the patient suffers with palpitation or violent action of the heart, he begins to get short of breath and is winded quickly by the stairs or by a slight hill. He may awaken at night in a slight paroxysm of dyspnœa. At this period examination may show a forcible apex beat and a high-tension pulse. An attack of angina pectoris or of pulmonary œdema may occur. Soon the dyspnœa increases and the patient feels that his disability is altogether respiratory, and that if he could only get his breath he would be all right. The signs of dilatation of the heart become more marked, and there is a characteristic picture of asystole, orthopnœa, slight swelling of the feet, and cough, with, perhaps, blood-stained expectoration. The pulse is often at this stage very deceptive, as it is not always weak. The apex beat is diffuse, undulatory on palpation, and one may feel a gallop rhythm, while over the whole heart the gallop rhythm is heard on auscultation. There may be an associated systolic murmur, and the aortic second sound may still be ringing or even amphoric in tone. The state of the urine depends entirely upon the degree of venous congestion. With judicious treatment the condition may be relieved in a week or ten days, and the patient may be able

to resume work. A dozen or more of such attacks may follow before the patient succumbs. Even after months of dyspnœa and asystole, recovery may take place.

Coronary Arteries.—The orifices, the main branches, or the smaller vessels may be affected. The narrowing of the orifices is a common cause of myocardial degeneration and weakness, and in young syphilitic subjects, of attacks of angina. The same may happen in any case in which the sclerosis is advanced at the root of the aorta and the orifices of the coronary arteries are seriously narrowed. Involvement of the main branches produces the same condition, but attacks of angina pectoris are more common and in a large group of cases sudden death occurs from thrombosis in one or other of the branches. In many instances of arteriosclerosis in comparatively young men the coronary arteries are involved out of all proportion to the other vessels and the attacks of myocardial weakness may precede or accompany angina pectoris, or one may be surprised to find, in a case of sudden death in a middle-aged man, who has never had any cardiac symptoms, that there is gradual fibrosis or perhaps areas of anæmic necrosis are present with softening and occasionally rupture.

Renal.—There are two great groups of cases: (*a*) associated with the small contracted kidney, following an acute nephritis or coming on insidiously in gout or chronic lead poisoning, there is an extreme grade of arteriosclerosis which may be regarded as secondary and due partly to the high pressure and partly to toxæmia; (*b*) the true arteriosclerotic kidney is a red, beefy organ which is firm, hard, and dark in color, not at first reduced in size, sometimes, indeed, slightly enlarged. Very often, with this kidney, there may be few or no urinary symptoms. In a late stage there may be large, flat areas of atrophy of the cortex, or a large section of one organ may be involved in consequence of an obliteration of the arteries passing to the part.

The urine in these two groups of cases present, as a rule, striking differences. In the small contracted kidney the amount is increased, the specific gravity is very low, the albumin small in amount, often absent in the morning, hyaline casts are present, and very often red blood corpuscles. The urine of the arteriosclerotic kidney may contain at first no albumin, or, if present, the amount is not large, the specific gravity is normal or sometimes high. Later, the albumin may be large in amount and sometimes, as when a patient is admitted with an attack of cardiac dilatation, the urine is scanty with large amount of albumin and numerous tube casts, due to an acute intercurrent nephritis.

Abdominal.—Much attention has been paid of late years to abdominal symptoms in arteriosclerosis. Pal and others believe that very many of the painful gastric and intestinal conditions are associated with spasm in the gastric and mesenteric vessels; some would associate the multiple functional disturbances of abdominal neurasthenia with degenerative changes in the arteries. Certainly one may see a sclerosis of the mesenteric vessels far in advance of that in other vascular territories, but the writer does not know that we are yet in a position to say that any definite symptoms are connected with it. Ulcer has been met with in connection with endarteritis of the smaller vessels of the stomach. The victims of angina pectoris may have marked abdominal symptoms, and of late writers have spoken of such attacks of abdominal pain as *angina abdominis*. This is really an old story, as years ago Leared described "a disguised disease in which the heart affection was so masked

by that of the stomach that nothing in the statements of the patient had any bearing on the primary disease." A number of these cases have come under my observation, but even when the pain is entirely abdominal the general features have usually been sufficient to make a diagnosis.

Milder attacks of epigastric pain and intestinal cramp and meteorismus have been attributed to arteriosclerosis. The clinical features of gastric and intestinal dyspnœa have been regarded as manifestations of circulatory disturbance in the sclerotic vessels. One cannot read the literature on the subject that has appeared of late without feeling that the writers have often been carried away with theoretical considerations. An intermittent claudication of the stomach has been described.

Peripheral Arteries.—A few among the many manifestations following sclerosis of the arteries of the limbs may be considered:

Cramps of the Muscles.—Local tetanus (cramp) in a muscle follows over-exertion or a sudden prolonged effort in a strained or unaccustomed position. Long-distance runners are very subject to cramp in the calves of the legs, and sustained use of any group of muscles may throw not the whole group, but some portion, into strong tetanic cramp. This form and the commoner variety, which results from strained posture, are met with in young and old, but in the latter there is a form of great interest, and often very troublesome, which is probably associated with arteriosclerosis. Few elderly persons escape attacks of cramp, chiefly nocturnal and sometimes of such severity that the condition requires treatment. It is more common in persons of full habit and of what we call a gouty disposition—*i. e.*, persons who eat too much and work too little; but attacks may occur in thin, abstemious persons. It is difficult to connect the condition definitely with angiospasm, but the writer has so often found marked sclerosis of the palpable vessels of the legs, or absence of the pulse in the dorsal arteries of the feet, that he has come to regard the bad nocturnal attacks in elderly persons as a manifestation of endarteritis. Twice attacks of the most dreadful agony have been seen, recurring every few minutes in the muscles of the legs, knotting them in places into hard lumps which took a minute or two to disappear. In one old woman they were so severe that only large doses of opium gave relief. In both these patients the pulse could not be felt in the feet. Ligation of an artery may throw the muscles into a spasm, and the sudden tap on the facial artery may cause tetany of the muscles, so that it is not impossible that angiospasm (a vascular crisis) may be responsible for these painful cramps in elderly persons.

Neuritic Pains—Erythromelalgia.—In connection with endarteritis obliterans of the vessels of the legs, numbness, tingling, burning, and shooting pains are common complaints. In diabetes a whole group of neuritic symptoms may precede the local gangrene of the toes, and the same may occur before senile gangrene. In erythromelalgia, the red painful neuralgia, arteritis obliterans has been found in many cases. And there is a very interesting group of cases of idiopathic endarteritis of the vessels of the legs, in which in comparatively young men, without any history of syphilis, pains precede the occurrence of the severe obstructive manifestations.

Intermittent Claudication.—In the cases in the horse, described by Bouley, and in Charcot's original case in man, the vascular obstruction was aneurismal. To Erb we owe the recognition of the frequency of this symptom in arteriosclerosis of the vessels of the legs. It is a question of a due balance

between a supply of energy through the blood and muscular expenditure, as Allan Burns puts it in his original explanation (1809). There are cases with neuritic pains and well-marked signs of vascular disease, palpable vessels, spasm of the arteries, with pallor of the feet in exertion, or absence of pulsation in the dorsal arteries of the feet. In others, the signs of arterial disease are not so clear, and it is possible that there may be an angiospastic form; or it may be in some cases, as Déjérine suggests, an affair of the spinal arteries with anæmia of the cord. In the majority of the cases seen by the writer, the arteriosclerosis has been pronounced. It is not always a cramp-like pain that causes the limping or claudication, but there may be a relaxation of the limbs, a giving way for a few seconds, or, without actual falling, an inability to make any further effort. The relation of arteriosclerosis to the peripheral arteries, to gangrene, erythromelalgia, scleroderma, etc., will be considered in other sections.

Diagnosis.—To the rule that the disease is uniformly distributed in the body there are many exceptions. The most widespread peripheral arteriosclerosis may exist with a moderate grade of disease of the aorta. On the other hand, the endarteritis deformans of the latter vessel may be out of all proportion to the disease in the smaller arteries. The vessels of the head, of the heart, or of the kidneys may be in an advanced stage of sclerosis, without any change in the palpable arteries. The most serious form is that in which the smaller vessels are chiefly affected and which comes on in middle life or in young persons.

From the appearance of the individual not much may be determined. To no condition is Shakespeare's remark more applicable—"the outward shows may be least themselves." A robust, vigorous looking man in the prime of life may have vessels in the most advanced stage of sclerosis. While there are patients who present a pronounced anæmia, the florid cardiovascular facies is the more common. The active muscular business man of forty-five years, who all his life has never had to spare himself, and who has prided himself on his "fitness" for everything, is shocked to find that there is something wrong with the machine; or to the young-old man who has reached the grand climacteric without a day's illness, Nemesis whispers "time is up." In other instances a remarkable change takes place in a few months. Following, perhaps, a domestic shock or a financial crisis, in other instances without any obvious cause, a man begins to fail. The elasticity and firmness go from the gait, the movements become less active, there is loss in weight, and the intellect is impaired, as shown in absence of initiative and in capacity for continuous work. So rapid may be the breakdown that some of these instances of pre-senile arteriosclerosis may be termed acute. Too much stress must not be laid upon certain features usually regarded as indicative of degeneration. Early graying of the hair may have nothing whatever to do with arteriosclerosis, and in my experience it has not been a common accompaniment. Nor is the arcus senilis of much value as an indication. It may occur in middle-aged men with perfectly good arteries, and it has not been in my experience a special feature in early arteriosclerosis.

The cardinal points in a case of arteriosclerosis are usually well marked: (1) thickening of the peripheral vessels; (2) signs of hypertrophy of the left ventricle, shown by the apex beat dislocated outward, the thudding first sound, and the accentuated aortic second; (3) heightened blood pressure;

(4) a slight and variable amount of albumin in the urine. As a rule, this quartet of symptoms is present in a large proportion of the patients when first they come under our observation. At this stage the damage is done. The important point for the practitioner is to learn to recognize the early stages, when there is a reasonable chance that the progress may be arrested. We can form a pretty clear judgment of the state of the arteries and the general physics of the circulation by sight, by touch, by estimation of the blood pressure, and by the study of the pulse.

When at all advanced, the superficial arteries of the body become visible and tortuous. This is particularly well seen in the temporals, which, as age advances, stand out as prominent, tortuous, even beaded cords. One must learn not to mistake a full for a sclerotic vessel. When the peripheral circulation is relaxed, as in high external temperatures or during excitement, the superficial arteries become prominent. When the sclerosis is at all advanced the brachials stand out markedly sinuous and throbbing visibly. The radials and ulnars, the external iliac just above Poupart's ligament, the femorals just below, and the dorsal arteries of the feet may all be visible. Of all vessels in which to see early thickening, the retinal arteries are the most important. de Schweinitz in particular has called attention to the great importance of its early recognition by the ophthalmoscope. Not only may it be readily seen that the arteries are thicker than normal and more tortuous, but the way in which they cut across the larger veins is very distinctive.

By palpation we are enabled to judge with fair accuracy of the degree of thickening of the vessel wall. It requires not only experience, but education, to form a correct judgment on the state of the arteries. A perfectly normal vessel, when contracted, may feel hard and cord-like. On the other hand, in a radial definitely thickened, but in a state of extreme relaxation, the hardening of the walls may escape detection. The state of the tissues about the artery, the amount of fat in the skin, the size and fulness of the veins— all have to be considered. One of the commonest of mistakes is to regard as thickened any vessel one can roll under the finger. But in a state of very high tension and if very full, the arterial tube may feel cord-like. To estimate the presence of sclerosis it is not sufficient to examine the radials and temporals, but the brachials and femorals should also be felt, and palpation should be made, first, in the natural condition; secondly, the artery should be felt below a point where the pulse wave is obliterated; and thirdly, a small section of the vessel should be emptied of blood and palpation made between the two points of pressure. It may only be in this last way that a true opinion can be formed of the existence of sclerosis. It does not do simply to obliterate the pulse and feel immediately below it, because in conditions of very high tension, in the radial and temporal arteries for example, the recurring pulse appears beyond the point of pressure. In the superficial arteries, as the radial, the finger is able to appreciate four distinct grades: (1) the normal vessel wall, which in a moderately thin wrist may be just differentiated from the adjacent tissues; in the cold, or if the hand has been placed in ice-cold water the tightly contracted artery may be felt as a fine cord; (2) moderate sclerosis in which the vessel is readily felt and in which, after the blood has been pressed out of the artery, there is a definite tubular cord; (3) extreme sclerosis in which the radial is felt like a piece of whipcord, firm, hard, incompressible, rolling under the finger, and presenting little or no difference in

the sensation with the blood in or out of the vessel; (4) calcification, which in the radial is easily felt, ringed or beaded.

The introduction of late years of clinical instruments for measuring blood pressure has given us one important means of estimating accurately the condition of a subject of arteriosclerosis. Early in the disease, or before the thickening of the vessel is evident, the blood pressure may be persistently high. This pre-sclerotic stage, as it has been called, is important to recognize, and yet it is only exceptionally that we are able to trace all the stages in a given patient. More commonly the high pressure and sclerosis are co-existent, but there is no definite parallel between the two processes. The very highest pressures, above 250 mm. Hg., may be present with quite moderate thickening of the vessels. On the other hand, low blood pressures may co-exist with early arteriosclerosis, or following an acute illness, dilatation of the heart, a shock, or certain complications, such as pulmonary œdema, and in the late stages of the intercurrent affections.

The character of the pulse in arteriosclerosis is best described as hard and resistant, and the vessel is plainly perceptible to the finger in the intervals of the beats. As already mentioned, it is important to recognize the difference between the hard sensation conveyed to the finger by a high-tension pulse and that conveyed by stiffening of the walls. The two may co-exist, but the former may give the deceptive sensation of a permanent cord to the artery. Usually, too, the pulse is incompressible, or, more correctly, is difficult to compress. One can always obliterate the pulse wave in the radial, but it quite commonly happens that, in spite of the firmest pressure, the pulsation may be felt beyond the finger. This is a recurrent pulse through the superficialis volæ, and it may be at once checked by compressing the ulnar artery. It is present frequently in high tension, but it is just as common when the smaller arterioles are greatly relaxed and the peripheral tension low. To estimate the state of the vessel wall in a high-tension pulse, obliterate the radial artery close to the metacarpal bone, then with the index finger of the other hand press the blood out of a section of the radial, compress it, and then, with the middle finger, feel the empty vessel. If very sclerotic, it will be almost as prominent empty as full. But when the cord-like sensation is due to a high pressure only, there may be very little sensation given to the finger by the vessel wall itself. The sphygmographic tracing of the high-tension pulse is very characteristic, with a wave of moderate height, a sloping ascent, and a delayed decline with a little or no dicrotic wave.

Treatment.—Once degeneration, fibrosis, and calcification have taken place, the damage is irreparable, and as "all the King's horses and all the King's men could not put Humpty Dumpty up" after his fall, so all the hygienic, dietetic, and medicinal measures cannot restore the normal structure of the arteries. But this does not mean that the condition is always hopeless. Much may be done to prevent the sclerosis increasing and much may be done to relieve symptoms.

The treatment may be carried out along the following lines, varying, of course, with the individual cases:

General.—The patient should be urged to live as peaceful a life as possible, cutting off all sources of mental strain and worry. A protracted holiday may be most helpful. It is not wise, as a rule, to urge a man to give up work entirely. Too often this is followed by a neurasthenic breakdown. The most difficult part of the treatment is so to arrange a man's life that he

may have moderation in work. So long as it can be lightened, there is no reason why he should not continue. Of course, when there are signs of cardiac failure or any pronounced local features, or if the mental changes are marked, it would be wise to urge complete rest. These patients often require the consolation of sensible advice. On hearing that they have hardening of the arteries, many men with years of useful life before them are inclined to throw up the sponge at once. When of moderate extent in a man aged forty-five or fifty years, it may not lessen the expectation of life by more than five or six years. The writer has several arteriosclerotic friends in whom the condition was recognized more than twenty years ago. One old patient, who returned from a visit to London in 1881, was prepared to give up everything because of his arteriocapillary fibrosis. The fright was the best thing that ever happened to him, as he lowered sail and has been going on very comfortably for twenty-six years and doing a fair amount of work.

Exercise.—Golf, horseback riding, walking, bicycling, all in moderation, are advantageous. Allbutt recommends cautious hill climbing. The relaxation of the vessels of the skin and of the peripheral arteries generally which follows moderate exercise lowers the blood tension and relieves the heart. All sudden effort likely to throw a strain upon the vessels should be avoided. The action of the skin should be promoted by a daily bath. In the winter it is best taken at night and warm. An occasional Turkish bath, with a good rub, is helpful.

Food.—The one essential factor in the diet of arteriosclerotic patients is reduction in the amount. He should be taught gradually to reduce the quantity of food until he finds the minimum on which he can maintain the mental and bodily vigor. He will often be surprised to find that it is one-third or one-fourth of that which he has been in the habit of taking. He may take a cup of tea, a boiled egg, and a couple of slices of toast for breakfast; a vegetable soup with a rice pudding for luncheon; a piece of fish, a couple of vegetables, and stewed fruit for dinner, with a glass of hot milk at night, or a bowl of bread and milk. With a diet along these lines an arteriosclerotic may successfully pray the prayer of Hezekiah, and get, like him, a fifteen years' extension. He can do without meat perfectly well. Oysters, eggs in moderation, and fish may be taken with plenty of fruit, vegetables, plenty of bread and butter, and milk. It does not seem that we need dread specially the injurious effects of the lime salts which are abundant in milk and in eggs. Buttermilk is an excellent and easily digested food, even when milk is not. Sour milk has been a favorite drink with many persons who have lived to a very advanced age, like Thomas Parr, and in this connection it is interesting to note the strong opinion of Metchnikoff as to the value of the lactic acid products in preventing abnormal processes of fermentation in the large intestine. Spirits of all sorts should be given up. Tea and coffee may be taken in moderation. A man who has been a heavy smoker should reduce his allowance to two or three cigars a day.

Medicinal Treatment.—Of remedies believed to have an influence directly upon the coats of the vessel, only iodide of potassium is of value. It is stated that, experimentally, arteriosclerosis may be prevented if, coincidently with adrenalin, iodide of potassium is given to the animal. In all syphilitic cases it should be used freely, and even in others in the early stages the drug should be administered in moderate doses, 15 to 20 grains (gm. 1 to 1.3) three times a day, and kept up for some months. It is believed by some that

the iodide of potassium lessens the viscosity of the blood, and in this way lessens the work of the heart.

The blood pressure is much more efficiently lowered by dieting and mode of life than in any other way. Of the drugs which have an influence, the nitrites are the most important. The commonly used nitroglycerin is often effective, but rarely given in large enough doses, and even then is apt to be very transient in its effect. It is best given in solution freshly made, and the patient may take from 1 to 3, 4, or 5 minims of the 1 per cent. solution three or four times a day. In crises of high tension larger doses may be given. It does not seem to do any harm, and individuals react so differently to the drug, that it is well always to test it upon each patient. We often do not get good results until much larger doses are given than those usually employed. The sodium nitrite, in 1 to 4 grain (gm. 0.06 to 0.25) doses every three or four hours, has a somewhat more permanent action and is often of very great service.

On the view that in arteriosclerosis the blood is poor in certain salts, various mixtures have been recommended, such as Trunecek serum, which is a mixture of the various salts of the blood in about the proportion contained in the serum. They are also prepared in tablets by various firms as antisklerosin tablets. Arsenic in small doses is helpful, particularly in the cases with early anæmia. One difficulty which everyone has experienced is to keep the blood pressure low by means of drugs; the reduction is temporary, and very soon the instrument records pressures as high as ever. In the crises of hypertension brisk saline cathartics are most helpful. In any case it is well to bear in mind that the only valuable measures for permanent reduction of blood pressure are the hygienic and dietetic. The treatment of the various complications of arteriosclerosis are dealt with in the other sections of diseases of the heart, kidneys, etc.

POLYARTERITIS ACUTA NODOSA (PERIARTERITIS NODOSA).

In 1866, Kussmaul and Maier reported a case of a man, aged twenty-seven years, who had an acute, progressive "chlorotic marasmus" with fever and tenderness of the skin and muscles. Hard, bead-like nodules were present in the skin of the thorax and abdomen, which were afterward found to be thickening of the subcutaneous arteries. The case was thought to be one of trichinosis. Postmortem, little aneurisms were found on almost all of the smaller arteries of the body. These were believed to be due to inflammatory infiltration of the adventitia, and they gave the name *periarteritis nodosa*. Since then there have been sixteen or nineteen cases recorded. A full abstract of each is given by Dickson in his recent paper.[1] Only three of the patients were females. The arteries of the heart, the kidneys, mesentery, and the liver were attacked in all the cases. The physical features depend a good deal upon the vessels affected. The onset is, as a rule, sudden and there is moderate fever throughout. Weakness, hyperæsthesia, pains in the muscles, anæsthesia, and anæmia are marked symptoms. Vomiting and diarrhœa are common. Headache, excitement, convulsions, optic neuritis, and paralysis may be present when the cerebral vessels are involved.

[1] *Journal of Pathology,* 1907, xii, No. 1.

The diagnosis has rarely been made; the condition is usually mistaken for meningitis or typhoid fever. A remarkable case was admitted to my ward in 1901, and is reported by Sabin:[1] The patient was a woman, aged thirty-two years, who had had dilatation and vomiting with emaciation and anæsthesia; she looked very ill and had been confined to bed for five weeks. There was an extreme grade of annular sclerosis of the arteries, numerous subcutaneous hard nodules were scattered over the abdomen, just such as were present in the case of Kussmaul and Maier. The case was very similar in many respects to the one reported by H. M. Fletcher.

Nothing is known as to the etiology of the disease. Bacteria have not been found. The earliest lesion apparently is a destruction of the muscular coat with the giving way of the internal elastic lamina of adventitia leading to aneurismal dilatation. Dickson thinks that there is a primary periarteritis established, involving the vasa vasorum. The little nodular bodies may be present in enormous numbers. Many of the little aneurisms are filled with thrombi. The condition differs entirely and must be distinguished from nodular periarteritis of syphilis.

[1] *Johns Hopkins Hospital Bulletin*, 1901, xii, p. 195.

CHAPTER XI.

ANEURISM.

By WILLIAM OSLER, M.D., F.R.S.

Definition.—A tumor containing blood in direct connection with the cavity of the heart, the surface of a valve, or the lumen of an artery.[1]

History.—Galen, the first author in antiquity to deal with aneurism, recognized two forms, one from dilatation, the other from the wounding of a vessel. In the former the tumor was deeply seated, and when pressed upon by the fingers a "sort of noise" was heard; in the latter the aneurism was rounded and felt more superficial. He knew that aneurism might follow a wound of an artery in performing venesection. A young and unskilled doctor opened the artery for the vein at the bend of the elbow. Galen cured it by the application of a sponge with bandages (*Methodus Medendi*, Liber V, folio LXIII, Linacre's edition, 1519). Of the men in antiquity who wrote on aneurism, Antyllus, the surgeon, who lived about the middle of the second century A. D., is the most interesting. Like Galen, he recognized that "there are two kinds of aneurism, the one arising from a local dilatation of the artery, . . . the second sort arising through rupture of the vessel, and the blood is poured out into the surrounding soft parts." He knew that it was dangerous to operate on the larger aneurisms in the neck and the axilla, but for the smaller sacs in the peripheral vessels he devised the operation which bears his name, and which consisted in ligating the artery above and below, opening the sac and clearing out its contents. From a remark which he makes we may gather that some of his contemporaries did the modern operation of extirpation of the sac which Antyllus thought too dangerous. Not much of additional value about aneurism is to be found in the ancient writers. The Arabians, who followed Antyllus in their method of operation, were familiar with the aneurism following venesection, and knew that it was associated with a hissing sound on palpation. Nor did the surgeons of the thirteenth, fourteenth, and fifteenth centuries—Lanfranc, De Mondeville, Guy de Chauliac—make any notable improvements. It was not until the sixteenth century that an advance was made by the recognition of aneurism of the internal arteries. Fernelius says that "aneurism likewise happens sometimes in the internal arteries, especially under the breast, about the spleen and mesentery, where a vehement pulsation is often observed" (Pathologia, i, 5, c. 12). Vesalius was the first to diagnose clinically aneurism of the thoracic and of the abdominal aorta. He seems to have seen many cases and to have been very familiar with the conditions.[2]

[1] It is not possible to frame a definition to include every condition which we now speak of as aneurism. For example, dilatation of the aorta, the uniform enlargement of arteries of the third and fourth dimension, and the abnormal communication between vessels are not within this definition.

[2] Roth's *Andreas Vesalius*, 1902, p. 239.

(448)

Of the sixteenth century writers, Ambroise Paré gives by far the best account, and he recognized aneurism by anastomosis, rupture, erosion, and wound. He describes very well the character of the pulsating tumor, the noise or blowing sound associated with it, the frequency of thrombosis in the sac, the occasional calcification of the thrombi, and he first suggested the relation of aneurism with syphilis. For the next one hundred and fifty years there was a great deal of discussion about the mode of origin of aneurism, whether produced by dilatation of the coats or by their erosion and rupture, of which an excellent account is given by Friend.[1]

Lancisi, the distinguished Roman physician, wrote the first great monograph on the disease (*De Aneurismatibus*, Romæ, 1728), a superb work, with excellent illustrations. He recognized the influence of a bad habit of the body, particularly of syphilis, and even spoke of a "venereal aneurism." Trauma and the weakening of the coats of the vessel by disease were regarded as important causes. He divided aneurism into true and false, the one arising from weakening of the texture and the power of resistance of the arteries, and the other by traumatism, whether from external causes or from rupture due to increased force of the impulse of the blood. From this division by Lancisi dates a long struggle over the forms of aneurism, of which writers recognized a *true*, in which all the coats were dilated, a *spurious*, in which one of the coats was ruptured and the others dilated, and the *mixed*, in which the coats were dilated and subsequently, by rupture, a true was converted into a spurious aneurism. There is a very rich literature on the subject in the eighteenth century. Morgagni, in particular, made a most accurate study of aneurism, and his familiar work *De Sedibus*, etc., 1761, contains many interesting histories of cases with the postmortem appearances. He recognized, too, the great influence of syphilis. William Hunter (1757) made an important contribution on the subject of arterio-venous aneurism.

In 1804 appeared the famous work of Scarpa (a monograph in folio, translation by Wishart, Edinburgh, 1808), who insisted upon the important fact that internal aneurism also arises from rupture in consequence of degeneration or ulceration of the coats. He was the first to lay special stress upon the importance of the media in maintaining the strength of the vessel. Independently of Scarpa, the great French surgeon, Larrey, also insisted that bursting of the coats of the artery was the essential cause of aneurism.

Scarpa did not regard the dilated aorta as, in reality, aneurismal, holding that form only to be aneurism which arises "in some point of the parietes of the arteries from the rupture of their proper coats." Hodgson, in his well-known treatise,[2] believed that rupture of the internal and middle coats, either by trauma or following disease, was the chief cause of aneurism, but, in opposition to Scarpa, he also described as aneurism the permanent dilatation of the whole circumference of the vessel, due to loss of its natural elasticity. Allen Burns (1809) took very much the same view. Rokitansky, in his great monograph on diseases of the arteries (1852), regarded spontaneous aneurism as arising, first, through inflammation and suppuration of the arterial wall; secondly, through spontaneous tears of both the inner coats; and third, the common form which follows the disease of the coats

---

[1] *History of Physic*, fourth edition, vol. i, pp. 183 to 203.
[2] *Diseases of Arteries and Veins*, London, 1815.

of the vessel, whether it results in a diffuse cylindrical dilatation or in the formation of a saccular tumor.

An important study by Helmstedter[1] from von Recklinghausen's laboratory showed that in the common spontaneous aneurism, splits and tears of the elastic coat of the media were the primary and important changes. The figures accompanying his paper show an aorta which we would now recognize as syphilitic, and microscopic pictures just such as have been described of late, as the mesaortitis due to this disease.

From this time on very special attention was paid to the condition of the middle coat, and in 1875, Köster brought forward the view that not an endarteritis but a mesaortitis of special form was the essential factor in aneurism. Two great studies appeared in Germany in the last quarter of the nineteenth century, one by Eppinger, as a supplementary Heft of vol. xxxiii of the Arch. f. klin. Chirurgie, 1887; the other by Thoma, in vols. cxi and cxii and cxiii of Virchow's Archiv. Eppinger regarded as the primary event the rupture of the media, particularly of the elastic elements, which led to the gradual saccular dilatation at one spot in the wall of the vessel. He did not regard the diffuse dilatation of the artery as a true aneurism. He also described most fully the erosion, verminose, and mycotic forms.

Thoma, too, regarded weakness of the media as the primary change, although he did not lay so much stress on rupture of the elastic elements, believing that a disturbance of nutrition and an atrophy of the media lessened its power of resistance. He brought his theory of aneurism into line with his well-known views on arteriosclerosis, believing that the thickened plaques of the intima were compensatory to the loss of substance in the media. He gives illustrations which show that this compensatory thickening may even be sufficient to obliterate the localized bulging of a small aneurism. He thought it was only in the rapid growth of the aneurism, in consequence of the yielding of the weakened media to the internal pressure, that prevented the compensatory endarteritis from keeping pace with it. His study of the dilatation—aneurism of the aorta—is by far the most important that has been made.

During the past few years the old views of Paré, Morgagni, and others on the influence of syphilis in cause of the disease have been amply confirmed. The careful study by Welch (1876) called attention to the subject, but the work of the pupils of von Recklinghausen and of Köster on the histological changes in the media, the studies of Heller and the improved methods of technique have given a great stimulus to this view. The studies of Benda and of Chiari[2] and the paper by Benda[3] give full summaries of the recent work on mesaortitis in its relation to syphilis and aneurism.

The important monographs for reference are Crisp (1846) and Broca (1856). The papers of Sibson (collected works) are also of great value.

Classification.—It is not easy to make a satisfactory division of the various forms of aneurism. The following will be found a useful one for practical purposes:

1. *True aneurism* (A. verum, A. spontaneum), in which one or more of the coats of the artery form the walls of the tumor.

[1] *Du Mode de Formation des Aneurismes Spontanes*, Strasburg, 1873.
[2] *Verhand. d. deutsch. path. Gesellsch.*, 1904.
[3] Lubarsch and Ostertag's *Ergebnisse*, 1904.

(a)

(b)
which
adven
(c)
extent
endoth
2. *F*
diffuse
3. *A*
either
aneuri
4. *S*
forms,
Etic
differs
Schroe
only 2
Barth
aneuri
necrop
aneuri
that it
Age
situati
forty
statist
the in
with.
in 190
occur
the sta
cases
of age
the th
syphil
Willso
and a
the an
rism i
small,
Sex
is a f
femal
Occ
soldie

(a) *Dilatation aneurism.*

    1. Limited to a certain portion of a vessel—fusiform aneurism, cylindroid aneurism.

    2. Extending over a whole artery and its branches—cirsoid aneurism.

(b) *Circumscribed saccular aneurism*—the common form in the aorta in which there is distention of two or more of the coats, or distention of the adventitia after destruction of the intima and media.

(c) *Dissecting aneurism*, with splitting of the coats to a greater or less extent and occasionally with the formation of a new tube lined with intimal endothelium.

2. *False aneurism*, following wound or rupture of an artery, causing a diffuse or circumscribed hæmatoma.

3. *Arterio-venous aneurism*—communication between artery and vein, either direct—aneurismal varix—or with the intervention of a sac—varicose aneurism.

4. *Special forms*, such as the traction aneurism, the erosion and parasitic forms, which have a pathological rather than a clinical interest.

Etiology and Pathology.—Incidence.—That the number of aneurisms differs in different localities has long been recognized. In Vienna, von Schroetter states that of 19,300 postmortems in ten years, there were only 230 aneurisms. Eppinger found only 22 in 3149 postmortems. At St. Bartholomew's Hospital, during thirty years, there were 631 patients with aneurism. At Guy's Hospital, between 1854 and 1900, there were 18,678 necropsies, with 325 cases of aneurism. There were 1078 deaths from aneurism in 1905 in England and Wales. The statement is usually made that it is more common in Great Britain and Ireland than on the Continent.

Age.—The large statistics of Crisp, 555 cases of aneurism in different situations, show the greatest frequency to be between the ages of thirty and forty years, 198 cases; between forty and fifty, 129. With this accords the statistics of Lebert and of Liddell, and it is of importance as showing that the incidence of the disease is below the age at which arteriosclerosis is met with. Of the 898 deaths from aneurism in males in England and Wales in 1905, 462 occurred between the thirty-fifth and fifty-fifth years. It may occur at any age. Jacobi and, more recently, Le Boutillier[1] have collected the statistics of aneurism in the young. The latter found in the literature 80 cases in persons under twenty years of age; only 14 were under twelve years of age, and the youngest was in a child of two. Eighteen of the cases were of the thoracic aorta, 5 of the abdominal. In the very young, congenital syphilis plays an important part, as in the remarkable case reported by Willson and Marcy in a child aged four years with extensive arterial disease and a large aneurism of the arch of the aorta. In the peripheral vessels the aneurisms are often of embolic origin. In extreme old age latent aneurism is not uncommon, either in the form of the dilatation of the arch or of small, saccular pouching of an atheromatous aorta.

Sex.—In Crisp's statistics the ratio of males to females was 5 to 1, and this is a fair average for aneurisms of all sorts. In 1905, 898 males and 188 females died of aneurism in England and Wales.

Occupation.—Hard workers, the strikers in foundries, the dock workers, soldiers, sailors, and the very muscular and robust men are chiefly affected,

---

[1] *American Journal of the Medical Sciences*, 1903, cxxv, p. 778.

but the disease may occur in feeble individuals who have never worked hard with their muscles. For years it has been known that soldiers were peculiarly liable to the disease, and the studies of Myers, Welch, and others called attention to the great frequency of aneurism in the British army. This reputation is still maintained. The recent figures given for the British army (1905) home contingent, strength 118,224, show 18 deaths from aneurism. In Germany (1904 to 1905), with a strength of 555,777, there were 4 cases of aneurism; and in Italy (1903), with a strength of 206,468, there were 6 cases of aneurism. The high percentage in the British army is undoubtedly associated with the great prevalence of syphilis. For the year ending September, 1900, the incidence of syphilis in the German army was 18.5 pro mille; in the Austrian, 64 pro mille; and in the English, 122.4 pro mille. In the British navy the figures for five years, as sent by Sir Herbert Ellis, Director General, are as follows: 1902, force 99,600, cases 16; 1903, force 103,100, cases 23; 1904, force 110,570, cases 13; 1905, force 111,020, cases 22; 1906, force 108,190, cases 29. Bassett-Smith calls attention to the frequency of aneurism at the Naval Hospital, Haslar—47 cases in seven years.

Race.—The Anglo-Saxon is stated to be more subject to the disease. The statistics of Guy's Hospital and of the Vienna General Hospital quoted above show a decidedly greater proportion in London. In the United States of America aneurism is common among the working classes. It is more frequent among the negroes of the Southern States. In the wards for colored patients at the Johns Hopkins Hospital arterial disease and aneurism were relatively much more common than in the wards for the whites. The figures relating to aneurism are as follows: Of 345 admissions to the medical wards for aneurism, 213 were white and 132 colored (the proportion of total admissions of white to colored is about 5 to 1).

Determining Causes.—The determining causes of aneurism of the aorta are three: First, poisons which lead to changes in the coats of the vessel; second, conditions which increase and keep up the arterial tension; and third, internal trauma, the strain of muscular effort, particularly in the fourth decade, when the vital rubber begins to lose its elasticity.

Among the most potent poisons in causing arterial changes are those of the acute infections, and among these the first rank is taken by *syphilis*. Someone has well remarked that "Venus loves the arteries." It has already been mentioned that the older writers, particularly Paré, Lancisi, and Morgagni, knew of the close association of lues and aneurism. Among modern writers the connection was referred to incidentally, but it is only a little more than a quarter of a century since investigations have shown the remarkably high percentage of syphilis among subjects of the disease. In his well-known investigation,[1] Francis H. Welch, of the British army, found that 66 per cent. of his series had had syphilis. He described very clearly, too, the macroscopic changes in the aorta, particularly the cicatricial-like puckering of the intima. The constriction of the clothing and the temporary forced exercise he regarded as secondary elements. Subsequent figures have strengthened this belief: Malmsten, 80 per cent.; Hampeln, 82 per cent.; Heller, 85 per cent.; Etienne, 69 to 70 per cent.; Pansini, 65 per cent., or, including doubtful cases, 84 per cent. On the other hand, Hansemann

[1] *Medico-Chirurgical Society's Transactions*, 1876.

found only 18.75 per cent., and he does not regard all cases of aneurism even in syphilitic subjects as due to syphilis. It is notorious that a history of infection, even in persons with well-marked signs of the disease, is not easy to get, particularly in women. There are a great many cases in which syphilis is latent, but the more closely the question is looked into the more one becomes impressed with the importance of lues as the essential factor in the causation of aneurism in persons under forty-five years of age.

The recent studies of Heller, Döhle, Chiari, and Benda have confirmed the views of Köster, that the primary change is in the media, and there is now very generally recognized a syphilitic aortitis with definite characteristics. Macroscopically, it may be limited in extent, localized at the root of the aorta, or about the orifice of an aneurism, or there is a band of an inch in width on some portion of the tube, while other parts of the aorta and its branches are normal. In other instances the intima is involved, not with the usual plaque-like areas of atheroma, but there are shallow depressions of a bluish tint and short transverse or longitudinal puckerings, sometimes with a stellate arrangement; or the intima is pitted and scarred with small depressions and linear sulci. Microscopically the most important changes are found in the media and adventitia: (*a*) perivascular infiltration of the vasa vasorum; (*b*) small-celled infiltration in areas of the media, with (*c*) splitting, separation, and destruction of elastic fibers and the muscle cells. The process is largely a productive mesaortitis, and so marked may be the foci in the adventitia and media that they look like miliary gummata, and, in fact, were so described as far back as 1877 by Laveran and by Heiberg. The intima over these areas may be perfectly normal, but it often shows signs of thickening with fatty degeneration and the production of hyaline. Similar changes have been described in the larger bloodvessels in cases of congenital syphilis by Weissner, Bruhns, and Klotz. And lastly, the specific nature of this mesaortitis has been determined by the detection of the spirochæte by Schmol and others.

The experimental production of aneurism bears out this view. The high pressure caused by injection of adrenalin produces a fracture and separation of the elastic fibers of the media, and over these areas where the wall is weakened the intima may split with the formation of a localized aneurism, sacculated or dissecting, or the intima may gradually yield without actual rupture.

The following are among the important features of syphilitic aneurism: It occurs, as a rule, in persons under forty; the ascending arch is most apt to be involved; angina pectoris may be an early symptom; aortic insufficiency is often associated with it; the aneurisms are frequently multiple, five, seven, and nine have been described; the small cup-formed sacs, of which there may be four or five in the ascending arch, are almost always syphilitic; other luetic features may be present, gummata of the liver or bones; there are signs of locomotor ataxia or the husband may have tabes and the wife aneurism, or, as in a case reported by Jaccoud, both husband and wife have aneurism; and lastly, antisyphilitic remedies may relieve the symptoms.

Other acute infections play a less important role. There are two ways in which aneurism may be associated with the specific fevers. In any one of them local spots of degeneration, usually of the intima, may occur, or patches of mesaortitis may develop, leading to a weakening of the wall.

Thayer and others have shown the frequency of these changes after *typhoid fever*, and the same may happen after *influenza, pneumonia, erysipelas,* and *scarlet fever;* there is doubt about *malaria,* upon which some of the French writers lay stress. The other way is associated with the endocarditis of the specific fevers. Direct extension to the aorta from vegetations on the valves may take place, but more frequently the process is embolic, with patches of mesaortitis over which the intima ruptures, just as occurs in the experimental production of aneurism. In the aortitis of *rheumatic fever* one or other of these forms may be followed by aneurism; but many of the cases described as aneurism of the aorta in this disease are instances of the dynamic dilatation associated with aortic insufficiency and a huge left ventricle. But true aneurism does occur. In a case recently reported by Renon, the patient, aged sixteen years, developed signs of aneurism very rapidly with aortic insufficiency in the course of rheumatic fever. Death occurred from hemorrhage. The difficulty in the diagnosis of these cases will be referred to later. The type arising in the acute infections will be considered in a special section on mycotic and embolic aneurisms.

Tuberculosis is frequently met with as a complication of aneurism, 25 to 29 per cent. (Soltau Fenwick), but it plays a very minor part in the etiology, except of the erosion form occurring in tuberculous cavities in the lungs. The aorta or one of its main branches may be eroded from without by a tuberculous gland with the formation of an aneurism.

Intoxications.—Alcohol favors arterial degeneration perhaps directly, but more often indirectly, as one of the causes of permanent high tension. It is one of the three factors which makes aneurism common among the laboring classes, although it plays a minor role in comparison with syphilis and hard work. There are some statistics, those of Étienne for example, which give a very low percentage of history of alcoholism—only 28 among 240 cases. *Tobacco* which has been shown experimentally to have an important influence in causing arterial degeneration, cannot be said to play any part in the etiology of aneurism. *Lead* has, in man, a decided action in causing degeneration of the arteries and in this way predisposes to aneurism.

All conditions which favor an excess or a retention in the system of the waste products of nutrition lead to arterial degeneration, and in a few cases to aneurism, but the causes of arteriosclerosis and of aneurism are by no means identical.

Embolism as a Cause of Aneurism.—In 1888 a man died in the Montreal General Hospital with fever and signs of aortic insufficiency and aneurism. The postmortem revealed an extraordinary condition—acute endocarditis of the aortic segments, with five aneurisms in the arch of the aorta. The largest of them, the size of a billiard ball, projecting to the right just above the aortic ring, was very thin walled and had numerous greenish vegetations on its lining wall, which at one point had perforated into the pericardium. The intima of the aorta was smooth, and on the arch above the larger aneurism were three small ones not larger than cherries. From the side of the intima they were not visible, but their site was indicated by the pressure of small, fungoid outgrowths. These were seen on the edges of narrowed slits of the intima which led directly into the small, saccular aneurism. This was the first instance in which the mycotic character of this type of aneurism was recognized. It has since been studied very carefully by numerous observers.

There are two modes of formation: (*a*) In the smaller vessels the condition, as described by Ponfick and by Pel, is due to the direct lodgement of emboli with infection and erosion of the wall and the production of an aneurism. A number may occur in different vessels. Libman reports a case with four aneurisms on the mesenteric vessels, a fifth on the right branch of the hepatic artery, a large one on the right femoral, and before death, right hemiplegia with aphasia probably from rupture of a mycotic aneurism of the left sylvian artery. In another case of Libman's, with mitral and aortic endocarditis, a mycotic aneurism of the left femoral artery perforated the vein with the formation of an arterio-venous aneurism. In this form there is no question of the direct local infection of the intima by the emboli.

(*b*) In the case of the multiple mycotic aneurisms of the aorta, it is a different matter. Here, in all probability, the emboli pass to the vasa vasorum and cause a mesaortitis with weakening of the wall. The intima splits, and in this way a small aneurism is formed. In the case reported by the writer, and in other instances, particularly the one reported by John McCrae,[1] splits in the aorta were sharp and defined as if made with a knife. There may be no disease of the intima itself in the neighborhood. With this view Eppinger concurs, and he remarks that the multiplicity of the lesions within a small radius is evidence of the embolic nature. In other instances there is a verrucose aortitis which has extended directly from the valves and is not of an embolic nature; and in a few rare instances this occurs in rheumatic fever. Embolic aneurisms are not always mycotic. A fragment from a calcified vegetation dislodged into the circulation may lacerate the intima at the point of lodgement with the formation of a traumatic aneurism. The writer saw a remarkable case of this kind in the Radcliffe Infirmary with Dr. Mallam: A man with aortic insufficiency and a remarkable musical diastolic murmur, had been under observation for a long time, and had frequently been used for examination purposes. Suddenly one day he had an agonizing pain in the calf of one leg, which became swollen, hot, and painful. As the swelling subsided a pulsation was noticed, and he recovered in a few weeks with a well-marked aneurism of the posterior tibial artery. The musical quality of the diastolic murmur disappeared entirely. No doubt a small calcified spike at the edge of one valve had been dislodged. A large majority of the cases occur in connection with ulcerative endocarditis. Pain of an agonizing character is present in the area where the emboli lodges. Peri-arteritis, swelling, and infiltration of the surrounding tissues usually occur, and it may not be until their subsidence that the pulsation is noticed.

Relation of Aneurism to Atheroma.—Everyone who has made many postmortems, particularly in very old people, must have been struck with the fact that the extent of atheroma bears no relation whatever to the frequency of aneurism. The aorta may be a calcified tube, with an intima as rough as the skin of a crocodile, without the presence of aneurism. The truth is the *endarteritis deformans* of Virchow is not necessarily associated with weakness of the media and adventitia. Chiari made a careful comparison between a series of cases of ordinary atheroma of the aorta and of mesaortitis. Of his conclusion, which has special importance in the differentiation of these two groups, a summary may be quoted: "In atheroma he found a primary

[1] *Journal of Pathology and Bacteriology*, 1905, vol. x, p. 373.

change in the intima, a thickening with a tendency to hyaline, mucoid, or fatty degenerations, leading to necrosis or calcification. In the early stages the media and adventitia appeared normal. In the later stages changes similar to those in the intima appeared in the inner layers of the media, while the outer layers showed proliferation of the vasa vasorum with small-celled infiltration around them, and in the adventitia there was in some cases considerable infiltration around the vasa vasorum, the walls of which showed some degree of proliferating endarteritis. These inflammatory changes, however, remained localized, and even in advanced cases did not reach a very great degree of intensity. Only by the actual pressure of a large calcareous patch was the media destroyed to any great extent. He considered that such a condition could be produced by any injury to the vessel, infections or intoxications, or the disturbance of nutrition which accompanies old age" (abstract by C. N. Aitchison, M.B.). In other groups the change was a mesaortitis in syphilitics or the subjects of general paralysis and the intima presented the furrows and scars already described.

High Blood Pressure.—Next to destruction of the elastic fibers of the media by a mesaortitis this is the most important single factor in the causation of aneurism. It acts in two ways: if permanent it leads to arteriosclerosis and weakening of the media, so that there is dilatation, either diffuse of the aortic arch or in spots. More important still is the sudden increase of tension following a rapid movement or severe strain, as in lifting, jumping, or the straining movements at stool or in the act of parturition. Here the danger is that by an internal trauma over the weakened media the intima may tear with the formation of a small sac. The process may be traced in the production of *experimental aneurism*. With adrenalin, tobacco, and bacterial poisons, extensive degeneration of the aorta and larger vessels is caused, but what is most interesting in this connection is the formation of aneurisms, either (1) multiple bulgings in areas in which the media is greatly weakened, causing pouch-like aneurisms, just such as we see in the endarteritis deformans of old people; or (2) the normal-looking intima is split over an area of mesaortitis, a clean-cut, knife-like incision, beyond which is a little saccular dilatation or the beginning of a dissecting aneurism. I am indebted to Klotz, in Adami's laboratory, and Rickett, of Cambridge, for showing me their specimens which illustrate this mode of formation of aneurism. Fischer[1] figures very well these splits of the intima, over local areas of degeneration, identical with those met with in the human aorta.

External trauma has a definite influence on the causation of aneurism. Vesalius notes this in one of his cases. Many instances have followed blows on the chest, falls, or the jar of any accident. While rupture of the healthy aorta may occur in these cases it is more probable that the intima ruptures over a patch of mesaortitis, and in this way the aneurism starts. Stern[2] has collected a large number of cases from the literature. The aneurism may appear in a few days or not until many months have passed.

In a few rare cases aneurism of the aorta is of the *erosion* type. A tuberculous focus may involve the wall of the aorta, as in a case reported by Councilman. A bullet lodged in the wall without perforating it has been followed by aneurismal dilatation (Freyham).

[1] *Deutsch. med. Wochenschrift*, 1905.
[2] *Ueber traumatische Entstehung Inneren krankheiten*, 1896.

Other causes may be mentioned. Mickle has called attention to the frequency of aneurism in the *insane*. This and the not very uncommon co-existence with *locomotor ataxia* is probably a parasyphilitic association. Lee Dickenson has described aneurism in connection with *hypoplasia of the aorta*. Both of his cases were in young adults with thin, narrow aortas, free from disease; one presented three aneurisms.

Number, Form, and Size of Aneurism and Vessels Affected.—*Number.*— In the aorta the aneurism is usually single, but three, four, five, even a score or more, may be present. The multiple cup-shaped tumors in young men are always syphilitic. The mycotic aneurisms are often multiple; in one of the writer's cases there were five in the arch of the aorta. In the embolic form there may be a dozen or more in the smaller vessels. In certain individuals aneurism may occur in different vessels, simultaneously or in succession.

The late Thomas King Chambers, whose clinical lectures "On the Renewal of Life" are still well worth reading, had first an aneurism of the left popliteal artery, then of the right, and finally of both carotids.

Form.—In the aorta there are two great types, the *cylindrical*, or *fusiform*, and the *sacculated*. In his study[1] Thoma calls attention to the physiological bulgings of the aorta: "The ascending aorta in the region of the semilunar valves presents an onion-shaped dilatation, the bulbus aortæ, in which are the sinuses of Valsalva. Immediately above the valves the lumen narrows distinctly, becomes circular, and then undergoes a second dilatation directed forward and to the right, known as the sinus quartus sive maximus Valsalvæ. This unilateral, spindle-shaped dilatation of the aorta also disappears again before the vessels of the neck are given off. After the origin of the left subclavian there follows a narrower portion of the lumen, the isthmus aortæ, after which the vessel again widens." As given in the plates illustrating the article, Thoma shows that in pathological states of the arch these physiological bulgings are followed; one or other or all of them may show dilatation, or the whole arch may be involved, forming a definite spindle. In other instances the arch is a huge, flabby sac scarcely retaining a semblance of its shape. Typical spindles are seen too in the arteries of the second and third dimensions, rarely in the smaller vessels. The cylindrical and fusiform are usually combined, as the dilatation tapers at either end. Sometimes the whole aorta or a large section of it is represented by an enlarged cylinder.

The *sacculated* form, in which there is a definite protrusion of one side of the wall, is the more common. The shape of the sac will depend on the extent of the area of the primary weakness of the wall; if large, the sac will be diffuse and crater-like; if small in relation to the aorta, it may have a small orifice, slit-like, oval, or round, leading into a circular pouch. Some sacs are flat, saucer-shaped, others cup-shaped, others pear-shaped, almost pedunculated, with a narrow neck. The saccular aneurism may arise on the wall of a diffuse dilatation, or a saucer-shaped sac may have two or three small ones upon it. Occasionally there is seen an aneurism of multilocular aspect, which has arisen from the excessive development of these secondary sacs.

In the small arteries, as of the brain and kidneys, these same types are

---

[1] Untersuchungen über Aneurismen, *Virchow's Archiv*, cxi.

seen—the saccular more often than the fusiform. The special forms of dissecting and arterio-venous aneurisms will be described later.

Size.—From a pin's head to the head of a child. There are almost microscopic tumors of the small arteries, while a sac connected with the

FIG. 44
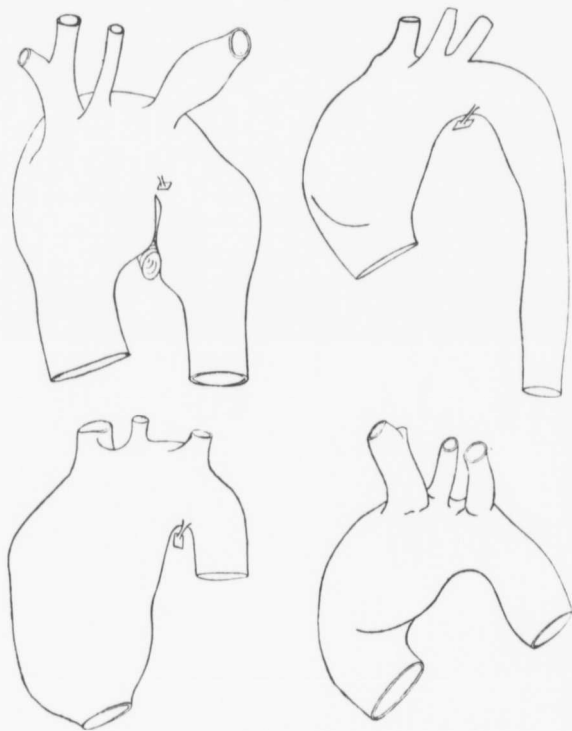
Forms of dilatation in aneurism of the arch of the aorta.   (After Thoma.)

aorta may fill one-half of the chest. When perforation of the chest wall occurs, or when there is a diffuse aneurism of the abdominal aorta, the size of an adult head may be reached, and with its contents the aneurism may weigh five or six pounds.

Vessels Affected.—On this point Crisp's statistics are still the best available:

Pulmonary artery	2
Thoracic aorta	125
Abdominal aorta	59
Common iliac	2
External iliac	9
Gluteal iliac	2
Femoral iliac	66
Popliteal	137
Posterior tibial	2
Innominate	20
Carotids	25
Intracranial	7
Temporal	1
Ophthalmic	1
Subclavian	23
Axillary	18
Suprascapular	1
Brachial	1
Total	501

Life History of an Aneurism.—Against the incessant strain offered by the pumping of blood sixty to eighty times a minute, the artery is protected by the elastic and fibrous tissues of the media and adventitia. Weakened at one spot and yielding, it is then a struggle between the blood pressure and the remnants of the tube at the affected spot—an unequal struggle, as the sac gradually yields. But nature does not rest passive in the matter. Only in the very acute cases is no attempt seen to limit the mechanical progress of the disease. In nearly all aneurisms healing of the breach is attempted by two processes, with two tissues, the one mural and the other hæmic, a new-growth of connective tissue and fibrin formation.

(*a*) Connective-tissue healing of an aneurism, seen to perfection only in small forms, is an intimal affair; in large sacs the adventitia play the chief part. We owe to Thoma the first good account of this method of healing. Fig. 45, here reproduced, shows a small sac on a branch of the ophthalmic artery entirely obliterated, with a growth from the intima in such a way that the inner surface of the artery and of the sac are on a level. Although the

Fig. 45

Cross-section of the ophthalmic artery showing diffuse arteriosclerosis and healing of an aneurism by intimal thickening. (After Thoma.)

same process may go on in the larger vessels (and Thoma figures an example in the abdominal aorta), it is much less rare than in the small branches. In every aneurism still lined with intima this compensatory thickening is to be found. But under the influence of the blood pressure the sac, as a rule, grows at such a rate that the endarteritis cannot keep pace with it. In the

common saccular aneurism the reparative process from the adventitia is much more important. There is active proliferation of the fibrous elements, and although it may yield and be thin at the point of greatest pressure, in the larger sacs there is found great thickening which is not always easy to differentiate from the surrounding connective tissue.

The lining of an aneurism may be the thickened intima (which is only the case in very small tumors), the media, in whole or in part, or, as the sac enlarges, the adventitia alone. Then comes a stage in the growth of the larger tumors in which part of the sac is no longer composed of an arterial coat, but is in direct connection with adjacent tissue, bone, lung, skin, or the structures of the mediastinum. In the big dilatation aneurism the intima may be everywhere unbroken, but thickened and roughened with calcareous plates and areas of atheromatous softening. In the saccular form the intima may be traced only to the orifice or for a short distance into the wall of the sac.

The second great element in the repair of an aneurism is thrombosis, the deposit of laminated fibrin in the sac. We are as yet ignorant of the precise conditions under which this process takes place. It does not occur in every case, even under conditions which look the most favorable. In a typical degree the deposition of fibrin is seen in the sacs with narrow necks, but it may be seen in the fusiform dilatation of any part of the aorta. In cutting across an aneurism in which this process has been going on, firm, hard, leathery sheetings of grayish-brown fibrin are seen, arranged in layers which may be peeled off like the flakes of an onion. In large sacs from 25 to 50 laminæ may be counted. The gradual formation of these is most interesting. One often finds on the lining membrane of a small-sized sac most remarkable deposits of platelets, usually ribbed like sand on the sea-shore or arranged in a tracery or network. The areas with the platelets show as grayish-white, soft thrombi, quite different in appearance to the reddish-brown ground substance on which they are deposited. The lamination may be in some way due to a successive deposition of platelets with which, as we know, the thrombogen is associated. Gradually the aneurism may become filled even to the mouth, and in this way permanent healing may be effected. At first the layers of fibrin are reddish brown in color, but in the very old sacs they are grayish white, and occasionally lime salts are deposited, so that the whole becomes a firm, calcareous mass.

Effects of Compression.—With the gradual growth of the sac remarkable effects of compression are seen. Passing anteriorly, an aneurism of the arch erodes the sternum, destroys the costal cartilages, fractures the ribs, which gradually become absorbed, and finally, there may be a hole in the front of the chest into which the two fists may be placed. Posteriorly, an aneurism of the descending thoracic aorta may perforate the chest wall and destroy four or five ribs, causing complete atrophy of the muscles in its course, and appear beneath the skin as a large flabby sac, as is very well shown in Fig. 50. Not less remarkable effects of erosion are seen in the spine, the bodies of three, four, or five of which may in large part be absorbed and the roughened bone forms part of the wall of the aneurism. A remarkable fact, noted by Morgagni, is that the intervertebral disks are not destroyed at the same rate as the bone, and may remain more or less intact while the bodies are deeply eroded. The exact method of this destruction of bone is much discussed. Some have ascribed it to a dis-

solving action of the blood, others believe it to be entirely mechanical, due to the pressure and shock of the systole. Cornil and Ranvier describe it as a rarefying osteitis, a low grade of inflammation by which the bone is gradually removed. Other effects of compression and the modes of perforation will be described later.

ANEURISM OF THE HEART.

1. **Aneurism of the Valves.**—Weakness of the tissue of the valve results from erosion, from myotic ulceration, or from softening of an atheromatous focus. There are acute and chronic forms. The acute valvular aneurism is seen most commonly on one of the aortic segments projecting from the ventricular side in globular form of the size of a pea or of a small nut. Sometimes it involves the entire valve. It may be at the line of attachment, so that there is partial aneurism of the sinus of Valsalva as well. It may be the only lesion, although more frequently it is associated with destructive changes. In very many instances the aneurism is perforated. Two, three, or even four little sacs have been found. Involvement of the mitral segments is not so common—the anterior valve more frequently than the posterior. The chronic atheromatous aneurism is a very different affair. Following the softening of a subintimal focus, it is usually seen in sclerotic or partially calcified valves, and in the aortic more often than in the mitral segments. Thrombi may be deposited; in one instance they were firm and laminated.

2. **Mural Aneurism.**—Two forms may be recognized, the acute and the chronic.

Acute Aneurism.—Acute aneurism, an event in connection with ulcerative endocarditis of the heart wall, is seen most frequently on the left side in the upper portion of the septum near the aortic ring, but it may occur on the right ventricle, and even in the auricles. Perforation is apt to take place into the pericardium or one of the other cavities, or into one of the larger vessels. An interesting variety of this is the dissecting aneurism of the heart, of which Vestberg[1] has collected 60 cases.

Chronic Aneurism.—This is an event in connection with fibrous myocarditis. It is not very uncommon, particularly the slighter forms. Strauch collected 55 cases which occurred in Berlin, chiefly at the Charité Hospital within ten years. There were 3 cases at the Johns Hopkins Hospital among 3000 postmortems. It is much more common in men than in women—64 out of 80 cases (Wickham Legg); 38 out of 55 cases (Strauch). The majority of the patients are above fifty years of age. A case has been reported in a boy of ten (Rosenstein).

Etiology.—The etiological factors are those of arteriosclerosis and chronic myocarditis. In Strauch's series 44 of the cases presented myocarditis alone without valve lesion. It is usually stated, and it certainly has been the writer's experience, that the coronary arteries are involved or the anterior branch is calcified and narrowed; but Strauch's cases, which seem to have been very carefully studied, do not bear out this view, as only 15 showed involvement of the coronary arteries. He regards it as

[1] *Nordiskt Med. Arkiv*, 1897.

a special pathological change, a degeneration which is difficult to connect with any other heart lesion. Syphilis did not appear to be a factor in many cases. The left ventricle is affected in almost every instance, in all of Strauch's series, and in a large majority the apex region is involved, extending toward the septum. Usually single, there have been cases reported with two or even three aneurisms. In the most characteristic form there is a globular distention of the apex region of the heart, with perhaps slight thickening of the pericardium or a definite change in the appearance of the muscle. The tumor may be the size of the fist, or even larger. From within thrombi are usually seen, attached to a sclerotic endocardium. On section of the wall of the sac the heart muscle may in great part be converted into fibrous tissue. The thrombi have been found calcified. As a rule, the sac is flat, in a few cases quite globular and communicating with the cavity of the ventricle by a narrow orifice. Cases have been described in which the sac has been larger than the heart itself.

Symptoms.—The symptoms are very obscure, and it is rarely possible to make a diagnosis. The cases are usually mistaken for chronic myocarditis, or the diagnosis is made of the associated valvular lesion. As the aneurism is at the apex and enlarges the left ventricle, the features of hypertrophy and dilatation are usually present. Symptoms of angina pectoris are not infrequent. Strauch has carefully analyzed the physical signs presented in a select group of his cases without throwing any very special light on the possibility of diagnosis.

DILATATION ANEURISMS.

There are two important groups: (1) In one, seen chiefly in the aorta and larger branches, the artery has passively dilated, owing to disease of its walls; (2) in the other, seen most frequently in small branches, there is an active dilatation due to growth and enlargement of the vessel.

Dilatation Aneurism of the Aorta.—New interest has been attached to this form since the introduction of the x-rays in clinical diagnosis. Formerly it was overlooked to a great extent even in the best clinics. In witness of this may be mentioned the striking fact that of the long series of cases studied by Thoma[1] scarcely one had been recognized in the wards, though under the care of one of the most skilful clinicians in Europe.

Joseph Hodgson,[2] in 1815, described what he called "a preternatural, permanent enlargement of the cavity of an artery," and distinguished it clearly from ordinary aneurism. He recognized its association with disease of the coats of the vessel, and remarked that saccular aneurism could be engrafted upon it. The dilatation, which might be partial or complete, affected most frequently the ascending aorta. He very acutely observes that the symptoms suggest organic disease of the heart rather than aneurism. Since Hodgson's date this form has been well recognized anatomically, but it has not received enough consideration clinically, and yet it is one of the most common forms in the aorta. Scarpa, too, in his great treatise, while recognizing dilatation of the whole tube of the aorta, regarded it as essentially

[1] *Virchow's Archiv*, cxi.
[2] *A Treatise on the Diseases of Arteries and Veins*, London, 1815.

different from aneurism, although he says the two may be sometimes found together. Morgagni, who has overlooked so little in the morbid anatomy of aneurism, makes a clear division between two kinds, one in which the tumor occupies the whole circumference of the arterial tube, the other in which the aneurism only affects one side of the artery. Primarily a disease of the media causing weakening, there are usually associated changes in the adventitia and extensive alterations in the intima. Among the forms recognized by Thoma are: (1) the multiple spindle-shaped aneurism; (2) the single fusiform aneurism; (3) the saccular engrafted or spindle form; and (4) the tent-shaped or sphenoid, a special form in connection with the upper part of the thoracic aorta, which, he thinks, results from abnormal tension at this point just where the upper intercostal arteries are given off. He lays great stress on the involvement of the adventitia, and with the periarteritis he would associate the attacks of pain so common in this condition. While, as a rule, this form is met with in old persons and is associated with extensive endarteritis deformans, one meets with a few cases in which the arch is considerably dilated with a smooth or not much involved intima.

Associated quite frequently with this dilatation of the arch is insufficiency of the aortic valves, due either to a sclerosis and shortening of the segments or to dilatation of the ring itself. It is to this combination particularly that the French give the name, *Maladie de Hodgson*, but in the original description of this author it does not seem that he refers to the associated disease of the valve.

In young men with syphilis the process may be limited to the arch, which in any case is most common, but it may involve the entire aorta. In nearly all cases there is extensive endarteritis deformans with calcified laminæ and atheromatous erosions. The dilatations may be onion-shaped or spindle-formed. They may be multiple. Sometimes on the wall of the spindle-formed dilatation there are small saccular aneurisms. Thoma's admirable paper gives outline figures of the various forms, all of which owe their origin directly to the action of blood pressure on the diseased vessel wall.

The dilatation aneurism is very common, particularly in old people, and is often found accidentally. Only when of a very large size does thrombus formation take place in it. There is a remarkable specimen in the McGill Museum presented by R. L. Macdonell, in which the descending thoracic and abdominal aorta, and the iliacs were greatly dilated. The abdominal aorta forms a fusiform aneurism, which is filled with a densely laminated thrombus. In other instances the whole aorta is dilated, or the arch may be double or treble the normal size and without thrombi on the roughened intima.

Symptoms.—There are three groups of cases: (*a*) Latent: The condition is met with accidentally in medicolegal work or in the postmortem-rooms of almshouses and infirmaries, particularly among old people. The dilatation may reach an extreme grade without any special symptoms. (*b*) With the picture of *angina pectoris:* In the syphilitic aortitis in men under forty years there may be no dilatation of the arch, but in the senile dilatation of the arch angina is a common, sometimes the only, symptom. The attacks of pain may recur at intervals for several years without any sign of cardiac insufficiency. (*c*) In a third group the features are those of organic disease of the heart, usually of aortic insufficiency, characterized by attacks of vertigo, dyspnœa, cough, and the usual symptoms of cardiac failure, which may be

present for weeks or months before the end comes. Hodgson recognized the fact that the clinical features of the condition were very often those of valvular disease. The incompetency of the valves may be due to the distention of the aortic ring.

Physical Signs.—*Inspection* may show a diffuse impulse over the manubrium, but in old persons with rigid chest walls and a calcified aorta there may be an extreme degree of dilatation without a visible impulse. The top of the aorta may reach to the sternal notch, and the innominate artery is elevated; but it is to be remembered that the throbbing in this situation is much more frequently due to the right carotid as it leaves the innominate, or to the innominate itself, than to the arch. The right subclavian is often visible above the clavicle, and Barié regards this as one of the best signs of dilated arch. An impulse may be seen on either side of the sternum in the second and third interspaces. Palpation may detect a systolic thrill, rough and harsh in cases of calcification of the intima, sometimes diastolic when the valves are insufficient. With one hand on the manubrium, the other on the spine, pressure may detect a deep pulsation. In the sternal notch the forcible throbbing of the dilated aorta may be felt. Tracheal tugging may be present. *Percussion* carefully made gives a dulness over the manubrium, varying in degree with the extent of the dilatation.

Auscultation.—A systolic murmur is heard, often of great intensity, and propagated into the vessels of the neck. There is nothing distinctive in it, nor does it differ from the bruit so often heard over the aorta in old persons with sclerosis. A diastolic murmur, if present, is more important, as it may be heard up the sternum, often quite loudly, and is even propagated into the vessels of the neck. The aortic second sound may be of a remarkably metallic quality and loudly heard up the sternum. O. K. Williamson has called attention to the high blood pressure in these cases, while in the ordinary saccular aneurism it is, as a rule, normal. Lastly and most important of all, the fluoroscope shows a pulsating shadow, larger and higher in position than the normal aorta, and which does not disappear in diastole.

Active Dilatation Aneurism. Cirsoid Aneurism.—No structures retain their powers of growth in greater degree than the arteries. Many physiological conditions demand the retention of this property; for example, the arteries of the uterus at term are four or five times as large as in the unimpregnated state. In tumors, in the enlarged spleen, in the proximal branches after ligation of a main trunk, the arteries not only increase in size, but there is an active development showing to what an extraordinary degree these structures possess the capacity for new-growth. With this power it is not surprising that we meet with instances in which spontaneously, at any rate from unknown causes, arteries enlarge. The condition is known as aneurism by anastomosis, racemose aneurism, or, more commonly, *cirsoid aneurism.* The arteries of the fourth and fifth dimensions are the most frequently involved, vessels, for example, of the size of the radial and its immediate branches, or of the temporal arteries. The dilatation may be confined almost entirely to the arteries themselves. In other instances the veins are involved, and the smaller vessels, even the capillaries, may be implicated, so that the structures form a diffuse angioma. The situations most frequently involved are the head and the hands, but the arteries of any part of the body may be affected and the aneurisms may be single or multiple.

There are three important exciting causes. The dilatation may arise in small birthmarks or little angiomas, particularly those about the ear and forehead. With a gradual increase in size, the arteries become convoluted and throb forcibly. In a second group of cases the aneurism follows directly upon an injury, in one instance a burn on the hand, another, a blow on the head with a club, and the third, a slap on the face. And thirdly, in an interesting series of cases the tumor arises as a sequence or during an attack of fever. Two such cases are reported by Bazy.[1] In one, a man aged nineteen years, who had had an induration on the palmar surface of one hand during convalescence from an attack of typhoid fever, a dilatation of the vessels of this hand began, and in two or three years the radial was as big as the brachial. Reverdin reports a case of a man, aged thirty-one years, who ten years before had had an attack resembling typhoid fever. The exact nature was never very clear. Following it in a few weeks he noticed a little tumor over the left eyelid in which the color of the skin had changed. This gradually increased, and when seen by Reverdin just ten years later there was a pulsating tumor of the temporal region above the left eyebrow. At the Johns Hopkins Hospital, in 1903, we had a patient in whom multiple cirsoid aneurisms were present; following an attack of typhoid fever there was a decided increase in the size of the vessels. Reverdin suggests that all sorts of infectious arteritis may be the starting point of the aneurismal dilatation.

Symptoms.—Small tumors may cause no inconvenience. There may be slight swelling of the skin over the bunch of dilated arteries, and when the hand is placed upon it the individual vessels are felt to be convoluted and dilated; the pulsation is forcible, there is usually a thrill to be felt, and with a stethoscope a loud whirring murmur is heard. If the arteries alone are dilated, this may be systolic and single. In other cases where there are large venous anastomoses, the murmur is more or less continuous with systolic intensification. In other cases, particularly about the ears and temporal region, the skin itself is involved. There is marked swelling with a bluish tint, the dilated arteries are visible, telangiectases are present in the skin, or, if the whole process has started from a small birthmark or a nævus, the entire tumor may present the character of an angioma. The side of the face and head may be involved, and exophthalmos be present on the affected side. Huge tumors of this kind are reported, and they have at times increased with the rapidity of a new-growth. Arising spontaneously, they have been known to disappear in the same way. A remarkable case is reported by Fernell.[2] A man aged twenty years, had a large pulsating tumor above the right clavicle which had lasted many years and which involved all the branches of the thyroid axis except the inferior thyroid; the transversalis coli and suprascapular could easily be made out, greatly enlarged and tortuous. During an attack of measles, in which the temperature rose to 106.5°, the tumor looked very red and angry, and pulsated very strongly, as if about to rupture. A compress was applied and veratrum viride, ergot, and iron were given. Following the attack of measles the tumor began to subside, gradually the pulsation and thrill disappeared, and it shrank to a mass of hard connective tissue which could be rolled about.

---

[1] *Gaz. des Hôpitaux*, 1889, p. 1363.
[2] *St. Louis Courier of Medicine*, 1887.

DISSECTING ANEURISM.

Splits and Fissures of Intima. Rupture of Aorta. Healed Dissecting Aneurism.—1. **Splits and Fissures of the Intima with Healing.**— In the artificial production of aneurism, already referred to, there is sometimes found over a patch of mesarteritis a small slit or fissure of the intima, cleanly cut as if with a knife, evidently due to rupture. Behind this there may be a small pouch-like distention of the media and adventitia, or a little dissecting aneurism. Precisely the same thing happens in man, and there may be spontaneous rupture of the intima in the form of a small slit one-fourth to one-half inch in length, or the entire circumference of the intima of the aorta may be cut through as if with a knife. A most remarkable circumstance is that these lesions may heal completely, leaving scars of the most extraor-

Fig. 46
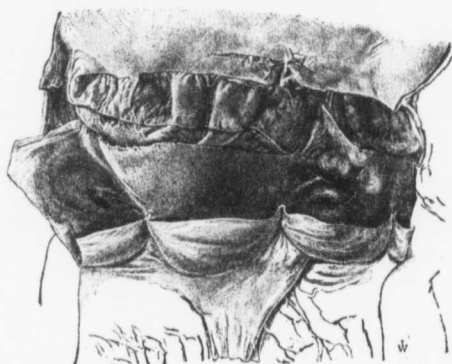
Illustrating a complete transverse split of the intima of the aorta.   (After v. Schrötter.)

dinary character. Deland has reported such a case.[1] Three years before the final attack the patient had had a severe attack of pain in the chest and unconsciousness, from which he had gradually recovered. Death occurred very suddenly from a fresh tear of the aorta and rupture into the pericardium. The cases are not very numerous in the literature. Von Recklinghausen describes the case of a woman who died postpartum of a rupture two inches long of the inner coat of the ascending aorta. In the descending aorta an inch below the duct there was a split of the intima completely encircling the tube which was entirely healed. Zahn reports a case of a woman, aged thirty-seven years, dead of pneumonia and an aneurism of the aorta. Sixty millimeters from the ring there were healed splits in the intima and the media.

[1] *Transactions of the American Climatological Association*, vol. xiv.

The latter coat was not quite cut through, and this he thinks was the cause why a descending aneurism was not formed. Von Schrötter gives a figure[1] which is almost identical with the aorta in Deland's case.

By far the most important study in the healing of those splits and tears is in the well-known paper by Rokitansky.[2] He had not at that time seen a case of complete healing of a dissecting aortic aneurism, but he well remarks that the healing of the tears of the inner coat of the aorta, which he had figured, are not less remarkable. A man, aged sixty years, had been for eight weeks laid up with trouble in his chest and had become dropsical. When admitted to the hospital he was dyspnœic, had profuse sweats, with pain in the left thorax, and a feeble, irregular heart. Death took place on the second day. Above the aortic valve there were splits with separation of the internal coat. The edges of the splits were smooth, and where the middle coat was exposed it had also a smooth and fibrous appearance. Spontaneous healing had taken place. He reports five cases of these healed splits of the intima. In Deland's case, the heart of which was dissected by the writer, in the first attack the intima of the aorta had split in the entire circumference and there was a fibrous cicatricial ring just above the valves. There was no pouching, and the margins of the intima were rounded and smooth. It looked an old and healed lesion. Farther up the arch was the fresh knife-like split of the intima and a rupture into the pericardium.

2. **Spontaneous Rupture of the Aorta.**—Traumatic rupture is not uncommon in medico-legal work. Spontaneous rupture is rare, but it may occur in a vessel apparently healthy, either as a result of sudden strain or sometimes without any effort. It may occur during confinement or in sudden muscular effort. It has occurred in a healthy boy aged thirteen following prolonged exertion. In the majority of the cases it is an intrapericardial rupture. The intima may be smooth and the lesion is usually sharp and well defined, as if cut with a knife. The rupture in the external coat is rarely directly opposite that in the intima, so that there is usually some evidence of dissecting aneurism. The cases present very characteristic clinical features, the symptoms occurring in two stages.

The case reported by Linn[3] is a good illustration: a woman, aged twenty-nine years (who had twice miscarried), in her third pregnancy, within fourteen days of term and without any special effort, complained of pain in the side and cardiac oppression. During labor, just after a pain, she started up in bed with an agonizing pain in her heart, and said she was dying. She became cold and pale and pulseless. She revived for a few minutes and was delivered in about two hours of a dead child. She remained cold and faint, with a small quick pulse, and Linn thought the heart was ruptured. She improved gradually and seemed to be doing very well until the fourteenth day after delivery, when she again complained of a sudden pain in the chest, and she died in a few minutes. A very good illustration accompanying the paper shows an aortitis with rupture into the pericardium. In a woman at this time of life, who had had miscarriage and such a condition of the aorta, the trouble was no doubt due to syphilis. Of the two clinical periods, one corresponds to the rupture of the intima, with which is associated the severe

[1] Fig. 50, p. 327, *Nothnagel's Handbuch*, xv, Bd. ii.
[2] *Denkschriften der Kaiserblichen Akademie der Wissenschaften*, Band iv, Wien, 1850.
[3] *Medical Records and Researches*, London, 1768.

pain and collapse, from which the patient gradually recovers. Then in the course of three or four days external rupture takes place with sudden death. In some instances, as in Linn's case, the interval may be for fourteen days.

3. **Dissecting Aneurism.**—In ordinary practice and in the work of a general hospital, dissecting aneurism is not very common. There were only two cases in sixteen years at the Johns Hopkins Hospital, where aneurism may be said to be exceptionally frequent. And yet it is a common event, particularly in medicolegal work. I remember well my surprise at the number of cases which the late Dr. Formad used to collect when Coroner's Physician in Philadelphia. A most interesting collection is in Boston, where, in the Warren Pathological Museum, there are twenty cases of dissecting aneurism and rupture of the aorta, most of them collected by the late J. B. S. Jackson. The writer is indebted to Joseph Pratt for getting the details about the cases. Apart from the traumatic instances, there are two groups of cases: the first, occurring in comparatively young persons, results from a rupture of the intima over the middle and external coats, weakened by syphilitic or some other form of aortitis. In the second group, occurring in elderly or very old people, there is extensive endarteritis deformans, and the rupture takes place at the edge of an atheromatous erosion, or an atheromatous intima may be split during a sudden exertion. The most frequent site is the arch and in its ascending portion. But the rupture may occur in any part of the aorta or in one of its main branches.

One of the early cases in which it was recognized was that of George II, who died suddenly of a rupture of the right ventricle. There was in addition in the trunk of the aorta a transverse fissure an inch and a half in length, through which blood had recently passed under its external coat and formed an elevated ecchymosis. As a rule, the blood infiltrates between the layers of the media, sometimes between the media and the adventitia. The extent of the splitting varies from a small area, such as that reported by Nicholls in the case of George II, to a complete separation of the coats of the entire aorta. There are instances on record in which the blood has passed down the crural arteries far into the vessels of the legs. Rupture may take place externally, which is very frequent, into the pericardium, for example, or internally in one or more places into the lumen of the aorta itself. The extent of the circumference of the vessel involved varies very greatly. In some instances only a small section is involved, in others there is a separation of a large part of the circumference, and the vessels may be torn across, although more frequently they are spared. In some cases the intracostal arteries, the coeliac axis, the renal vessels, and superior mesenteric have been torn across. A great majority of the cases of dissecting aneurism prove fatal. The symptoms are those already mentioned in connection with spontaneous rupture of the aorta, a sudden sharp pain, collapse, and death follows in from two to fourteen days from bursting of the aneurism. But in a few cases recovery takes place with an illustration of the most remarkable reparative processes seen in the human body, the formation of a healed dissecting aneurism.

4. **Healed Dissecting Aneurism.**—Shekelton,[1] a Dublin surgeon, first reported cases of this kind, one of the abdominal aorta and the other of the left common iliac. In his first case so similar was the structure to that of

---

[1] *Dublin Hospital Reports and Communications*, vol. iii, 1822.

the artery that he was inclined to regard it as an anatomical anomaly, but in the second case the doubt was cleared. Henderson, of Edinburgh, in 1843, reported a remarkable case,[1] in which from just behind the origin of the left subclavian the entire aorta consisted of two tubes. The outer canal communicated with the inner through an orifice into the left common iliac artery. The outer tube did not extend around the entire circumference. Both Shekelton and Henderson appreciated the true character of this remarkable condition. But Hope, in his well-known work on *Diseases of the Heart*, in referring to a case, thought that it was a congenital anomaly, a double aorta. Indeed, when one sees a specimen it is not surprising that

Fig. 47
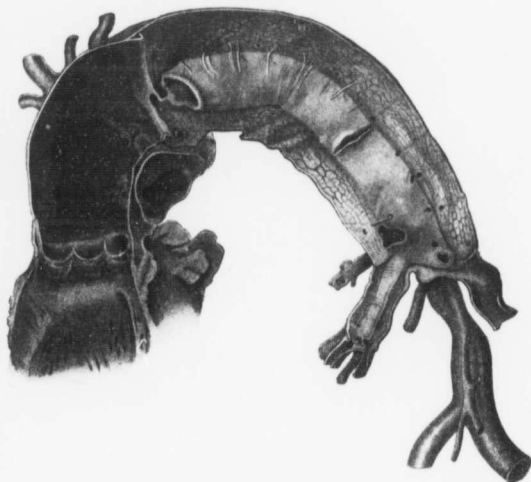
Healed dissecting aneurism. (After Böstrom.)

this mistake has been made. The best accounts of the condition are given by Böstrom,[2] and by Adami,[3] who has been able to collect altogether 39 cases, among which women were almost as numerous as men. An interesting point is the fact that in a majority of the cases there was no advanced disease of the aorta. This is as we should expect, since, as mentioned in connection with spontaneous rupture, it is due to weakening of the media, and the intima may show little or no atheroma. The site of the primary rupture was in the ascending aorta in 13 cases, below the origin of the left subclavin in 12 cases,

[1] *London and Edinburgh Monthly Journal of Medical Science*, vol. iii, 1843.
[2] *Deutsches Archiv f. klin. Med.*, Bd. xlii.
[3] *Montreal Medical Journal*, 1896, xxiv, p. 945.

the lower part of the thoracic aorta in 5 cases, in the abdominal aorta and iliac artery 1 case each. As already mentioned, the outer tube may extend the entire length of the aorta and occupy a variable section of the circumference. The branches of the aorta very frequently take origin from the outer sac. A feature which perhaps attracts most attention and has no doubt led to the belief that in these cases a congenital anomaly exists, is the smooth, natural appearance of the outer tube. Rindfleisch showed that a growth of endothelium took place, with the formation, in part at least, of a new intima.

The duration extends over many years. When a student in Toronto, the writer frequently visited the gaol with his old friend and teacher, Professor Richardson, and at intervals they saw there a soldier who had been discharged from the British army soon after the Crimean War for aneurism. He seemed a very healthy man, and there was no evidence of any existing tumor. He died in 1886, and J. E. Graham, who made the postmortem and who reported the case, kindly sent the specimen to me for dissection. There was a small healed aneurism at the third portion of the arch, and from the margin of this sac, just beyond the left subclavian, the aorta formed a double tube. There was little question that this had lasted for more than thirty years from the time of his discharge from the army with symptoms of aneurism.

SACCULATED ANEURISM.

As the great majority of cases of sacculated aneurism in medical practice affect the aorta, we shall deal with the disease as it is met with in this vessel. For convenience of description we may divide the aorta into three parts—the arch, the descending and the abdominal portions:

Aneurism of the Arch of the Aorta.—As already mentioned, this part of the vessel may be uniformly dilated, but it is much more common to have one or other portion involved in a saccular aneurism situated in a sinus of Valsalva, the ascending or the transverse portion of the arch.

Aneurism of a Sinus of Valsalva.—Aneurism of a sinus of Valsalva is a common and important variety, met with particularly in syphilitic subjects and in comparatively young men. There may be a pouching of all three sinuses, but more commonly one only is involved. The orifice of a coronary artery may be given off from the sac, and the first part of the vessel may itself be dilated. The aortic ring may become involved and the adjacent semilunar valve may be rendered incompetent. The aneurism may perforate one or other auricle from the right posterior sinus, or into the pulmonary artery or the right ventricle from the left posterior sinus, or from the anterior; or the sac may pass beneath the ring and perforate into the left ventricle itself. By far the most common perforation is into the pericardium; or rupture may take place into the superior vena cava. There are cases in which the aneurism seems to be given off directly at the aortic ring and involve as much of the ventricle as of the sinus.

Aneurism of this portion of the arch has very definite features: (*a*) It is not detected in the wards, but is seen in the dead-house, particularly in connection with medicolegal work. (*b*) It is very often latent, death occurring from perforation before there have been any symptoms. (*c*) It is frequently syphilitic. (*d*) Angina pectoris may be an early feature. (*e*) Aortic insufficiency is a common accompaniment.

Aneurism of the Ascending Arch.—Perhaps the most common situation for the saccular tumor is from the convexity of the aorta, an inch or so above the valve. The tumor grows freely to the right, displacing the vena cava and the lung, and some of the largest sacs met with originate in this situation. Anteriorly, it appears to the right of the sternum, in the second and third interspaces, and may gradually erode the bone and cartilage, and, passing upward, lifts the sternoclavicular joint and appears as a large, external tumor. The sac may perforate into the pericardium, the right auricle, the superior vena cava, the lung, the right bronchus, or, passing backward, erode the spine.

FIG. 48   FIG. 49
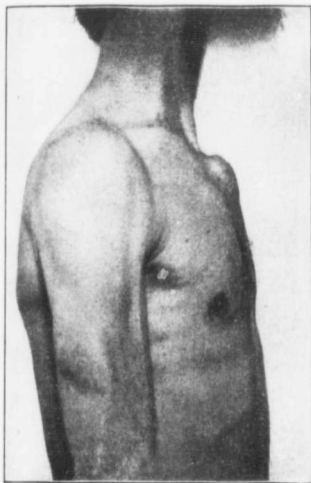
Aneurism of the thoracic aorta.

Aneurism of the subclavian artery.

Aneurism of the Transverse Arch.—Owing to the very small space between the spine and the sternum, the tumor here is restricted in its growth, and is likely to cause early and severe symptoms from pressure, particularly upon the windpipe. The left recurrent laryngeal is involved, and changes in the voice, attacks of dyspnœa, and painful dysphagia are common. Small tumors may cause the most intense symptoms without, indeed, any physical signs. Although in this situation the sac, as a rule, does not grow to such a size, yet there are instances in which the extension laterally has been enormous, producing some of the largest and most chronic types of aneurism. Growth backward may involve the spine, producing agonizing pain.

Physical Signs.—*Inspection.*—The well-known dictum of Jenner may be taken as text: "More mistakes are made by not looking than not knowing." A majority of aneurisms of the thoracic aorta present suggestive features to the eye, but the inspection must be made with care. A good light, good eyes, a bare chest, and system are indispensible. There are dark consulting-rooms in which it would be impossible to see the slight throbbing to the right of the sternum or the general diffuse heave of the manubrium. Even in a good light one may look directly at a pulsation and not see it. The point of view is everything, and it is best to examine the patient on a revolving stool, which can be turned easily so as to get the effect of the light falling at different angles. Good eyes are the physician's best tools, but it is not merely acuteness of vision, though this is important, but it is the educated, seeing eye, which is only to be had by careful training.

"Strip to the buff" is the rule. If the shirt and undershirt are tucked up to save time, the all-important area above the level of the second rib may be covered. More than once it has happened in the writer's experience to have the sought-for diagnosis stare at the astonished doctor from the first or second interspace or the supraclavicular region. System is most important: apex region first, then along the sternal margins, the sternal notch, the supraclavicular fossæ, the state of the neck, the superficial veins, the skin, the larynx, the face, eyes, pupils, the epigastric region, all these in quick succession in a preliminary survey, and then anything which attracts attention may be looked at in more detail. Turn the patient and examine the back, particularly the interscapular areas. If not done in order as a routine, the chances are that it will be forgotten as the interest increases in other parts of the examination, and perhaps the diagnosis may be missed altogether. Certain cases make an earelessness impression on one. In 1888 the writer saw, at the Girard House in Philadelphia, a man with orthopnœa, a greatly dilated heart with an unusual widespread impulse in the lower sternum and adjacent parts. There was a loud, diastolic murmur, and the whole trouble had been attributed to aortic insufficiency. But there were very puzzling features in the case, which need not here be discussed. After finishing the examination in front the patient's back was turned to the light, when the diagnosis was instantly seen in the form of a prominent pulsating tumor in the left interscapular region, which had been overlooked. The writer on several occasions has missed the diagnosis by carelessness in the routine examination. In a patient named McKinley, very well known to a succession of classes at the Johns Hopkins Hospital, when first seen at the out-patient class, we were so interested in the physical signs in the front of the chest, which were those of a very obscure heart trouble, that we forgot to look at his back. In the ward the House Physician made the diagnosis for us on inspection of the patient's back. There is no disease more conducive to clinical humility than aneurism of the aorta. Mistakes occur with the most careful and the most skilful. Sometimes the diagnosis is beyond our art; more often it is not made because of the carelessness that so easily besets us in our work. The confession of the great Pirogoff always seems to me most touching: "There are in everyone's practice moments in which his vision is holden, so that even an experienced man cannot see what is nevertheless perfectly clear, at least I have noticed this in my own case. An overweaning self-confidence and preconceived opinion, rarely a weariness, are the causes of these astonishing mistakes."

Face.—The subjects of aneurism are geneally robust, vigorous-looking young or middle-aged men, with what is sometimes called the cardiovascular facies. Marked suffusion of the face is common when the aneurismal sac presses on the veins near the heart. The conjunctivæ may be dusky and infiltrated, and occasionally there is cyanosis. These features of venous compression are not, however, so common in aneurism as in tumor. Occasionally the congestion of the veins may be unilateral.

Inspection of the face gives us the interesting features supposed to be associated with pressure on the cervical sympathetic. Of these, inequality of pupils, *anisocoria*, is the most common. This is present in a very considerable number of cases, and may be due to three causes: (1) When the cord of the sympathetic in the neck is irritated there is contraction of the pupil on the affected side; when there is complete paralysis there is dilatation. Associated phenomena of sympathetic irritation are flushing, unilateral sweating, and drooping of the eyelid. (2) Cecil Wall and Ainley Walker have brought forward evidence to show that this anisocoria is due more often to local vascular conditions The size of the pupil is influenced very largely by the state of turgescence of the vessels. With low blood pressure, large pupils, with a high pressure, contracted pupils, are associated; and these authors think that the anisocoria met with in aneurism is associated with unilateral change in the blood pressure. In 26 consecutive cases of inequality of the pupils in thoracic aneurism they found that there was nearly always a relation between the state of the pupils and the arteries. Where the temporals or radials were small the pupil was large. Experimentally, too, they found that obstruction of carotid vessels in the neck was always associated with a large pupil. In one case of aneurism at the root of the neck on the right side, in which the pupils were equal, distal ligature of the common carotid was followed by enlargement of the right pupil, and an operation on the carotid is reported in which this same sequence followed. In the majority of individuals, pressure on the carotid on one side is followed by enlargement of the pupil. This study gives a very rational explanation of the phenomenon, and removes a very serious difficulty, namely, that very often pupil changes are found when anatomically the aneurism has no connection whatever with the sympathetic. (3) In a certain number of cases the inequality of the pupils is a parasyphilitic manifestation associated with the Argyll-Robertson phenomenon and absent knee-jerks.

Inspection of the neck may show great engorgement of the face on one or both sides, absence of the carotid pulsation on one side, sometimes enormous distention of the right jugular sinus, and in the aneurism of the arch or of the innominate arch together, pulsation of the tumor itself is visible just above the sternum or the sternoclavicular joint. An interesting feature sometimes seen is the visible *tracheal tugging*, a systolic retraction of the box of the larynx, and of the tissues of the root of the neck along the line of the windpipe which may show a lateral deviation.

Arm and Hand.—Sometimes there is swelling of both upper extremities. Particularly is this the case in the aneurism of the ascending aorta, which has grown to the right and compressed the superior vena cava. Much more commonly the arm on one side is congested with enlarged veins, less commonly cyanosis. Pallor and sweating may be present in one arm only. A very interesting feature is the unilateral clubbing of the fingers in thoracic aneurism, of which the writer has seen two cases, one on the right side and

one on the left. It is associated with peripheral stasis. Groebel, of Nauheim, has reported several cases.

Skin of Chest.—Distention of the veins over the shoulder and pectoral region is common. A network of distended veins may be marked on the right side above the third rib. Very great enlargement of the mammary veins is not so often seen in aneurism as in tumor compressing the superior vena cava. The whole front of the chest may be occupied by large plexus of vessels communicating with the epigastric veins and all the well-known features of obstruction to the blood entering the auricle from above.

Pulsation.—Three sorts of pulsation may be seen in the chest: (*a*) A general shock, such as is present with violent throbbing of the heart, of an aneurism, or of a pulsating aorta. In great hypertrophy of the heart and dilatation of the vessels with marked anæmia, the front of the chest is lifted and jarred with each impulse, often the subclavians throb, and there is a pulsation in the suprasternal notch. Even without organic disease of the heart, as, for example, in cases of Graves' disease, neurasthenia, and severe anæmia, this diffuse throbbing, particularly when associated with marked pulsation of the subclavians, may lead to the diagnosis of aneurism. The shock may be so pronounced as to jar the bed.

(*b*) A diffuse impulse localized over certain parts of the chest and quite different from the general thoracic shock. Usually limited to one side of the chest, to the right mammary or subclavicular regions, it may occur, as is well known, with pleural effusion, gaseous or liquid. There are remarkable instances in which this diffuse pulsation of one side of the chest has occurred without any very obvious cause. Sailer has reported such a case in a Russian Jew, aged twenty-six years, with a normal but not very vigorously beating heart and with marked throbbing of the abdominal aorta. There was a slight though distinct visible systolic pulsation of the whole right side of the thorax, perceptible also on palpation. This sort of throbbing may occur in anæmia and be most deceptive, as in the case reported by A. R. Edwards, in which over the lower left chest there was a diffuse pulsation extending horizontally from the angle of the left scapula into Traube's space and the epigastrium—"the pulsation was vigorous and distinctly expansile to both the eye and the hand." A systolic bruit was heard over it. Naturally the case was regarded as one of aneurism of the thoracic aorta. The postmortem showed moderate arteriosclerosis of the aorta, but no aneurism. Lafleur reported a very similar case with pulsation in the same region, and in addition paralysis of the left vocal cord. And lastly, in chronic mediastinitis there may be a most deceptive pulsation simulating that of aneurism. In 1902 there was under the care of the writer for some months, a patient aged fifty-nine years, who had increasing dyspnœa, cough, and some pain in the chest; the fluoroscope showed an indefinite shadow to the left of the sternum. The voice was a little cracked, the arteries were thickened, and in the second right interspace extending toward the axilla was seen a diffuse impulse, very indefinite, when the breath was held. Taken in conjunction with other symptoms and a slight tracheal tugging, naturally a diagnosis of aneurism was made. W. T. Howard, of Cleveland, who made the postmortem, found a remarkable condition of chronic mediastinitis.

(*c*) *The punctate, heaving, true aneurismal impulse*, which is of a totally different character, localized, and when of any extent visibly expansile. It is first of all most important to recognize the regions in which the cardio-

vascular impulses may be visible. The apex beat in the fifth interspace and an impulse of the right ventricle in the left costoxiphoid angle are seen over the hearts of thin-chested, healthy persons. Other impulses which must not be mistaken for aneurism are the following: (1) The throbbing of the conus arteriosus in the second left interspace—very common in young persons and in thin chests, and seen particularly well during expiration. (2) Pulsation of the heart in the second, third, and fourth interspaces, extending as far out as the nipple line in cases of sclerosis and retraction, from any cause, of the upper lobe of the left lung. (3) Heart pulsation in the second, third, and fourth right interspaces in connection with similar conditions of the right apex. (4) Effusion in either side of the chest may so dislocate the heart that there is a marked impulse at or outside the nipple line on either side. (5) Throbbing subclavians seen in the outer half of the infraclavicular regions, usually bilateral; this is met with in thin-chested persons, in neurasthenia, in early tuberculosis, and in anæmia. Sometimes it is unilateral, and when accompanied with a thrill and a murmur it may form a mimic or phantom aneurism. Samuel West[1] has reported 8 cases of this kind. (6) In the back part of the chest visible pulsation is nearly always aneurismal; but occasionally, in Broadbent's sign the tugging may be so limited and localized in one interspace that it simulates pulsation, but palpation easily corrects this.

Palpation.—Over a blood tumor connected with the aorta and close to the heart, three things may be felt: (1) *The true aneurismal impulse.* To appreciate its character one must understand that this is identical with the cardiac impulse, and to learn to recognize it one should practise carefully the palpation of an actively beating apex. The remarkable vigor and intensity, the impossibility of resisting it, the closeness under the fingers with the definite expansile quality, are its important features. Of course, these are only appreciated when the aneurism reaches the surface, but even when the sac itself cannot be palpated there may be communicated to the chest wall a forcible heave which is entirely different in sensation from the ordinary shock. In the deep-seated tumor beneath the manubrium this may sometimes be appreciated best by bimanual palpation—one hand upon the spine and the other forcibly compressing the sternum. The communicated shock or jar which is felt over the chest in a case of hypertrophied heart or a throbbing aorta is diffuse, without localization, without any punctate, heaving quality and without that sense of forcible expansion directly beneath the fingers which is so characteristic of the cardiac and the aneurismal beating (2) Over the aneurismal sac near the heart may be felt the shock of either a thudding first sound or, what is much more common, the sharp flap of the second sound. The latter is of great diagnostic importance, and may sometimes be felt by the slightest application of the finger to the sac as a snapping, short shock. (3) *Thrill:* A marked vibratory thrill may be felt, usually systolic in character, much more rarely diastolic and not often double. Thrill is not a special feature of aneurism of the thoracic aorta, and a great majority of cases are without it. It is relatively more common in aneurism of the abdominal aorta. A diastolic thrill is exceedingly rare.

Tracheal Tugging.—When the sac is adherent to the windpipe, with each systole the larynx may be slightly drawn down, and if the finger be placed

---

[1] *St. Bartholomew's Hospital Reports,* 1880, vol. xvi. p. 119.

upon it, or if the windpipe is stretched, a slight tug may be felt. This very valuable sign, first described by Surgeon-Major Oliver, is present in a large proportion of all cases of aneurism of the arch when it is in contact with the windpipe. Occasionally it is present in great dilatation of the aorta and in tumors. To elicit this important sign Oliver gives the following directions:

"Place the patient in the erect position, and direct him to close his mouth and elevate his chin to almost the full extent; then grasp the cricoid cartilage between the finger and thumb, and use steady and gentle upward pressure on it, when, if dilatation or aneurism exists, the pulsation of the aorta will be distinctly felt transmitted through the trachea to the hand." It is often visible as well as palpable.

Inequality of the radial and carotid pulses is a very common feature in aneurism. Usually the radial pulse on the one side may be slightly retarded or very much smaller. The carotid may be extremely feeble or obliterated, an event less common in this vessel than in the radial. The right pulse is more frequently smaller than the left. The inequality is most commonly due to involvement of the innominate in the sac with narrowing of its orifice. On the left side the subclavian, with or without the carotid, may be involved in the sac. Either subclavian may be compressed outside the sac. The radial may be smaller on the side opposite to that in which the sac is prominent. Thus a small radial on the left side with a projecting sac from the ascending aorta on the right side may be due to an atheromatous narrowing of the orifice of the left subclavian, or there may be a small secondary aneurism.

It was Harvey, I believe, who first noted the change of pulse in aneurism. In Chapter III of the *de Motu Cordis* he describes the following case: "A certain person was affected with a large pulsating tumor on the right side of the neck, called an aneurism, just at that part where the artery descends into the axilla, produced by an erosion of the artery itself, and daily increasing in size; this tumor was visibly distended as it received the charge of blood brought to it by the artery with each stroke of the heart; the connection of parts was obvious when the body of the patient came to be opened after his death. The pulse in the corresponding arm was small in consequence of the greater portion of the blood being diverted into the tumor and so intercepted."

The pulse may be imperceptible at the wrist and just felt in the brachial, or a very feeble impulse may be seen or obtained by the sphygmograph when nothing is felt by the finger. There are cases in which no pulsation is felt in any of the arteries of the head or of the upper extremities, generally instances of large aneurism of the transverse arch. It is much more rare to meet with obliteration of the pulse in the abdominal aorta or in the femorals. The writer reported one instance in which this interesting condition was present. Absence of the pulsation in a vessel does not necessarily mean that the orifice at the main trunk is obliterated. Feebleness of the pulse on one side may be due, as Harvey suggests, to the diversion into the tumor of the greater portion of the blood, and in the case of a very large sac the force of the cardiac systole may be entirely absorbed and an intermittent converted into a continuous stream.

Blood Pressure.—For several years at the Johns Hopkins Hospital the blood pressure was compared in the vessels of the two arms in cases of

thoracic aneurism, and not infrequently valuable information was found in the great reduction on one or other side. Naturally it shows best in cases in which the sphygmograph or the finger shows feebleness of the pulse on one side. O. K. Williamson has made a very careful study of this condition in 30 cases and finds that while the arterial blood pressure in aneurism is either normal or slightly above normal, in a majority of cases of thoracic aneurism there is a marked difference in the blood pressure in the two arms, and when this is greater than 20 mm. it is a point in favor of aneurism. He finds the sphygmomanometer much more sensitive than the finger.

Percussion.—When the aneurism reaches the chest wall impairment of resonance shading to flatness is a common physical sign, detected most commonly to the right of the sternum, upon the manubrium, to the left of the sternum in the subclavian and mammary areas, and in the left interscapular region behind. When the sac is closely surrounded by a lung the impairment of resonance may be very slight and only brought out on deep percussion. In large tumors the compression of the lung may lead to shades of tympanitic notes.

Auscultation.—Over an aneurismal sac what one hears will depend very greatly upon the degree of lamination with fibrin and the state of the aortic valves. Usually the heart sounds are transmitted loudly into the sac, the first dull and thudding, the second clear, ringing, and accentuated, relatively louder, as a rule, than the first. This diastolic sound may be the only one audible, and when present is a very valuable diagnostic sign. Adventitious sounds are not always heard. It is surprising, indeed, in how many aneurisms a murmur is not heard. A systolic bruit is common, and it may be transmitted to the vessels of the neck. The diastolic murmur is less frequently heard, and is present when the aortic valves are insufficient or the ring dilated. Sometimes it is caused in the very large sac itself. A to-and-fro double murmur is not uncommon. A continuous humming-top murmur, with systolic intensification, is present when the sac has opened into one of the large vessels or communicates with one of the chambers of the heart.

A systolic murmur is not uncommon over the trachea, and David Drummond pointed out that it may sometimes be heard at the open mouth.

State of the Heart.—Large sacs of the arch displace the heart downward and to the left, and cause it to assume a more transverse position in the chest. This is usually very well seen in the x-ray pictures. A very large aneurism growing downward may gradually dislocate the heart and occupy its position, as in the remarkable case reported by Gee. Aneurism of the descending thoracic aorta growing forward may flatten the heart somewhat and give a widespread and very diffuse sort of pulsation in the cardiac area. As a rule, the heart is not enlarged. With the co-existence of aortic insufficiency, dilatation and hypertrophy of the left ventricle are present, and associated conditions, such as arteriosclerosis of the small vessels and contracted kidneys, may cause hypertrophy. But, as a rule, the heart is not enlarged in aneurism of the aorta. Yet occasionally, without any obvious reason, the heart may be voluminous. The writer reported the case of a man aged forty years, with a large saccular aneurism of the descending aorta, in whom the signs of hypertrophy of the heart during life were very marked. At postmortem the organ was found to be greatly enlarged. There was no valvular disease. The left ventricle was much dilated and

hypertrophied, the chamber measuring, from aortic ring to apex, 12 cm. and the walls from 15 to 20 mm. in thickness.

Symptoms.—*Of aneurism of the aorta in general:* In many cases the condition is *latent*. Those who have seen much medicolegal work appreciate the great frequency of sudden deaths from this cause in apparently healthy individuals. The latent aneurisms are the small, rapidly growing sacs in or just above the sinuses of Valsalva. The small, dissecting aneurisms with rupture, more rarely the ordinary aneurism of the arch reaches a considerable size without symptoms or physical signs. It seems scarcely credible, and yet an aneurism of the arch may penetrate the chest wall and form a tumor the size of the top of a lemon without the patient suffering any serious inconvenience.

The symptoms and physical signs of thoracic aneurism are to a certain extent antagonistic. A patient with the most characteristic physical signs may have no symptoms; one with every symptom may have no physical signs. Hence, Broadbent's useful division into *Aneurism of Symptoms* and *Aneurism of Physical Signs*. As a rule, both features are combined. The symptoms may be considered under the three groups, functional, symptoms caused by compression, and certain special features.

(a) *Functional.*—A sac of moderate size interferes little, if at all, with the work of the heart, so that enlargement does not necessarily occur, and when present is usually the result of aortic insufficiency, relative or valvular. Palpitation of the heart, and irregular, unpleasant throbbing may be complained of. During a sudden exertion fainting may occur. Disturbances in the functions of the organs, due to lack of blood supply, are not very common. One carotid may be obliterated without any cerebral disturbances. Hemiplegia, however, may occur. The writer has never seen an instance in which imperfect blood supply to the upper extremities was associated with either paresis or intermittent claudication. But aneurism of the thoracic or abdominal aorta or its branches may be associated with intermittent claudication, and it was in a case of aneurism of the internal iliac that Charcot described first this condition in man.

The *pain* in aneurism is usually attributed to the stretching of the nerves about the aorta and on the sac, but it may be largely due to changes in the artery itself, which has a rich nerve supply. We know that local conditions in the intima may cause agonizing pain, particularly the plug of an embolus. The writer once went into a house for a consultation, a doubtful case, just as the young man had an embolism of the left femoral. He was howling in agony, and could not bear to have the spot touched. Thoma refers to the early pain in the chronic aortitis which leads to dilatation of the arch and attributes it to the involvement of the Pacinian bodies in the adventitia.

Alan Burns, too, called attention to the pain in arterial disease. Attacks of severe angina pectoris may occur in the early stages of aortic aneurism. The cases are met with in comparatively young men who have had syphilis, and the paroxysms may be of great severity and of frequent recurrence. The physical signs may be negative, and it may be a year or more before aneurism is suspected.[1] In other instances there are well-marked signs of aortic insufficiency. A feature of very great interest in certain of these cases

---

[1] For group of cases, see *Medical Chronicle*, 1905.

is the complete disappearance of anginal attacks with the use of iodide of potassium.

(b) *Symptoms of Compression.*—An aneurism may grow to a large size without causing inconvenience. Whether active symptoms of compression are caused depends on the situation of the tumor and on the direction of its growth. From the ascending and terminal portions of the arch tumors extending laterally are much less likely to interfere with neighboring structures, and the largest tumors arise from these portions. The space between the posterior wall of the sternum and the spine at the level of the aorta is only a few centimeters, so that aneurisms growing from the transverse portion of the arch cause early signs of compression.

The chief symptoms of aneurism are those of tumor, and arise from interference with neighboring parts by compression. The following are the more important structures involved: (1) *Nerve trunks and plexuses:* Pain due to stretching and pressure on the nerves is a common yet a very variable feature. A huge sac may erode the chest wall without causing any serious inconveniences. The pain presents very different characters. As already mentioned, there may be attacks of angina pectoris associated with an aortitis, and the beginning of the formation of the aneurism. More commonly, it is of a dull, heavy character, deep seated, and greatly aggravated in certain positions. It may present the features of a cervicobrachial neuralgia; in other cases, of an intercostal neuralgia of great severity and persistence. Sometimes the pain shoots down the arm, and there may be numbness and tingling as far as the finger tips. Erosion of bones is usually associated with pain of a very intense boring character, but the sternum and adjacent cartilages and ribs may be eroded and perforated without causing any distress. On the other hand, the spinal column when compressed is a source of persistent and terrible pain. Sometimes it is of the well-marked character of nerve-root pains, such as we see in secondary carcinoma of the spine, but in other cases it is different—a deep-seated, boring intense agony only relieved by maximum doses of morphine. These terrible tragedies of pain are most common in aneurism of the lower thoracic and abdominal portion of the aorta. The corresponding skin areas of Head may be sensitive to touch, in the region of the nipple, along the left sternal border, and over the neck.

Compression or irritation of certain nerves may cause special symptoms. Irritation of the *phrenic* may be associated with hiccough. Symptoms arising from compression of the pneumogastric are not often met with. Some have attributed to this cause the attacks of nausea and vomiting which occasionally occur, and the recurrent dyspnœa, but this does not seem to be very likely.

Pressure on the *sympathetic* has already been considered in speaking of the physical signs. It does sometimes occur with the characteristic features, namely, flushing of one side of the face with increased heat, sweating, dilatation of the pupil, and slight drooping of the eyelid. This is, however, a rare combination. It has already been mentioned that the difference in size of the pupils is most frequently a question of tension in the ophthalmic arteries. Unilateral sweating is probably the most characteristic sign of compression of the sympathetic. This interesting feature, first noted by Gairdner, is usually confined to the sides of the face and neck, toward which the aneurism projects, and more frequently on the right side than on the left. The writer

has seen it on the side opposite to that in which the aneurism is bulging, but it is not always possible to say how far the sac may extend on either side of the middle line, and it is a very short distance from the aorta to the cord of the sympathetic. The sweating may extend to the arm and side of the chest and the skin of the right hand may be like that of a washerwoman's. Instead of being flushed and of a higher temperature, the skin on the affected side may feel cold and be several degrees lower than the opposite side. The skin of the face may look pale, and sometimes the hand and arm of the affected side is quite pallid.

The Recurrent Laryngeal Nerve.—Pressure on this nerve is a common event in aneurism of the arch, around which the left nerve curves, and it may occur with very small tumors. The right nerve may be involved in a large sac springing from the ascending aorta and the transverse arch. The symptoms caused are very important: (*a*) Alteration in the voice, which has a cracked character, often sufficient to attract the attention. Sometimes the change is very slight, but in others it is most striking. Actual aphonia is rare, although the voice may be reduced to a whisper. Most commonly the voice is that of a unilateral paralysis. (*b*) A peculiar quality of the cough, which becomes ringing, "brassy," or croupy. It differs from the cough of tracheal or bronchial compression, which is dry, harsh, and grating, and is usually accompanied with dyspnœa. (*c*) In rare instances there is painful spasm of the muscles of the larynx and pharynx, and even of the œsophagus. (*d*) Attacks of dyspnœa, which may occur with unilateral paralysis, are more common when both nerves are affected, as they may be by two aneurisms, or in rare instances by an ascending neuritis and extension to the nucleus of the other nerve.

Œsophagus.—Dysphagia is a very common and, with the small tumor from the posterior part of the arch, an early symptom. It is rarely extreme, but it may prevent the patient from taking solid food. Perforation of the œsophagus and fatal hemorrhage may occur without any previous difficulty in swallowing. The results of the compression may be necrosis of the wall without perforation. Ulceration may occur over the point of greatest compression. When the sac perforates directly into the gullet there is fatal hemorrhage; sometimes the orifice is temporarily blocked by a clot.

Trachea and Bronchi.—The most common and characteristic features of aneurism are associated with irritation and compression of the air passages. The condition may at first be mistaken for asthma. *Cough,* one of the earliest symptoms, is due in a great many cases to tracheal irritation, more particularly when the sac is in the neighborhood of the bifurcation. When there is simple compression, anything that lowers the tension in the sac benefits the cough, and ten days in bed may cause its disappearance. On the other hand, the slightest exertion may bring it on. In other cases the cough is due to a tracheitis, and the mucous membrane is found swollen and reddened and there is a great increase in the secretion. There is a difference in the character of the cough in the two conditions. In one it is dry and wheezing, nothing is brought up, but in the other there is a very large amount of expectoration. The peculiar, brazen quality of the cough in aneurism is laryngeal, not tracheal.

Dyspnœa.—Aneurismal dyspnœa presents the following characteristics. In the first place there may be the ordinary shortness of breath associated with the growth of a large intrathoracic tumor, but without any signs of direct

compression of the trachea. Aneurismal dyspnœa resulting from this cause is infralaryngeal, with all the qualities of this type so thoroughly discussed by Grossmann[1] in his well-known study on tracheal stenosis. All grades of it are met with. In the aggravated cases there is an orthopnœa with prolonged inspiration, often noisy, sometimes with a marked stridor, or a fine sibilant sound. Expiration is shorter and not so noisy. While the difficulty of breathing is constant, there are paroxysms in which the intensity is greatly increased and the patient feels, as Morgagni expresses it, as though a cord was being tightened about the windpipe. Retraction of the tissues at the root of the neck, the epigastrium, and the costal borders is usually present. Gerhardt called attention to the limitation of vertical movement of the larynx in tracheal stenosis: "In spasmodic and stridulous breathing laryngeal movement of less than one centimeter is a certain sign of tracheal or tracheo-bronchial stenosis." Very often these patients are admitted to the hospital in terrible paroxysms, and it may not be easy to determine whether the narrowing is laryngeal or not. If a laryngeal examination can be made it is not difficult, but otherwise it is not at all easy. The cracked voice, the brazen character of the cough, the quality of the stridor, whether over the larynx or lower in the course of the trachea, the degree of movement of the larynx in inspiration, are important points.

Compression of Bronchus.—An aneurism may narrow one or other main bronchus without seriously compressing the bifurcation, or only the branch going to one or other lobe may be involved. This may produce a picture in which the true nature of the disease is obscured. In gradual compression the condition of atelectasis may follow with subsequent sclerosis. This does not often happen to an entire lung, but it may to a lobe or part of a lobe. The narrowing results in retention of secretion and intense bronchitis, sometimes with expectoration of large quantities of muco-pus. Dilatation of the bronchi may supervene, but more common and deceptive is the gradual invasion of the lung tissue itself, so that the organ becomes consolidated, the bronchi filled with pus, sometimes quite inspissated, and the lung infiltrated, perhaps here and there a cavity formation. The whole process resembles tuberculosis, for which clinically the cases are mistaken. There may be areas of consolidation and bronchiectasis in both lungs as a result of tracheal compression. At the Montreal General Hospital the late George Ross used to speak of this condition as "aneurismal phthisis," and the writer has seen four or five cases in which the diagnosis of consumption had been made.

Lung.—The growing sac may push aside the lung and compress the upper lobe without causing anything more than slight atelectasis, expressed clinically by the very important physical sign of feebleness or absence of breath sounds. But the sac may grow directly into the lung, the tissues of which form its actual wall. Under these circumstances, if the sac is small and grows from the terminal part of the arch into the left apex, and if hæmoptysis is present, the case is of course mistaken for one of tuberculosis. The writer saw two such instances in 1907, one at the Royal Victoria Hospital, Montreal, with Dr. John McCrae, the other at the Radcliffe Infirmary, Oxford, with Dr. Mallam. In neither was there any suspicion of aneurism. In both there was fatal hemorrhage. In other instances the aneurism grows into the lung, and in the formation of a large sac repeated small hemorrhages

[1] *Wiener Klinik*, 1890.

occur. Complete consolidation may follow. There is a specimen in the McGill Museum of an aneurism which occupies a large portion of the centre of the left lung, and which had become obliterated by thrombi.

Bloodvessels.—Considering how close in many cases the aneurism is to the great veins, it is surprising how rare are severe symptoms due to compression of the superior vena cava. The pressure may be exerted on the vena cava itself, on the innominate, or on one of the subclavian veins. It is not very uncommon to meet with congestion of the veins of the neck and head, and sometimes one or other arm is swollen. All this may disappear completely after a copious bleeding or after a week's rest in bed. The small aneurism of the ascending portion of the aorta growing to the right may compress the vena cava very early, even before physical signs are apparent. It is in this situation particularly that the most marked effects of compression from aneurism are seen. Narrowing of the lumen is the most common event, and throughout the course of the disease there is more or less fulness of the veins of the head and upper extremities. Rupture of the aneurism into the superior vena cava is followed by remarkable signs and symptoms, which will be discussed under the section of arterio-venous aneurism. The gradual compression may lead to thrombosis and complete obliteration of the superior cava. Of the 29 cases which the writer collected in a paper on obliteration of this vein, 4 were associated with aneurism. The picture is usually a very striking one, owing to the enormous development of the collateral circulation. This is carried on through a number of channels: (1) If the obliteration is above the point of entrance of the vena azygos, a large amount of blood from the arms and trunk finds its way into this vein through communications of the intercostals with the internal mammaries. (2) Over the surface of the chest the plexus of mammary veins enlarges and the subcutaneous tissues may be swollen, and the entire front of the chest is occupied by a system of greatly distended veins. These may be seen in and beneath the skin forming tortuous channels the size of the finger and converging to two or three large vessels which unite with the epigastrics. On the front of the abdomen are seen large convoluted vessels which empty below into the femoral veins. In some cases the venous plexuses are entirely subcutaneous. In others the veins of the skin itself are dilated and give the general surface a purplish red hue. So distended may the superficial mammary veins become that in the large sinuses thrombi form which may ultimately calcify, forming vein-stones. (3) Extensive communications exist between the deep cervical and the vertebral veins with the intercostals and the whole network of veins along the front of the spine. These communicate freely with the branches of the azygos, or when the orifice of that is obliterated numerous channels are established between the lumbar vessels and the territories of the inferior vena cava.

The *inferior cava* is less often compressed. The *innominate vein* or one *subclavian* may be narrowed, rarely obliterated, causing great engorgement of the hand and arm. The *pulmonary artery* may be narrowed or perforated. Gangrene of the lung has been caused by compression of the vessels. *Compression of the vena azygos* may cause œdema of the chest wall or effusion into the right pleura. The *thoracic duct* may be involved in any part of its course, but symptoms due to this complication are rare. Morgagni noted the great dilatation of the abdominal lymph vessels with varices and lacunæ in a case of aneurism of the thoracic aorta.

Spinal Cord.—In a few instances the bodies of the vertebræ have been destroyed and the spinal cord directly compressed by the sac, causing paraplegia. Rupture has occurred into the spinal canal. The paraplegia may be due to blocking of the aorta, which causes anemia of the cord such as follows ligation of the vessel experimentally.

Special Symptoms.—*Hæmoptysis.*— Latent tumors growing backward from the transverse arch may rupture into a bronchus or the trachea, causing early and fatal hemorrhages. More frequently there are well-marked signs, and the bleeding may be of very different characters. With pressure and a granular tracheitis, bloody sputa may occur for weeks and gradually disappear. Brisk hemorrhage almost always comes from an open erosion, but it is not necessarily directly fatal. The laminæ may be within the lumen of the trachea, and through small chinks and crevices the sac may "weep" at intervals, or continuously for weeks and months. There are remarkable cases in which in the course of a few weeks numerous hemorrhages occur. T.W. Clarke reports a case of this kind in which sixteen hemorrhages occurred between July 23 and September 15, the amount of blood ranging from a few ounces to 36 ounces at each bleeding, a total of 14 pints in seven and a half weeks. A saccular aneurism was found projecting upward and backward into the upper lobe of the right lung, which incased two-thirds of its extent, occupying nearly the whole of the upper lobe of the lung; into it small bronchi could be directly traced. Rupture occurred into the right pleura. Death may not follow for months or even years. A patient of Dr. Fussell, with aneurism, upon whom the writer lectured in Philadelphia, lived for four years after a severe hæmoptysis. The famous surgeon, Liston, had, in July, 1847, a feeling of constriction at the top of the windpipe and slight difficulty in swallowing. A profuse hæmoptysis, 30 to 40 ounces, nearly killed him. Liston himself suspected aneurism, but neither Watson nor Forbes could discover anything in his chest. He was greatly relieved by the hemorrhage. In October the symptoms returned, but it was not until December 6 that he died in a paroxysm of dyspnœa. The trachea was perforated, but the orifice was blocked by firm laminæ of fibrin. The small tumors growing upward into the apex of the lung on either side may be associated with repeated hemorrhages, and the diagnosis of tuberculosis is usually made.

Modes of Perforation.— 1. *External.*—As the sac enlarges, the wall of the thorax is perforated, the tumor appears beneath the skin, and may reach an enormous size. Finally the skin becomes reddened, a spot of necrosis forms, slowly increases, the aneurism at first "weeps," and finally bursts with fatal hemorrhage. Considering the large number of cases in which the chest wall is perforated and the skin eroded, fatal hemorrhage from this cause is comparatively rare. The sac may be very voluminous, as represented in Fig. 50, which shows a negro with an aneurism of the descending thoracic aorta. Lined as it is with firm thrombi, the sac may perforate the skin without any hemorrhage, and the patient may live for months and die of internal rupture. William Hunter reports the case of a man with an aneurism perforating to the right of the sternum, in whom the sac bled for weeks at intervals from an orifice plugged by a coagulum which protruded and retracted with the systole and diastole of the heart. A sudden cough burst out the plug, and "the blood gushed out with such violence as to dash against the curtain and wall, and he died not only without speaking but

without a sigh or groan." The writer has seen a sac "weep" for months; in one patient it became infected with the *Bacillus capsulatus aërogenes*, and the patient died of a general infection. It is remarkable how much a sac presenting externally may vary with the condition of the patient. Prolonged rest in bed, bleeding, wiring, may reduce the size, and we have had instances in which the external tumor has completely disappeared. Great relief may be obtained by a carefully adapted bandage, but it must not be too tightly applied. Some years ago the writer saw a physician with a very large sac projecting beneath the right clavicle, for the support of which he wore a very ingeniously devised pad. Lancisi refers to a case in which for a tumor in the same region the surgeon ordered a kind of truss to restrain it, but the sac

Fig. 50
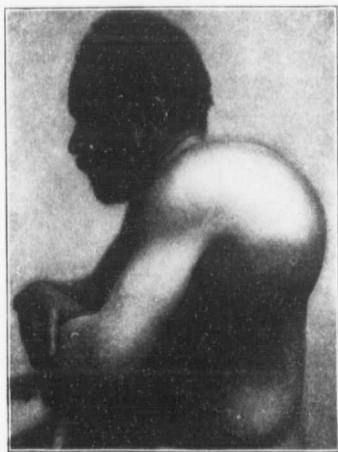
Aneurism of the descending thoracic aorta.   (Photograph taken by I. C. Skinner, M.D., of Selma, Alabama.)

burst internally. By far the most common site of external perforation is to the right of the sternum. A prominent sac may disappear completely after external rupture (Morgagni).

2. *Perforation into the Trachea or Bronchi.*—Already under the section on hæmoptysis this has been referred to, and it is perhaps the most common of all localities. It usually takes place in the lower third of the tube, and the orifice may be single or double. By pressure the wall is gradually eroded; a small, rapidly growing sac may perforate before there have been any special symptoms; more commonly there is an irritative cough and the characteristic dyspnœa. As already mentioned, the perforation is not necessarily fatal, and the symptoms may be, as in Liston's case, greatly

relieved by the hæmoptysis. The orifice may be closed by firm thrombi, and months or even years may elapse before final perforation takes place. In one case under the care of the writer there were two perforations, and the patient died of a third one into the œsophagus. The left bronchus is more frequently involved than the right, more frequently, indeed, than the trachea itself.

3. *Rupture into the Lung.*—This has already been discussed in speaking of the pulmonary features. The lung tissue itself may form a large part of the wall of the sac, and it is particularly aneurisms of the terminal portion of the arch and the first part of the thoracic arch that tend to grow into the upper lobe or invade the central portion of the lung. Slight and recurring hæmoptysis may occur, and the diagnosis of tuberculosis is sometimes made. The writer has not met with an instance of fatal hemorrhage unless the sac opened into a bronchus. There may be a very large sac almost completely consolidated within the lung substance itself. A brief reference to the Index Catalogue (both series) under Aneurism gives a good idea of the great frequency of rupture into the trachea, bronchi, and lungs.

4. *Œsophagus.*—This is not so common, and there were only 9 cases among 226 of Crisp's series. The rupture takes place usually by gradual erosion, which has sometimes been preceded by local necrosis and gangrene. Dysphagia usually precedes the perforation, but in small sacs the rupture may take place suddenly in individuals in excellent health. The writer has reported such an instance in a woman, aged thirty-five years who died in syncope. The aneurism was only 5 by 5 cm. in extent, and communicated by a linear slit 1.5 cm. in length with the lumen of the aorta. It is not uncommon to find the œsophagus stretched over the wall of the sac, closely adherent, and the muscular layers much wasted. The cases in which ulceration and gangrene precede the rupture are of special interest, since cancer of the œsophagus may be suspected. In the Index Catalogue, second series, there are 17 cases of perforation of the œsophagus noted. It may take place simultaneously into the bronchus or trachea and the œsophagus. The coats of the œsophagus may be split and the blood pass between them and burst into the stomach, as in a case reported by Frederick Taylor.

5. *Rupture into the Pericardium.*—This is one of the common causes of sudden death in robust, apparently healthy men. Medicolegal records of large cities show the very great frequency of this accident. The perforation may be of a small sac of one of the sinuses of Valsalva, or there is a tear of the intima with a small dissecting aneurism and rupture of the external coat, or the intrapericardial portion of an aneurism of the ascending portion of the arch gives way. The rupture may be pinpoint in size or a large transverse tear. In a few cases a small mycotic aneurism bursts. Death takes place with suddenness. There are instances on record in which the patient has lived for some hours.

6. *Other modes of rupture* are on record—into the anterior or posteror mediastinum, the muscles of the neck, and into the vessels and heart, which will be referred to in the section on Arterio-venous Aneurism.

The conditions under which rupture may occur are important. When the individual is at rest or sleeping the fatal event may happen. More often, the rupture is during some exertion, while straining at stool, or in a scuffle, or while under an anæsthetic. The dangers of coitus were referred to by Morgagni, who says that many patients die in this way.

Fig. 51

Fig. 52
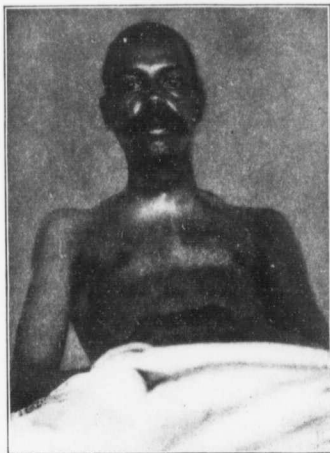
Side and front view of a thoracic aneurism just beginning to "point."

Pleura.—Hydrothorax is not very uncommon, and may be a pressure effect on the azygos veins, and it is more frequent on the right side than on the left. It may complicate the diagnosis, and sometimes recurs repeatedly. The bloody serum may be present as an effect of pressure on the veins. Acute pleurisy, usually tuberculous, may be a terminal event. In a few cases aneurism has been complicated by empyema.

Descending Thoracic Aneurism.—Aneurism of this portion presents a few special features. It is rarer than in the abdominal aorta. If we add the statistics of Crisp, Lebert, and Myers, this portion was involved in 49 against 159 of the ascending, 113 of the arch, and 83 of the abdominal aorta. It was only involved in 3 out of 64 cases of aneurism of the aorta among 2200 autopsies at the Johns Hopkins Hospital.

Symptoms.—There may be no symptoms whatever; the first indication may be a sudden syncope from internal hemorrhage, vomiting of blood or hæmoptysis. Three out of the 14 cases described by the writer were latent. A second feature is the intensity and the peculiar character of the pain. Owing to the close relation of the aorta to the spine and the frequency with which the tumor grows backward, pain in the back and along the sides from pressure on the nerves is usually *the symptom* of the case. Erosion of the spine to an extensive degree may occur without pain, but this is rare. Some of the patients are never without it for a moment, except when under the influence of morphine, of which one patient took for a long period as much as between 30 and 40 grains a day. There may be nothing in the case but the *pain*. Perhaps to the left of the spine there is heard a soft systolic murmur, or there are feeble breath sounds in the left lung, but it may be months before there are any physical signs. The third special feature is the prominence of the pulmonary symptoms due to pressure either on the lung itself or on the main bronchus. Hemorrhage occurred in only 3 of 14 of the writer's cases; it may be due to a direct weeping through the lung tissue, or it is a terminal hæmoptysis due to perforation of a bronchus. The whole lung may be compressed by an enormous aneurism, or the bronchus may be blocked with the production of purulent bronchiectasis, and the patient may present the symptoms of extensive destruction of the lung. And lastly, some writers have referred to pressure on the gullet as a special feature of aneurism of this part. It was present in only two of the writer's cases and in only one did rupture take place into the œsophagus. The tumor may grow to an enormous size, as in the famous case[1] in which the patient lived for twelve years and the greater part of the left chest was occupied by a nonpulsating tumor.

Abdominal Aorta.—The *incidence* varies in different localities. Sixteen cases occurred among about 18,000 admissions to my wards. The ratio of abdominal to thoracic aneurism was 1 to 10. Among 2200 autopsies at the Johns Hopkins Hospital there were 11 instances of aneurism of the abdominal aorta. The Guy's Hospital figures have been collected by the late J. H. Bryant for the years 1854–1900; among 18,678 necropsies, there were 325 cases of aneurism of the aorta, of which 54 (or 16 per cent.) were of the abdominal portion. Males are much more frequently attacked than females. Only 2 of the writer's 16 cases were females, and all statistics indicate this infrequency in women, a point to be borne in mind, as the

---

[1] *Deutsch. Arch. f. klin. Med.*, Band xix.

throbbing aorta is so much more common in them. A majority of the patients are young men. In 63 per cent. of Bryant's series they were under forty years of age, and in 2 the disease began before the twentieth year.

It is most frequent in the upper portion of the abdominal aorta, and it is usually of the saccular form. Rupture into the retroperitoneum is common, forming the diffuse or false aneurism, which may reach a colossal size. A huge sac may occupy one-half of the abdomen and project in the back, forming a tumor the size of the head.

Symptoms.—In no situation are the symptoms of aneurism so obscure, and even when pulsation is present the diagnosis is not easily reached. This is well brought out by Bryant in the analysis of the Guy's Hospital statistics: "A correct conclusion during life as to the nature of the disease was arrived at in 18 only out of the 54 cases on which this lecture is based, an analysis showing that an abdominal tumor was detected in 31, pulsation in 35, expansile pulsation in 8 only, and in 26 a systolic murmur. Incorrect diagnoses of a variety of diseases were made, including malignant tumors lying in front of the aorta, renal calculus, lead colic, spinal caries, sarcoma of the kidney, nephritis, perinephritis, pneumothorax, pleuritic effusion, epithelioma of the œsophagus, malingering, chronic intestinal obstruction, etc."

Pain, usually the first indication, remaining throughout the special feature and reaching an intensity not met with in any other disease, presents three features of importance. It is usually of a constant, dull, boring character, particularly when the aneurism has eroded the spine. There may be paroxysms of the greatest intensity for months before a diagnosis is made. And lastly, when the aneurism ruptures into the retroperitoneal tissues, the pain with other features may give to the case the characters of the acute abdomen. The writer knows of at least four cases in which the operation for appendicitis was undertaken. Nausea and vomiting may be early and severe symptoms. In one of the cases there was great dilatation of the stomach due to pressure upon the duodenum. In another there was great dilatation of the œsophagus owing to pressure at the cardiac end of the stomach. The aneurism may rupture into the stomach, duodenum, or colon, into the retroperitoneal tissues, which is the most common mode, or pass upward and rupture into the pleura. The peritoneum, the bladder, or the inferior vena cava may be perforated. Embolism of the aorta below the sac may occur, or one femoral may be blocked with the result of gangrene of the leg. The writer has not found a case of external rupture. Embolism of the superior mesenteric artery may occur with infarction of the bowel.

ARTERIO-VENOUS ANEURISM.

A communication between artery and vein with or without an intervening sac. In the one case the term *aneurismal varix* is applied, and in the other, when a sac is formed between the two vessels, *varicose aneurism*. Although chiefly a surgical affection, met with in the peripheral arteries, it occurs in the internal vessels and has important medical bearings.

William Hunter, in 1757, described a particular species of aneurism following the simultaneous opening of an artery and a vein, in consequence of which the latter became dilated and varicosed, and had a pulsatile, jarring

motion with a hissing noise. He described several cases which occurred from unskilful venesection at the bend of the elbow. The observation was not new; from the time of Galen it has been known that aneurism might follow unskilful venesection at the bend of the elbow, but Hunter recognized it as a special form. The monograph of Breschet[1] and the work of Broca[2] are of great value; indeed, there is not a better description in literature than that given in the latter.

Traumatic.—These cases have a surgical rather than a medical interest. While in the internal vessels the communication is usually direct, in the larger external trunks there is more often the intervention of a sac. Formerly, venesection at the bend of the elbow was the common cause, and the communication existed between the brachial artery and the vein. Now the cases are chiefly the result of stab wounds and of bullet wounds. Military surgeons state that with modern bullets the lesion has become more common. The experience of the South African War is given by W. F. Stephenson[3] in a Government Report, and of the Russo-Japanese War by Siago.[4] The recent work of Matas[5] and the extraordinary technique in arterial surgery developed by Carrel (Rockefeller Institute Publications, New York) should lead to greatly improved results.

The vessels most commonly involved are the femorals, subclavians, axillaries, brachials, and popliteals. So much higher is the arterial than the venous blood pressure, that when an artificial communication exists between vein and artery, the former with its branches becomes permanently distended. The obstruction offered to the free return of blood makes the distention of the collateral veins still more marked. The orifice of communication may be small and slit-like or oval, and, as already stated, a sac may exist between the two vessels. In many cases the communication is direct. The anatomical changes are chiefly in the veins, which become greatly enlarged, varicosed, with thickened walls, and frequently present flakes of atheroma in the intima.

The three distinguishing features of this aneurism are: (1) The swelling of the part caused by the distention of the veins. When only the deeper vessels are involved, they may not be visible externally, but, as a rule, large varicose vessels are to be seen. In the case of arterio-venous aneurism of the femorals or iliacs the engorgement of the veins may be enormous. In no condition do we see such huge saccular dilatations. In the annexed figure one of these is shown forming a large tumor just above Poupart's ligament. In the veins and in the large venous sinuses pulsation may be visible, but, except close to the arteries, it is not forcible. (2) On palpation a vibratory thrill is felt, of maximum intensity over the position of the orifice, but widely diffused, and in the case of an aneurism of the axillary vessels, to be felt as low as the palm of the hand, and in the case of an aneurism of the femoral vessels, to be felt as low as the foot, and even to the crown of the head. In the large bunches of subcutaneous veins, the calcified walls and occasionally phleboliths may sometimes be felt. When a sac intervenes between the artery and the vein, it may be felt, and presents aneurismal pulsation, forcible

---

[1] *Mémoires de l'Académie de Médecine*, 1833.   [2] *Des Aneurismes*, 1856.
[3] *On the Surgical Cases, etc.*, 1905.
[4] *Deutsch. Zeit. f. Chir.*, Band lxxxv.
[5] *Journal of the American Medical Association*, 1902, vol. xxxviii, p. 103.

and expansile. (3) On auscultation there is heard everywhere over the aneurism and up and down the limb a "bruit de diable" of great intensity. An interesting point is the fact that one of the earliest instances recorded of auscultation was in a case of varicose aneurism reported by Mr. White, a surgeon at York, in a letter to William Hunter. He states, "On applying my ear to the tumefied basilic vein, the pulsation, tremulous motion, and noise are distinctly perceived." The murmur is continuous, with systolic intensification.

The condition may remain stationary for years. Spontaneous healing does not occur. There may be progressive increase in the veins, leading to enormous varicosity and to great disability, and it is for this that relief is sought. Rokitansky reports a case of a man, aged sixty-two years, who thirty-three years before had had a bullet wound in the left shoulder. There were uneasy feelings in the arms at times, but only for two years had it increased greatly in size and become blue-red and œdematous. This progressive enlargement of the veins is really the chief danger. At the age of fifteen

FIG. 53

Arterio-venous aneurism of the iliac vessels.

years a young man fell and forced a lead-pencil into his axilla. This was followed by a gush of blood, and in a few moments the arm began to swell and became black and blue to the wrist. He gradually got better, but there was always a swelling in the armpit and infraclavicular region. It did not, however, interfere with his work or exercise. Ten years after, when the writer saw him, he had well-marked signs of arterio-venous aneurism of the axillary vessels. He was athletic and had rowed in races. He has been seen at intervals since, and there is practically no change in the arterio-venous aneurism. He subsequently served in the South African War, and was invalided for aneurism of the shoulder! The writer heard of him last in 1901, which was twenty-three years after the accident. Broca mentions two interesting circumstances: the greater growth of the limb below a femoral aneurism of this kind, and the increased growth of hair on the skin, both the result of the venous engorgement.

Internal Arterio-venous Aneurism.—While rare, this form is of great interest.

1. **The Aorta and Superior Vena Cava.**—This gives a very remarkable picture. One morning, at the hospital of the University of Pennsylvania, a Chinaman, aged forty-eight years, was admitted in a condition of extreme dyspnœa, with the skin of the face and arms cyanosed, the eyes suffused, and the whole upper part of the body engorged and œdematous. He presented an extraordinary appearance on account of the contrast between the upper and lower part of the body. The writer had never seen a similar picture. The case, which was under the care of his colleague, Pepper, excited a great deal of interest. The most striking physical signs were: a loud thrill over the præcordia, a continuous "humming-top" murmur, with marked systolic intensification, which was heard best over the base, and was transmitted into the vessels of the neck and down the arm as far as the elbow. The patient lived for two weeks, with extreme orthopnœa and an increase of the œdema of the upper part of the body; so intense was the infiltration of the blood-vessels of the conjunctiva that blood oozed. The writer made the autopsy with Crozer Griffith, who, in conjunction with Dr. Pepper, has reported the case very fully.[1] A small aneurismal sac of the ascending aorta had perforated the superior vena cava. A second case at the Johns Hopkins Hospital, in 1899, presented an almost identical appearance.[2] The patient's face was enormously swollen and blue looking, like a man who had been strangled. There was the same extraordinary contrast between the upper and the lower part of the body. In the second right interspace was heard a loud, continuous murmur, with marked systolic intensification. The patient had had syphilis two years before, and although there were no signs of aneurism, there could be very little question as to the nature of the trouble.

The first report of a case of this kind was by John Thurnam,[3] whose paper on these internal arterio-venous aneurisms was the first and is one of the best in literature. A man aged forty-one years, had sudden swelling and cyanosis of the upper part of the body, with a loud "bruisement," like the vibration of a string, on the right side of the sternum. At postmortem an aneurism of the aorta was found to have perforated the superior vena cava. Pepper and Griffith collected 28 cases of this lesion, and there have been a good many reported since the appearance of their paper. The symptoms are quite distinctive: (1) cyanosis, œdema, and distention of the veins of the upper part of the body, with signs of obstruction in the tributaries of the superior vena cava; (2) suddenness of the onset of the symptoms; (3) evidence of the presence of a tumor in the thorax, (4) the existence of a murmur characteristic of a communication between an artery and a vein.

2. **Aorta and Pulmonary Artery.**—This is rather more frequent, and the condition has been carefully studied by Frederick Taylor and Gairdner; Kappis,[4] from Baümler's clinic, has collected 30 cases. The symptoms are not unlike those of perforation into the superior vena cava and are characterized by a sudden onset with cyanosis and œdema, which, however, are not so accurately limited to the upper half of the body, as in the cases of perforation into the superior vena cava. Signs are usually present of aortic aneurism. A thrill is felt over the base of the heart, and there is a loud humming-top murmur, with maximum intensity to the left of the upper part of

[1] *Transactions of the Association of American Physicians*, 1890, vol. v.
[2] Notes on Aneurism, *Journal of the American Medical Association*, June 7, 1902.
[3] *Medico-Chirurgical Society's Transactions*, 1840, vol. xxiii, p. 323.
[4] *Deutsch. Arch. f. klin. Med.*, Band xc, 1907.

the sternum. Thurnam has reported a case of perforation of an aneurism into the right ventricle, which had a murmur of the same character in the second left intercostal space.

Perforation of an aneurism into one of the branches of the pulmonary artery gives rise to a similar murmur. In a case admitted to the wards in 1901, with aneurism of the thoracic aorta, there was a feeble thrill and very loud continuous murmur occupying the entire cardiac cycle, with marked systolic intensification. This was heard best to the right of the sternum. The aneurism was found to have compressed the right lung, which formed the posterior wall of the sac into which one of the main branches of the pulmonary arteries had opened.

3. **Abdominal Aorta and Inferior Vena Cava.**—This is not so common. Thurnam reports 3 cases in his paper, in all of which the perforation had taken place from an aneurism. In 1 case in J. H. Bryant's series at Guy's Hospital the vena cava was perforated. As a rule, the symptoms are well defined, namely, those of aneurism of the abdominal aorta, with sudden onset of swelling and cyanosis of the lower extremities, and œdema of the lower half of the body. The characteristic humming-top murmur is heard over the tumor.

DIAGNOSIS OF ANEURISM.

From Dynamic Dilatation of the Aorta.—That the throbbing, distended aorta, the condition of preternatural pulsation, as Allan Burns calls it, may lead to diagnosis of aneurism is an observation that dates from the time of Morgagni. It is met under the following conditions.

1. **Aortic Insufficiency.**—In young persons the degree of dilatation caused by the propulsion of a large volume of blood from a powerfully acting heart may be extraordinary. It is not very uncommon to see a slight throbbing of the aorta to the right of the sternum in these cases. Occasionally in a young man, when the insufficiency is extreme, and if anæmia is present, the degree of throbbing and the extent of visible impulse in the second and third, or in the first and second right interspaces almost compels the diagnosis of aneurism; and yet postmortem the aorta may not be beyond the ordinary size. Much more commonly the mistake arises from the throbbing and dilatation of the innominate and the right carotid. Corrigan calls attention to this in his original paper: "So strong were the pulsations for years in the region of the arterio-innominate that until the examination after death there was never even a doubt expressed that the case was not aneurism." Many cases of this sort have gone into literature as aneurism. In 1886, Hare[1] reported an interesting case of this kind. A girl of seventeen had had repeated attacks of rheumatic fever, and she had been made the subject of several clinics, at which no doubt had been expressed as to the existence of aneurism. Nor is this to be wondered at when one reads Hare's statement: "There was an egg-shaped protrusion in the suprasternal notch, very expansile and bulging with each systole of the heart, and the dilatation extended well up into the vessels." There was great hypertrophy of the heart, a double aortic bruit, and a Corrigan pulse. I had

[1] *New York Medical Record*, 1886, vol. xxix, p. 558.

repeated opportunities to examine the patient; it was not a case of throbbing of the innominate and the right carotid during ventricular systole, but there was a prominent, dilated tumor to be grasped between the fingers just above the sternal notch. Having had a lesson in a somewhat similar though not so exaggerated a case, I had learned to be very chary in making the diagnosis of aneurism in young persons with aortic insufficiency. At the postmortem it was not a surprise to find the condition had been one of simple dynamic dilatation. The heart was enormously enlarged, there was an extreme degree of insufficiency of the aortic valves, the arch of the *aorta did not admit the index finger, nor the innominate the little finger.* It is important to bear in mind that there may be a permanent fulness of the vessel, so that there is a tumor-like dilatation felt above the sternal notch or the right sternoclavicular articulation. Many of the cases of so-called aortitis and aneurism in young persons following rheumatic fever are of this nature.

2. **Dynamic Dilatation in Neurotic Conditions.**—In hysteria, in neurasthenia, and in Graves' disease the throbbing vessels may lead to diagnosis of aneurism. It is not often that the dilatation and pulsation is of the arch. Bramwell, in his work on *Diseases of the Heart*, p. 723, has reported a remarkable instance in which "pulsation and dulness in the region of the heart were so distinct as to lead Dr. Murray, of Newcastle-on-Tyne, whose diagnostic ability generally, and in aneurism in particular, is well known, to believe that an aneurism of the ascending portion of the arch of the aorta was probably present." Within a few months these physical signs "completely disappeared."

About a year ago the writer was consulted by a clergyman for aneurism of the aorta which had been confirmed by one or two physicians, and he brought an *x*-ray photograph. He was extremely neurotic, had an unusual degree of vascular excitement, throbbing of the subclavians and carotids, and a general jarring of the front of his chest. The *x*-ray photograph suggested a moderate dilatation of the arch. The condition had lasted for a couple of years, and he had become almost incapacitated. A positive assurance that he had not aneurism was followed by an extraordinary lessening of the abnormal pulsation. It is more particularly in the abdominal aorta that the abnormal aortic pulsation leads to error in diagnosis. The subjects of this remarkable pulsation are usually neurotic, sometimes definitely hysterical. They complain of pain in the back and at the occiput, and have the usual symptoms of nervous exhaustion and debility, but the special feature upon which all their feelings centre is the throbbing in the abdomen, which may be so severe as to interfere with their sleeping or even with the taking of food. In extreme cases there are pain, shortness of breath, and even remarkable attacks of hæmatemesis. It is stated that Hippocrates had noticed this pulsation, but to Morgagni we owe the first accurate description. Allan Burns[1] gives a very careful account of the condition, and quotes from Albers, of Bremen, a remarkable instance in which, associated with the throbbing, there was passage of dark blood in the stools. The association of small hemorrhage from the stomach and intestines has been described by Sidney Phillips,[2] but the writer has seen no reported case more remarkable than that of Albers. The girl was excessively neurotic, had faint-

[1] *Observations on Diseases of the Heart, etc.*, 1809.
[2] *British Medical Journal*, 1887, vol. ii.

ing fits, great palpitation in the abdomen, and an astonishing degree of violent pulsation. She had passage of blood from the bowels, and the diagnosis of aneurism was made, but a Dr. Weinhalt, who was called in, said he doubted if the pulsations proceeded from aneurism, as he had read of similar cases in Morgagni.

The points to be borne in mind in these cases are: (1) That the pulsation occurs in nervous or hysterical women, or in neurotic or hypochondriacal males. In mild forms it is common. (2) The subjective sensations may be pronounced: pain, abdominal distress, nausea, sickness, constipation, and, in some instances, the vomiting of small quantities of blood and the passage of blood in the stools. (3) The degree of visible and palpable pulsation may be extreme. The abdominal aorta is easily palpable and may be grasped in the fingers. It is sometimes tender. No definite tumor is felt. With much anæmia a thrill may be present. A soft systolic bruit may be heard, even without any pressure of the stethoscope. A mistake is not likely to occur if it is remembered that no pulsation, however forcible, no thrill, however intense, no bruit, however loud, singly or together, justify the diagnosis of an aneurism of the abdominal aorta, but *only the presence of a palpable, expansile tumor.*

3. **In Anæmia.**—In extreme anæmia from any cause the bloodvessels throb in a remarkable manner, and may suggest aneurism. This is not often the case in the thoracic aorta and its branches, but in the abdominal aorta it may be extreme. There are conditions, indeed, under which the diagnosis of aneurism seems forced upon us. The writer has often referred to an interesting experience of this kind in a case seen in 1885 with Dr. Whiteside. A large stout man, aged forty-five years, had had for some months dyspepsia and pain in the abdomen. He had become very anæmic, and the day before he was seen he had an increase of the pain. When examined he was sweating, pale, and the large, fat abdomen throbbed in a most extraordinary manner. The shock of the impulse was communicated to the patient's body, was visible everywhere from head to foot, and standing against the foot of the bed one could feel distinctly the jarring impulse communicated to it. On palpation the throbbing was violent with each systole, but it was trifling in comparison with the extent of visible pulsation. There was a loud systolic murmur, but no thrill. That evening he passed a large quantity of blood from the bowels, and though a definite tumor could not be felt, it was thought that the diagnosis of aneurism was certain. The postmortem showed a duodenal ulcer placed directly upon the pancreas. The aorta was normal. In pernicious anæmia in the vessels of the neck and in the subclavians the throbbing may be so violent as to suggest aneurism.

From Other Tumors.—These may be subcutaneous, of the chest wall, or internal. (*a*) *Subcutaneous:* It does not often happen that a tumor beneath the skin on the chest wall is mistaken for aneurism. The suspicious ones which have come under my notice have been associated with necrosis of the sternum and the formation of the cold tuberculous abscess just to the right of it. There may be communicated throbbing, more particularly if the abscess has lasted long and there is periostitis of the posterior part of the sternum directly over the aorta. There may then be a definite jarring which is visible in the tumor. The points of difference are, however, very clear. The abscess tumor is softer, and there is not an expansile, forcible impulse. The shock of the heart sounds is not felt, and there is no murmur.

More confusing are the rare instances in which the *empyema necessitatis* pulsates. Here, too, the projecting tumor between the ribs has not a strong, heaving, expansile pulsation, but it is a diffuse throb. Then the signs of empyema are usually very clear, and, if in doubt, the needle may be inserted.

The ruptured aneurism of the abdominal aorta may form a very large tumor in the back, or the blood may pass down and form a mass in either iliac fossa, which may be mistaken for abscess or for appendicitis. Nowadays, with the frequency of abdominal operations, the mistake is not uncommonly made. The writer knows of four instances in which under these circumstances operation was performed, thrice for appendicitis, once for supposed abscess. As already mentioned, in some of the very large diffuse aneurisms of the abdominal aorta there may be little or no pulsation. The older authors mention many instances in which aneurism was opened in mistake for abscess. Ambroise Paré mentions a case of a priest in whom a barber surgeon had opened an aneurismal sac, and the patient bled to death. Morgagni also gives a case.

(*b*) *Of the Chest Wall.*—It does not often happen that a tumor of the chest wall is mistaken for aneurism. Osteosarcoma of the sternum or myeloma of this bone or of the rib may form a tumor to which a jarring impulse is communicated. A vascular osteosarcoma of the sternum may have a very deceptive pulsation of its own, but the writer has not met with any such case and pulsation of a rapidly growing tumor of the rib has been seen, the other circumstances left no doubt as to its nature.

(*c*) *Internal.*—Since the symptoms caused by an aneurism are those of tumor, it is not surprising that difficulties arise in mediastinal and other growths, but these difficulties have been greatly diminished with the aid of the *x*-rays. In two groups of cases error is possible. (1) The *small, solid growth* in the posterior mediastinum connected with the glands or with the œsophagus, which presses upon the windpipe, causing cough and orthopnœa and perhaps paralysis of the left recurrent nerve, gives a clinical picture identical with that of deep-seated aneurism. Nowadays even a very small aneurismal sac may be recognized with the *x*-rays. In a case of mediastinal tumor which gives only symptoms, that is to say, when there is orthopnœa and urgent distress, but nothing to be made out on examination by ordinary means, aneurism is much more likely than new-growth. Occasionally the small tumor of the œsophagus is mistaken for aneurism. The statement is made that an œsophageal bougie, used for purposes of diagnosis, has been thrust into an aneurismal sac, but the writer has not found the record of such a case. The confusing circumstances are those in which there is difficulty in swallowing, attacks of dyspnœa, stridulous cough, and paralysis of the left vocal cord. When the œsophageal tumor is just at the bifurcation of the trachea it may form a small, hard mass involving the recurrent laryngeal and causing great difficulty in diagnosis. In a case of A. L. Scott's at the Pennsylvania Hospital, Philadelphia, in which the tumor occupied this situation, even with the *x*-rays it was not easy to determine the nature of the shadow just to the left of the vertebral column. An important point in the diagnosis of new growth is the age of the patient, which is more likely to be advanced. In the small tumor, whether of glands or gullet, the cervical lymph glands may not be involved.

The voluminous intrathoracic tumor growing from mediastinum, lung, or pleura may offer great difficulty. When situated over the aorta or over

the heart, particularly to the left of the sternum, the communicated pulsation may be most deceptive, the heaving quite localized, and there is usually a bruit. There is never the strong expansile impulse, felt directly beneath the fingers, and upon this, not upon the extent of visible or palpable impulse, stress should be laid. With venous obstruction and the anterior wall of the chest œdematous and congested, the difficulty may be very great indeed, and the associated features of the case may be more helpful than any other. An enlarged gland above one clavicle or in the axilla, the mode of onset, the age, sex, the history of syphilis, are all important elements. The *x*-ray examination is most helpful in this group, as the outline of the pulsating aorta and heart may be differentiated from the lighter shadow cast by the tumor.

On the other hand, the huge chronic thoracic aneurism may simulate tumor, as the lamination may be so dense that pulsation is absent. In a famous case,[1] Oppolzer diagnosed aneurism and Skoda tumor. The left half of the thorax was flat and there was no pulsation. The patient lived twelve years. The sac filled the greater part of the left chest. Aneurism and sarcoma may occur together, as in a case reported by Virchow in which the two were in direct connection.

From Other Forms of Pulsatile Tumor.—Not every abnormal pulsation indicates an aneurism. It may be well to mention the various forms of pulsatile tumors: (a) *Erectile tumors:* The diffuse angioma, in which all the vessels, arteries, capillaries, and veins are involved, forms a red- or violet-looking tumor when the skin itself is involved (which is usually the case), but sometimes it is entirely subcutaneous. The pulsation is diffuse, and a bruit is heard over the tumor. (b) Cirsoid aneurism, in which the arteries are chiefly involved; and in the recognition of this form there is rarely any difficulty. (c) Ordinary aneurism, true or false. (d) The arterio-venous aneurism. (e) The very vascular malignant tumors.

The last is the form of pulsating tumor which may be confused with aneurism. Rapidly growing tumors of bone and vascular sarcomata of the abdomen may present an expansile impulse, usually better felt than seen, but occasionally very marked on inspection. The writer remembers only two instances in which the extent and force of the pulsation led to error in diagnosis. One was a man with a large, rapidly growing sarcoma of the upper part of the thigh bone, in which the pulsation was so pronounced that the femoral artery was believed to be involved. The other was an instance of a large sarcoma, probably growing from the retroperitoneal glands, which had a forcible expansile pulsation, and a loud bruit could be heard. In the case of tumors of bone, either in the extremities or in the head, there should rarely be any difficulty; but the pulsating sarcoma in the abdomen is not so easy, particularly when one bears in mind the frequency with which diffuse aneurism of the abdominal aorta has been mistaken for tumor. The important point is the character of the pulsation, which may be diffuse, even expansile, but rarely conveys to the hand that sense of force and strength communicated directly from an aneurism of the aorta or of one of the larger vessels. The bruit over the aneurism is usually louder, but it must be borne in mind that when the sac is very large and filled with masses of coagulum there may be no bruit.

---

[1] *Deutsch. Arch. f. klin. Med.*, Band xix, p. 623

Aneurisms Which do Not Pulsate.—There are two conditions in which an aneurism does not pulsate: (1) When a sac is obliterated with laminated fibrin. Sometimes met with in aneurism of the aorta, this is much more frequent in the popliteal and femoral vessels. In the latter regions it is a serious matter, as the leg may be amputated under the belief that the tumor is a sarcoma. Such an instance was seen in Montreal, in which there was a very large mass in the popliteal space which had neither pulsation nor bruit, but proved on dissection after amputation of the leg to be a completely obliterated aneurismal sac. A remarkable case is reported by Hulke[1] and a sequel is given by Baker[2] in his paper "On Aneurisms Which do Not Pulsate." A huge tumor, which proved at postmortem to be an aneurism, occupied the left side of the neck from the trachea to the vertebræ, passed behind the clavicle, filling the axilla, and passed through the superior aperture of the thorax into the left pleural cavity, occupying its upper third and compressing the lung. It sprang from the left subclavian artery. The large aneurism referred to in the previous section did not pulsate. (2) The second condition in which an aneurism may not pulsate is when it ruptures into the neighboring tissues, forming a diffuse tumor. This may occur in the neck, as in the case reported by Hulke and Baker, but it is much more common in the abdomen. As in two cases which the writer has reported, the tumor may be of enormous size and present slight, almost imperceptible pulsation. Sometimes no impulse whatever is to be felt. More particularly is this the case when the tumor extends rapidly in the flanks, forming a large solid mass. If the patient survives, as is sometimes the case, for weeks or months, the clots become firmer and the pulsation may diminish or even disappear entirely. But even very shortly after the rupture the pulsation may be readily overlooked in the intensity of the other symptoms. Many of them present the features of the acute abdomen, and as already mentioned there are a number of recent cases in which the patients have been operated upon for this condition, usually with the diagnosis of appendicitis, without the slightest suspicion on the part of the surgeon that an aneurism was present.

Certain Special Points in Relation to Thoracic Aneurism.—Innominate or arch? The question is important with a view to surgical interference. The innominate is affected in many aneurisms of the arch, either uniformly dilated with it, or the orifice of the vessel is given off in the sac. The high position of the tumor, the presence of pulsation at the sternoclavicular joint without pulsation in the second and third right interspaces, the extension of a definite tumor above the sternal notch, and above all the information to be obtained by the x-rays, are the important points. In young persons with aortic insufficiency there may be a prominent tumor above the clavicle, due to dynamic dilatation of the arch and innominate. In the following case a sac of the arch in a peculiar positon led to a mistake in diagnosis: In 1879 there was in the Montreal General Hospital a man, aged thirty-eight years, with a strong pulsation above the right sternoclavicular joint. On palpation the outlines of the tumor could be felt, with a smooth, rounded border just above and behind the joint. Vigorous lateral pulsation was felt with one finger in the sternal notch and the other at the outer border

[1] *Clinical Society's Transactions*, 1878, vol. xi, p. 123.
[2] *St. Bartholomew's Reports*, 1879, vol. xv, p. 75.

of the sternocleidomastoid muscle. There was flatness behind the inner end of the right clavicle. A loud, systolic murmur was heard, but he had no aortic insufficiency. There was slight paralysis of the right cord. The question arose as to the possibility of cure by distal ligature, as the aneurism was thought to be of the innominate. He refused operation, and died of pneumonia about four months later. At the postmortem a dilated aortic arch was found, and just before the innominate was given off there was a small aneurism the size of a walnut, conical in shape, which passed up by the side of this vessel, occupying a position immediately behind the sternoclavicular articulation.

The X-rays.—With a good apparatus in the hands of an expert the results are of extraordinary value. For the technical details of the examination the reader is referred to special monographs. There is rarely difficulty in the diagnosis of the saccular aneurism, as the shadow pulsates and the rounded mass is readily differentiated. F. H. Baetjer, who had a very large experience with aneurism at the Johns Hopkins Hospital, classifies the positions as follows:

1. "Aneurism of the ascending portion of the aorta usually casts a shadow more to the right than to the left of the sternum, above the heart, and by localization would be found to be nearer the anterior than the posterior wall of the chest."

2. "Aneurism of the arch casts a shadow slightly to the left of the sternum, and this shadow extends well up into the neck, and by localization would be found nearer the anterior chest wall."

3. "Aneurism of the descending arch of the aorta casts a shadow to the left of the sternum, and by localization would be found nearer the posterior than the anterior chest wall."

In the diffuse aneurism with the arch uniformly dilated a broad shadow extends along the sternum on both sides, and pulsation of the shadow may be seen and the shadow persists between pulsations. In the simple dynamic dilatation of the aorta, pulsation of the shadow is visible, but between the pulsations the shadow disappears, as the aorta contracts and its shadow lies within that cast by the sternum and the spine. In large aneurisms the depression of the heart and its somewhat transverse position are usually well seen. It is particularly in the group of aneurisms without physical signs that the x-ray examination is of the greatest possible value. We had at the Johns Hopkins Hospital a most interesting series of such cases, many of which have been reported by Baetjer. One is greatly impressed with the accurate localization of the tumor in some of these latent cases. A woman, aged twenty-three years, was admitted cyanosed and with urgent dyspnœa. There was evidently tracheal compression. After she was relieved by venesection a most careful examination of the chest could detect but one physical sign—less air entered the lower lobe of the left lung than the corresponding lobe of the right lung. The x-ray examination showed a small aneurism of the transverse arch; the position corresponded accurately with that as determined at the postmortem. Several of the latent cases presented only persistent pain. In skilful hands there is rarely much confusion between aneurism and tumor. Williams, the pioneer in radioscopic work in internal medicine in America, very fully sums up the position in the following words: "To make a definite diagnosis of aneurism by the usual physical examination we may be obliged to wait for the development of marked signs, and this

delays treatment. On the other hand, if the physician begins treatment because the signs are suspicious, he runs the risk of subjecting his patient to unnecessary regimen. The advantages of x-ray examination when compared with the usual physical examination are evident. A definite diagnosis can be made in most cases before there are physical signs. Treatment can, therefore, be begun at an earlier and more hopeful stage, can be planned more intelligently as the knowledge of the position and extent of the aneurism is more accurate, and its results can be better estimated because we can more accurately measure any change in size."

PROGNOSIS OF ANEURISM.

In aneurism of the aorta itself the outlook is always grave, and yet a number of cases recover. The mode of cure has already been spoken of. Canby Robinson, in an examination of the specimens in the Philadelphia Museum, was able to find many cases of spontaneous healing. In the great majority the aneurism had been latent. Lebert estimated that the period of the evolution of an aneurism was from six months to four years. In a great majority of all cases the fatal result occurs within two years from the onset of the symptoms. The most favorable is the saccular form projecting anteriorly or to the right, but it is not always easy to determine the exact shape, although now with the x-rays one can often get a very good idea of the form. Once an aortic aneurism is healed, the individual may live for many years. Under Dissecting Aneurism the case of a soldier who was invalided for aneurism after the Crimean War, in 1855, and who lived until 1881, was mentioned. Among favoring elements in the prognosis are: (1) Position and form of the sac. Moderate-sized, saccular aneurisms of the ascending arch of the descending part and of the abdominal aorta are more frequently seen obliterated than those springing from the transverse arch. (2) Early diagnosis and treatment. In the case of a young man who has had syphilis, specific treatment thoroughly carried out, in combination with absolute rest, gives at least a chance of cure. (3) In a few instances the sac projecting anteriorly has been permanently occluded as a result of operation. The San Francisco case operated upon by Rosenstern lived for many years. Even after a sac has perforated the chest wall, life may be prolonged. Jamieson reported the case of a man aged thirty-two years, who lived and worked for twelve years with an aneurism projecting through the chest wall. There are deceptive features in thoracic aneurism which must be taken into account in the prognosis. The pulsating tumor may diminish, may even disappear, and yet the sac may increase in another direction. In a case of this kind, which was seen with George Ross, of Montreal, the patient had been most faithful in carrying out a strict Tufnell treatment, and had taken potassium iodide in very large doses. The pulsation anteriorly had lessened remarkably, and it was thought that surely the aneurism was healing, but he died suddenly of rupture into the pleura, into which, it was found at postmortem, the sac had extended.

Death takes place usually from the rupture of the sac, sometimes from sudden paralysis of the heart, rarely from the effects of pressure or from gradual asthenia.

TREATMENT OF ANEURISM.

Necessarily in great part symptomatic, only in a few cases is a cure effected. In a case of thoracic or abdominal aneurism seen early the following plan of treatment may be carried out:

1. *Rest.*—By diminishing the vigor of the heart's action, and possibly by diminishing the volume of the sac, there is often an extraordinary relief to the cough, the shortness of breath, and the pain. The rest should be complete, the patient remaining for from six to twelve weeks in the recumbent posture and making as few movements as possible. It is not an easy treatment to carry out. If the aneurism is large and has already eroded the chest wall, it is hardly worth while to insist upon prolonged rest. Between the recumbent posture and the erect with exercise the reduction of the number of pulsations per minute in the sac may be from twenty-five to thirty, so that in the course of the day there is a considerable saving of the strain upon its walls.

2. *Diet.*—The intake of solids and liquids may be reduced to a minimum. Tufnell's diet is as follows: "For breakfast, two ounces of bread and butter and two ounces of milk or tea; dinner, three ounces of mutton, three ounces of potatoes or bread, and four ounces of claret; supper, two ounces of bread and butter and two ounces of tea; total *per diem*, ten ounces of solid food and eight ounces of fluid, and no more." Only in early cases is it worth while to put the patient to the serious inconvenience of this diet.

3. To aid in the reduction of the blood pressure, and to increase the tendency to coagulation in the sac, small bleedings may be practised, five or six at intervals of a week, taking six to ten ounces of blood. This triple combination of rest, low diet, and bleeding is the Valsalva method, which was used with success by Albertini and other Italian physicians in the eighteenth century. Morgagni gives it succinctly: "When as much blood as was requisite was withdrawn (by repeated small bleedings), he (Valsalva) ordered a progressive diminution of food and drink until the quantity was reduced to a determined weight of aliment and water. Having so enfeebled the patient that he could scarcely raise his hand from bed, on which he was ordered to lie from the beginning, the quantity of aliment was cautiously increased." Morgagni remarks: "There are many persons to whom Valsalva's method of cure may appear more intolerable than the aneurism itself, especially at the only time when any treatment could avail. The inconvenience of the disease at that period is but slight and the danger is not imminent, etc."

4. *Iodide of Potassium.*—The value of this drug in aortic aneurism is undoubted. Formerly the favorable results were attributed to condensation of the sac by its action on the fibrous tissues and to the promotion of coagulation. A more rational view is that the luetic mesarteritis is directly influenced by it. It is remarkable with the promptness with which the pain is relieved in the syphilitic cases. Formerly we gave enormous doses, up to 200 and more grains three times a day, but of late years the writer has found that moderate doses are just as effective, and it is rarely necessary to give more than 25 to 30 grains (1.5 to 2 gm.) three times a day. When the syphilis has been recent mercurials may be given as well.

5. *Measures to Allay Pain.*—The iodide of potassium often gives relief. Local applications—belladonna plasters, an ice-bag, a hot poultice, or a hot-water bottle—are helpful, but in the majority of cases, where the pain is due

to pressure, morphine must be given. And in such a desperate malady it is well to give it early and freely.

6. Additional measures employed *to increase the coagulation of the blood*. To assist the low diet and rest and iodide of potassium in promoting the coagulability of the blood, calcium lactate may be given in from 15 to 20 grains (1 to 1.3 gm.) doses three times a day. Gelatin subcutaneously injected, 200 to 250 cc. of a 2 per cent. solution, was introduced by Lancereaux. The writer gave it a very thorough trial for several years, and the cases from his clinic have been reported by Futcher. In one or two instances it seemed to diminish the pain and lessen the size of the sac; but we did not get in any case the brilliant results which the distinguished author of this plan of treatment reports. Of 126 collected cases from the literature, benefit followed in 58 (v. Bottenstern).

Not in every case of thoracic or abdominal aneurism should a *cure* be attempted. A majority of the patients come under observation at a period when symptomatic treatment is alone possible. In what class of cases may a cure be expected? In the young syphilitic subject under thirty, in whom the diagnosis is made early, in cases in which the fluoroscope shows a small and sacculated aneurism, and in elderly persons, in whom, as postmortem experience teaches, the sac may spontaneously heal. When the sac is large, or if the fluoroscope shows a diffuse dilatation of the arch, it is best to allow the patient to continue his occupation, unless it is too arduous, and treat the symptoms as they arise.

What is to be done to relieve the frightful pressure dyspnœa? Patients are not infrequently brought to hospital cyanosed, gasping for breath and literally choking to death. As already stated, it is not always easy at first to make a diagnosis, but it is well to remember that in 9 out of 10 of such cases in adult males aneurism is the cause. Venesection from one or both arms to 25 or 30 ounces may give prompt relief. The removal of much smaller amounts may be effectual. It may be repeated several times in the course of a week. There are very few conditions in which free bleeding is so helpful. Morphine hypodermically should be given, unless there is an extreme degree of pulmonary infiltration, as shown by fine bubbling rales. In any case, if the patient is *in extremis* and suffering, it should be given. In the paroxysmal dyspnœa suggesting spasm of the larynx, due to irritation of the recurrent laryngeal nerves, the inhalation of chloroform may be tried; even if not immediately relieved, the comfort to the sufferer is very great. Should tracheotomy ever be performed in these cases? Theoretically, of course, with an aneurism or a tumor garroting the trachea at the bifurcation, it is useless, and yet it is often impossible to resist in the case of a poor fellow admitted choking and in a dying state. The writer has seen it done in a good many cases, never with permanent benefit, occasionally with temporary relief. In one case the woman's suffering was so frightful that after a preliminary tracheotomy Dr. Halsted attempted to reach the seat of compression by resecting the upper portion of the sternum, on the chance of giving freedom in this way and possibly of placing one of his rings about the aorta above the sac, the position of which could be accurately defined with the fluoroscope. The patient died on the table in a paroxysm. In a case at the West London Hospital, under Seymour Taylor, tracheotomy gave immediate relief.

Surgical Treatment of Internal Aneurism.—*Ligation* of the aorta has been done ten or twelve times for aneurism of the abdominal aorta, always

with fatal result. *Digital compression* has been tried in many cases. William Murray, of Newcastle-on-Tyne, cured a man aged twenty-six years, who had a pulsating tumor to the left of and above the umbilicus. Between the sac and the free border of the rib there was room enough to permit one part of a tourniquet to press on the spine and control the pulsation. The patient was put under chloroform for two hours, during which time the pulsation was arrested. On removal of the pressure there was no effect. Three days later the pressure was again applied under anæsthesia of five hours' duration. In the last hour the pulsation was no longer evident when the tourniquet was released, the extremities were cold, and the femorals could not be felt. The patient got perfectly well and lived six years, when another aneurism occurred at the cœliac axis.[1] A number of successful cases have been reported. When by digital compressions or a tourniquet the pulsation in the sac may be obliterated, this is the safest method. But it is not always satisfactory, and death has followed from peritonitis, obstruction of the bowels, and reduction of the pancreas to a pulp.

Insertion of Foreign Bodies in the Sac.—In 1864, C. H. Moore, of the Middlesex Hospital, attempted the cure of aneurism by the introduction of wire into the sac, believing that by it coagulation of the blood would be favored. He put 78 feet of fine wire into the sac of a thoracic aneurism. Death occurred on the fifth day. Many other substances have been used, catgut, horsehair, Florence silk, etc. It has not been a very successful method. In October, 1900, Hunner collected 14 cases, 8 of thoracic aneurism, all fatal; 6 of abdominal aneurism, with 3 recoveries.

Electrolysis.—Corradi recommended the passage of an electrical current through the wire inserted into the sac, and this Moore-Corradi method is the one most frequently used.

In the hands of Finney and Hunner at the Johns Hopkins Hospital the technique has been much improved,[2] and the operation is one that may be performed with safety in suitable cases. Of 23 cases treated in this way, 17 thoracic and 6 abdominal, 4 were cured. Rosenstern's patient was alive seventeen years after the operation. Three cases were improved. In 10 cases death was probably hastened. Of my series of cases of aneurism of the abdominal artery, 7 were treated by the Moore-Corradi method, 2 were improved, and 1 was alive three and a half years after the operation. The sacculated tumor with small orifice is best adapted for this, and with the improved facility afforded by the x-rays in determining the position and shape of the aneurism the chief difficulty will be overcome in the selection of suitable cases.

Needling the Sac.—Macewen introduced the practice of needling the inner lining of the aneurism with a view of promoting thrombus formation. It has been successful in a few cases. The practice of injecting irritating liquids into the sac—iodine, tannin, perchloride of iron—has been given up.

For the statistics of the surgical treatment of the important recent series of cases of arterio-venous aneurism the reader is referred to W. F. Stephenson's *Report on the Surgical Cases in the South African War,* London, 1905, p. 223, and to the paper by Saigo in the *Deutsche Zeitschrift f. Chirurgie,* Bd. xxxv, on traumatic aneurism in the recent Japanese-Russian War.

---

[1] *Medico-Chirurgical Society's Transactions,* 1864. *Inductive Method in Medicine,* Murray, 1891, p. 120.

[2] *Johns Hopkins Bulletin,* 1900, vol. xi, p. 263.

Tuberculosis Exhibition & Conferences
Oxford, Nov. 8–13, 1909

What the Public can do in the Fight Against Tuberculosis

BY

THE REGIUS PROFESSOR OF MEDICINE

W

g
in
p
a
th
ev
an
ep
n

o
g
b
a
c
a
v
w
a
r
o
g
t.
c
w
in

WHAT THE PUBLIC CAN DO IN THE
FIGHT AGAINST TUBERCULOSIS

THAT was a very happy remark of Tennyson, 'knowledge grows but wisdom lingers.' After all, the greatest difficulty in life is to make knowledge effective, to convert it into practical wisdom. We often confuse the two, thinking they are identical. But it was another poet—Cowper—who said that far from being one they often have no connexion whatever. Now, wisdom is simply knowledge made efficient; and you are asked in Oxfordshire to *join in a campaign of efficiency*, a campaign of education, against one of the most dreaded foes of the race.

There is a grisly troop of infections that we all know only too well, called the fevers, with which two of the greatest illustrations of human efficiency may be said to be connected; for if you look over the record of human achievement there are not more than four or five which can be placed in the same category with antisepsis or asepsis and preventive medicine—the *two most important victories of science* in the last half century. All know what Lister has done in introducing cleanliness in wounds and operations, what we call *asepsis*, and how it has revolutionized the practice of our hospitals. Of the other victory, that of preventive medicine, a special glory of England—let me give one example. Until about the middle of the last century typhus fever ravaged the country. Even in the decade from 1871 to 1880 there were 7,495 deaths from this disease in Ireland alone; but in 1905 there were only 68! Of this victory many of you

are not aware. You do not remember it, but perhaps your fathers have told of the terrible days in the forties, when the awful plague of typhus almost decimated Ireland. If there is one record of which the medical profession may be proud, it is that of their battle with typhus fever. Let me illustrate it by one fact. In 1847— the year of the great epidemic—*one-fifteenth of the entire medical community of Ireland died*. According to Stokes's investigation on causes of mortality among 743 physicians in Ireland, the deaths of 331 were caused by typhus fever—nearly 45 per cent. Not only has this disease disappeared, but enteric fever is gradually going, and within the next twenty-five years a case will be as rare as is now one of typhus. And in other directions this victory of human efficiency may be illustrated. I will mention another disease, the greatest, perhaps, that the white man has had to contend with—namely, malaria. The victory over it is to-day practically complete, and we may say that the solution of the white man's position in the tropics has been solved by the scientific investigations of Laveran and Ross and of others.

A great scourge remains—' the white plague,' as Oliver Wendell Holmes calls it—a disease which kills, it is estimated, at least a million annually—the terrible malady tuberculosis, which this exhibition serves to illustrate. This, too, is a disease upon which we may entertain a full measure of optimism : just as full, indeed, as about enteric fever. In the past twenty-five years there has been an extraordinary increase in our knowledge relating to it. We know *eight* things about the disease.

In the first place, we know the germ—the cause. We can pick it out as easily as you pick out a beech-nut from other nuts. Give to any professor of Pathology a group of these germs and he will pick out that of tuberculosis as a farmer will sort oats from wheat.

Secondly, we know whence it comes—its two great sources, the sputum of persons affected with consumption, and the milk of tuberculous cows.

Thirdly, we know how it gets into the body—through the breath and swallowed with the food.

Fourthly, we know what happens to the germ when it enters the body. Like seed sown in any other way, it illustrates the old story—the parable of the sower. Some of the seed, you remember, fell by the wayside, and the birds of the air picked it up. Fortunately, a great many of the germs of tuberculosis fall by the wayside and never get into us. Some of the seed falls on stony ground, and it does not flourish because of the lack of depth of earth. And just so, into a certain number of us these seeds of tuberculosis enter; but fortunately we are of rocky constitutions, and they do not develop. And some of the seed fell among thorns, and the thorns sprang up and choked it. Now, it is a very fortunate thing for some of us that we have thorny constitutions, and when the germs get in there may be a growth for a short time, and they may thrive and develop, but in a little while thorns spring up. In other words, the constitutional resistance is so great that the germs are killed, and the patient is cured. But, alas! too much, indeed, falls on good ground, and you know then what happens. It brings forth a hundredfold, and tuberculosis in some form results.

Fifthly, we know how the good ground is prepared. It is well to remember that the seed is not everything—the seed is everywhere—it is the soil that is important. Now, how do we prepare the ground for the seed that it may grow to tuberculosis? There are the three 'bads'—bad food, leading to ill-nutrition, which is the great preparation of the ground; bad air in wretched habitations and miserable cabins; and bad drink, alcohol. Those are

the three 'B's' for you to remember with reference to the preparation of the soil for consumption. And just as a farmer has not his crop of grain unless he cultivates the ground properly and prepares it and fertilizes it, so the great majority do not get tuberculosis if they avoid these three 'B's', and do not cultivate a body-soil proper for its growth.

Sixthly, we have learned how to recognize the disease. Upon this point I need not enlarge further than to say that we now see the cases earlier, and are able to advise treatment in the curable stage.

Seventhly, we have learned how successfully to prevent it. And it seems so easy—first by the destruction of the germ, and secondly by making the soil unsuitable.

Then, *eighthly, we have learned how to cure the disease.* The all-important matter is to *get the cases early*.

And, *lastly*, to the great consolation of the public, *we know that the disease itself is not directly hereditary.*

Within half a century the death-rate from tuberculosis in England and Wales has fallen from 3·3 per thousand living to 1·6, and yet in 1907 56,101 persons died of the disease. In Oxfordshire there died 255, which means that there are about 2,500 cases in the county.

What can the public do to still further reduce the mortality from this disease, and hasten the day, which is well within the vision of sanitary science, when there will be no more tuberculosis ?

First, help in a campaign of education. This is being undertaken by the National Association for the Prevention of Tuberculosis, and the Exhibition to be held in the Schools for the week beginning November 8 will do much to teach just what the people should know about the disease. Through the press, the pulpit, by private effort, by lectures and pamphlets, a campaign of incessant activity must be waged.

All who can should join the National Association, 20 Hanover Square, London. Annual subscription, 5s.

Secondly, notification of all cases to the Health Authorities. The only possible way to get at a disease is to know where it is, and this may be done without personal inconvenience or discomfort to anybody.

Thirdly, in each county provision should be made for the care of advanced cases of tuberculosis among the poor.

Fourthly, special dispensaries for tuberculosis should be established. It is well known that a great many early cases do perfectly well in their own homes, if they are taught how to live properly. The questions as to how to provide accommodation for the tuberculous poor will be discussed at the Public Meeting by Drs. Newsholme and Phillip, two of the leading authorities on this subject.

Tuberculous patients should not be looked upon as social outcasts, to their own great distress and to the alarm of their families. For this feeling there is no justification. So long as a patient with tuberculosis takes the proper precautions there is no risk in close contact. If you are afraid of taking consumption, and desire a place of safety free from the germs of the disease, live in a first-class sanatorium, where fewer germs are scattered about than in the cities.

Finally, in this crusade against tuberculosis there are two indispensable factors, *enthusiasm for the work*, which should not be hard to maintain, since we are everywhere fighting a winning battle ; and the second essential factor is *perseverance*. It is not a year's work, nor five years' work ; a decade will make a great difference ; a generation should see a reduction in the mortality of 50 per cent., and your children and grand-children should be able to point at a victory over tuberculosis as memorable as that which our fathers have won against typhus and typhoid fevers.

ARCHIVES

DES

MALADIES DU CŒUR

DES VAISSEAUX

ET DU SANG

EXTRAIT

De la paralysie du nerf récurrent gauche dans les affections mitrales

PAR

WILLIAM OSLER

Regius professor de médecine à Oxford.

DE LA PARALYSIE
DU NERF RÉCURRENT GAUCHE DANS LES AFFECTIONS MITRALES

PAR

WILLIAM OSLER,

Regius professor de médecine à Oxford.

———

Il est deux ordres de circonstances dans lesquelles les affections valvulaires du cœur peuvent donner l'impression d'un anévrysme de l'aorte. Dans l'insuffisance aortique, — Corrigan le faisait remarquer dès son premier travail, — les battements de la crosse peuvent faire parfois penser à ce diagnostic : ainsi en est-il particulièrement chez les jeunes sujets où les dilatations systoliques de ce vaisseau peuvent être considérables au point d'en imposer pour un anévrysme (1).

Lorsque les lésions mitrales s'accompagnent d'une grande dilatation de l'oreillette gauche, avec compression du récurrent du même côté, on peut rencontrer de même un ensemble de symptômes et de signes physiques qui donnent à première vue tout à fait l'impression d'un anévrysme. Aux paroxymes de dyspnée, à la cyanose, à la voix bitonale, à la paralysie de la corde vocale que montre le laryngoscope, on peut même voir se joindre, comme pour mieux tromper le médecin, une impulsion visible dans le deuxième espace intercostal, à gauche du sternum.

Mon attention a été attirée sur ces faits cliniques par une malade que j'eus l'occasion d'observer, et chez laquelle le regretté professeur Nothnagel (de Vienne) avait émis le diagnostic d'anévrysme, bien qu'il fût notoire que la malade était affectée depuis de longues années déjà d'une lésion mitrale. C'était une femme forte et obèse : ses crises dyspnéiques et son état de cyanose prononcé, l'absence chez elle d'œdème comme de tout autre signe de stase veineuse éveillaient naturellement l'idée de l'anévrysme. Dans un second cas, que je rencontrai ultérieurement, ce diagnostic ne paraissait pas vraisemblable. Chez un troisième malade, on y était au contraire

(1) Certaines observations publiées d'anévrysme chez des jeunes gens doivent se rapporter à ce type : chez une jeune fille de seize ans qui présentait au-dessus du sternum une tumeur visible et palpable, je rencontrai à l'autopsie une aorte de la dimension de l'index avec un tronc brachiocéphalique qui n'admettait pas l'introduction du petit doigt.

conduit par la coexistence de la paralysie laryngée avec une
impulsion qui s'étendait jusqu'au deuxième espace gauche.

Cet ensemble clinique est d'ailleurs relativement rare : je n'en
ai rencontré que trois cas, et je ne pense pas en avoir laissé
passer d'autres, car l'attention est attirée de suite chez les malades
de cette sorte par le trouble de la phonation.

Ortner (de Vienne) semble avoir été le premier à signaler ces
faits. Chez un jeune garçon de quatorze ans, porteur d'une lésion
mitrale, il nota une inégalité des pouls carotidiens et une para-
lysie complète de la corde vocale gauche. Le diagnostic d'ané-
vrysme fut porté, mais contredit par les constatations d'autopsie,
qui firent voir seulement la lésion mitrale et une compression
du nerf récurrent gauche entre l'aorte et l'oreillette considérable-
ment dilatée.

Depuis la publication d'Ortner, de nombreux cas analogues
ont été rapportés, principalement à Vienne et en Italie, en Amé-
rique par Herrick (de Chicago). Le plus habituellement, les
autopsies ont montré que le récurrent était comprimé entre l'aorte
et l'oreillette dilatée ; chez quelques sujets cependant, cette com-
pression était exercée par les veines pulmonaires élargies, et
même, dans un cas de Fischauer (de Vienne), par la branche
gauche de l'artère pulmonaire. Dans certains cas, les deux nerfs
récurrents se sont trouvés paralysés, et on a dû supposer que le
poids du cœur dilaté et gorgé de sang avait pu, à la longue, en
attirant vers le bas la crosse et les grosses branches, tirailler les
deux anses nerveuses récurrentielles, et en provoquer l'atrophie.
Dans l'observation III du présent travail, la portion du nerf
récurrent comprise entre la paroi auriculaire et l'aorte était nette-
ment modifiée, d'une coloration plus blanche et plus opaque que
les autres segments du tronc nerveux.

Il a pu arriver aussi que des sujets affectés d'une ancienne lésion
mitrale ont vu se produire chez eux une paralysie laryngée d'une
tout autre origine. Tel était le cas chez une malade de Reitter,
qui présenta des troubles laryngés à la suite d'une diphtérie.
Cette hypothèse avait été soulevée chez notre deuxième malade,
mais l'enquête montra que le trouble de la voix avait précédé la
diphtérie de plus de six mois.

OBSERVATION I. — Le 10 juin 1888, je vis pour la première fois
Mme G..., grosse femme de quarante-cinq ans, se plaignant d'essoufflement
d'effort avec quintes de toux et dyspnée nocturne. Très bien portante
autrefois, elle avait eu six enfants ; jamais de rhumatisme et, jusqu'à
l'année précédente, aucun trouble du côté de la circulation. On lui avait
dit, une fois, bien des années auparavant, qu'elle avait une maladie de
cœur, et elle se rappelait avoir toujours eu la respiration un peu courte.
Depuis six mois, sa voix s'était modifiée.

En avril de cette même année, se trouvant à Vienne, elle avait consulté le professeur Nothnagel : celui-ci écrivit à son mari qu'en plus d'une lésion mitrale il était très probable qu'elle avait un anévrysme de l'aorte : la présence des paroxysmes de dyspnée et de la paralysie récurrentielle gauche devait en effet faire songer à une compression médiastinale.

La malade pesait 195 livres. La figure et les mains étaient légèrement cyanosées, la dyspnée d'effort très prononcée. Il était impossible de déterminer la pointe du cœur, soit à la vue, soit à la palpation ; mais on sentait un faible *thrill* sous le mamelon gauche. Aucune impulsion n'était visible ni perçue à la main à gauche du sternum. On ne sentait pas de secousses trachéales. L'aire de matité cardiaque, impossible à déterminer rigoureusement, paraissait augmentée. A l'auscultation, on entendait un souffle présystolique bien marqué au niveau de la pointe, avec un souffle systolique doux qui s'irradiait jusqu'au milieu de l'aisselle. On ne percevait pas les bruits du cœur par derrière, et la respiration était normale aux deux bases. La voix était bitonale et, au laryngoscope, on voyait la corde gauche paralysée. Pouls petit, irrégulier.

Le régime, une bonne hygiène de vie, la digitale améliorèrent beaucoup son état. Je la revis en mai 1889, avec un peu d'œdème des pieds, une arythmie prononcée, une dyspnée extrême. La paralysie de la corde vocale existait toujours. Elle s'améliora de nouveau et put se rendre en Europe au cours de l'été. En septembre, elle succomba à un paroxysme dyspnéique.

L'*autopsie* fut faite et ne montra aucun anévrysme : l'orifice mitral était rétréci et l'oreillette gauche extrêmement dilatée. Je tins ces renseignements du mari de la malade : il y avait eu tant de discussions autour de ce cas, particulièrement au sujet de la possibilité d'un anévrysme, que le désir d'éclairer ce point spécial l'avait décidé à autoriser l'autopsie.

OBSERVATION II. — Mᵐᵉ S..., âgée de vingt-sept ans, me consulte en mars 1892. Elle se plaignait d'essoufflement, de palpitations, de toux et de raucité de la voix. Elle avait toujours joui d'une assez bonne santé, sans avoir jamais été très robuste. Pas d'antécédents familiaux ; pas de rhumatisme, ni de chorée, ni de fièvre typhoïde, mais une scarlatine à l'âge de douze ans, suivie de coqueluche. Cette dernière, d'après les détails qu'en donnait le père, avait dû être particulièrement pénible. En octobre 1891, légère attaque de diphtérie pour laquelle elle ne s'était même pas alitée, mais depuis laquelle elle n'avait pas repris ses forces.

En janvier, elle avait été prise d'une fièvre de cause indéterminée, accompagnée de dyspnée marquée. Le trouble de la voix avait été remarqué environ un an auparavant. Je la trouvais pâle, respirant difficilement, et je notais tous les signes d'une sténose mitrale typique. Je lui ordonnai des cardiotoniques et l'adressai au Dʳ Warfield pour les soins de la gorge.

Au cours de l'été, elle se trouva certainement mieux : la toux n'était plus rauque, mais la voix l'était légèrement, en même temps que bitonale, et elle ne pouvait l'élever aisément. A chacun des examens successifs du Dʳ Warfield, la corde vocale gauche se montrait à peu près complètemen, paralysée. Pouls 84, petit, mais régulier ; pression artérielle non élevéet Pointe normalement située, avec impulsion forte précédée d'un *thrill* très net. La matité cardiaque commençait à la troisième côte. A l'auscultation, souffle présystolique intense et rude, suivi d'un premier bruit claquant. Il existait aussi un souffle systolique, court, mais intense. Le deuxième bruit pulmonaire était accentué, le second bruit aortique normal.

En *avril 1893*, je revois la malade, encore plus essoufflée et avec un léger œdème des pieds. Elle est plus pâle, l'appétit médiocre, la voix encore rauque, et le Dr Warfield constate toujours la paralysie de la corde vocale gauche. Les signes physiques cardiaques se sont modifiés sensiblement : le choc de la pointe est plus diffus, le souffle systolique, à la fois plus intense et plus élevé, se propage avec force dans l'aisselle ; on perçoit nettement le souffle présystolique, mais le *thrill* est moins net.

L'automne suivant, l'œdème survint ; elle s'affaiblit et mourut le 9 novembre.

OBSERVATION III. — Je montrai à ma leçon, le 25 février 1908, un malade du Dr Mollams, A. R..., âgé de quarante-huit ans, chez lequel on soupçonnait un anévrysme. Le malade présentait de l'œdème des jambes et des deux bases, de la dyspnée avec tous les signes d'une asystolie grave.

A l'examen de la poitrine, on notait une large impulsion cardiaque dans les 3e, 4e, 5e et 6e espaces gauches ; à la main, le choc cardiaque paraissait diffus et irrégulier. Dans le 2e espace gauche, il existait également une pulsation très distincte. A l'auscultation, double souffle aux foyers aortique et mitral. Il existait une paralysie de la corde vocale gauche avec voix bitonale.

Le malade avait toujours été bien portant, à l'exception de trois attaques de rhumatisme articulaire aigu, aux âges de quatorze, vingt-six et quarante ans. Depuis sept mois, il avait de l'essoufflement et de l'œdème. La crise actuelle avait débuté un mois auparavant et s'était peu à peu aggravée.

Après avoir été très mal pendant quelques semaines, il se remonta et, au milieu d'avril, l'œdème avait disparu. Le cœur était régulier, l'impulsion cardiaque large. La pulsation visible du deuxième espace gauche, très prononcée, se continuait directement avec celle du troisième espace ; on la voyait mieux qu'on ne la sentait. C'était la coïncidence de cette zone pulsatile avec la paralysie de la corde vocale qui avait fait penser à la possibilité d'un anévrysme. L'écran radioscopique montrait nettement une oreillette gauche très agrandie et l'absence de tout anévrysme aortique. Le malade quitta l'hôpital le 26 juin 1908, pour y rentrer le 18 août en état asystolique. Il mourut le 24 juin.

L'*autopsie*, pratiquée par le Dr A. G. Gibson, montra une aire cardiaque, non recouverte par les poumons, qui commençait à la deuxième articulation chondro-sternale gauche, se dirigeait en bas et en dehors vers l'union de la quatrième côte avec le cartilage et de là transversalement en dehors. En ouvrant le péricarde, on voyait la pointe de l'oreillette droite atteindre le bord gauche du sternum. Tout le reste de la surface antérieure du cœur en relation avec la paroi était constitué par le ventricule droit. Les valvules aortiques étaient insuffisantes ; l'orifice mitral admettait deux doigts ; l'orifice tricuspide, trois. Toutes les cavités étaient très dilatées, et l'ensemble du cœur très hypertrophié. L'oreillette gauche était énorme, admettant un poing de petites dimensions. Les sigmoïdes aortiques étaient scléreuses ; les valves mitrales, très épaissies ainsi que les cordages tendineux, et l'orifice quelque peu rétréci. Les coronaires étaient normales. Le nerf récurrent gauche paraissait scléreux et d'un blanc particulièrement opaque dans sa portion comprise entre la paroi auriculaire gauche et l'aorte ; cette portion tranchait en effet par son aspect avec celui du restant du trajet nerveux.

CHRONIC INFECTIOUS ENDOCARDITIS

By WILLIAM OSLER [1]

An endocarditis with fever as its only symptom may be prolonged for weeks or months under many different circumstances. Following rheumatic fever in a child an endocardial complication may keep up a temperature of from 100° to 101° for several months, during which time there may be no other symptoms and the general condition may remain fairly good. In chronic valvular disease in the stage of broken compensation slight irregular fever may persist for months, associated with the presence of fresh endocarditis. As a rule, the form of endocarditis to which we give the term infective, septic, or ulcerative runs its course under three months. That occasional instances were characterized by a very protracted course was noted by Wilks, Bristowe, Coupland, and Lancereaux. In my Goulstonian Lectures 1885, I stated that this type had the following characteristics: the fever was irregular and intermittent, resembling ague; the cold, hot, and sweating stages might succeed each other with great regularity; in the intervals fever might be absent; two or three paroxysms could occur in the course of a day. In many of the instances the disease was prolonged to three or four months, and I give the notes of a case of Bristowe's, in which the condition persisted for five months. The recurring chills usually led to the diagnosis of malaria and also gave rise to the opinion widely held, particularly by French writers, that ulcerative endocarditis could be caused by this disease. The cases to which I wish to call attention in this communication are of this chronic character, not marked specially by chills, but by a protracted fever, often not very high but from four to twelve months' duration. At the time of the delivery of the Goulstonian Lectures I had not seen a case of this type. In the past twenty years I have seen ten cases of this form, two of which I have already reported (*Practitioner*, 1893). I have put them together in tabular form to indicate their main features.

SUMMARY OF TEN CASES OF CHRONIC INFECTIOUS ENDOCARDITIS.

No.	Name.	Age.	Date.	Former Rheumatic Fever.	Old Valve Lesion.	Early Symptoms.	Type of Fever.	Skin Symptoms.	Embolism.	Heart Lesions.	Duration.
1	J. M.	28	July, 1888	Yes	Mitral	Fever	Remittent and intermittent	Painful nodular erythema	None	Mitral endo-carditis	13 months
2	T. B.	43	March, 1892	No	Mitral	Chills and fever	Remittent	Purpura	None	Mitral endo-carditis	10 months
3	Florence D.	21	March, 1899	Yes	Mitral	Chills and fever	Remittent	Painful nodular erythema	Brain	No p.m.	7 months +
4	Mary B.	19	June, 1890	Yes	Mitral	Chills and fever	Remittent	Painful nodular erythema	Brain	No p.m.	5 months +
5	R. B.	53	May, 1902	No	Aortic	Chills and fever	Remittent with chills	—	None	No p.m.	4 months +
6	Dr. B. T.	33	Sept., 1902	No	Aortic	Arthritis, chills, fever	Intermittent and remittent	Painful nodular erythema	None	No p.m.	8 months
7	Dr. R. T.	53	Feb., 1903	Yes	Mitral	Fever and sweats	Remittent	Painful nodular erythema	Retina, spleen, kidney	Mitral, aortic, and tricuspid endocarditis	8 months +
8	R. W.	36	Nov., 1906	Yes	Mitral	Chills and anaemia	Remittent	Purpura	None	No p.m.	6 months
9	Dr. C.	52	May, 1907	No	Mitral	Fever	Remittent	Painful nodular erythema	Brain	No p.m.	7 months
10	Alice A.	20	Jan., 1908	Yes	Mitral	Fever	Remittent	Painful nodular erythema	None	No p.m.	7 months

It has long been recognized that malignant endocarditis is really an acute septicaemia with localization on the endocardium, but the symptoms are not necessarily due to the local lesion. The clinical picture is a septicaemia sometimes of a typhoid type, sometimes like a pyaemia—then again with predominant meningeal symptoms, occasionally with pronounced cardiac features. The pneumococcic, the gonorrheal, and the streptococcic forms present, as a rule, a picture in which the heart-symptoms are in the background. Cases of infection with these organisms may run an identical course without any endocarditis. On the other hand, there is a large group of cases in which the endocarditis plays a more important rôle and the vegetations and ulcerations appear to be directly responsible for the fever and the associated symptoms. As a rule, the valves involved are already the seat of a sclerotic change. The source of the infection is rarely to be determined. Thus, in only one of the series here reported was there an external lesion. The patients in this series were all adults, five women and five men. In six there was a past history of rheumatic fever; eight had old mitral lesions, two aortic, well compensated, and not giving any trouble at the time of the onset of the symptoms. It was not always possible to get a definite history of how the attacks began. In five of the cases there were chills and fever, mistaken for malaria. Cough and loss of weight in some cases suggested tuberculosis. The slight fever without any localizing symptoms may raise the suspicion of typhoid fever. In my series these have been the three diseases the diagnosis of which has been suggested. Once established the fever becomes the dominant, and for months may be the only, symptom. This is the most striking peculiarity of the cases. Week after week, month after month, the daily rise of one and a half or two degrees may be the only indication there is of an existing mischief. In Case I, in which the fever lasted for thirteen months, the patient's sister, a trained nurse, had decorated the room with yards of the temperature charts ; fever with an occasional sweat were the only symptoms. The appetite remained good and she lost very little in weight. There were no embolic features and from month to month there were few, if any, changes in the cardiac condition. In this very protracted form chills are not nearly so common as in the more acute cases, nor is the fever so high, not often reaching above 102·5° or 103°. It is of a remittent type, not falling to normal at any period of the day. With the occurrence of a chill the temperature may rise to 104° or 105°, but in none of the cases was there the type of fever in which the paroxysms recur with great regularity—quotidian or tertian, as we see so often in the acute forms of ulcerative endocarditis. Another peculiarity is the occurrence of periods of apyrexia, usually towards the end, but in one or two of the cases there were afebrile interludes which gave deceptive promise of recovery. It is well recognized now that fever is not an invariable accompaniment of endocarditis. Following pneumonia there may be for months a slight toxaemia with little or no fever in connexion with a patch of endocarditis.

The cardiac features in this group are usually well marked, but as a rule

there are no symptoms. The patients complain neither of palpitation nor of pain. There is no dyspnoea except towards the close, and in no case did dropsy occur. In eight of the ten cases there were the well-marked physical signs of a mitral lesion and the associated slight enlargement of the heart. In only six cases was there marked hypertrophy and dilatation. In two of the cases there was aortic insufficiency. One of the most striking circumstances is the very slight change in the character of the heart murmur in spite of the fact of most extensive vegetations and alterations in the valves. Thus in the case of Dr. R. T., with the condition of whose heart I had been familiar for fourteen years, the comparison between my first examination in 1889 and that in 1893 showed very little change beyond the slightly greater dislocation outwards of the apex beat. In several of the cases the absence of any change in the character of the heart murmur and the remarkably quiet, negative state of the organ were urged strongly against the existence of endocarditis. It is rather remarkable, considering the anatomical changes, that so little alteration may occur in the physical signs. In Case VI, Dr. B. T., the murmur of aortic insufficiency became more intense towards the close, but in no instance was there the development under observation of alterations in the physical signs such as are sometimes seen in acute ulcerative endocarditis.

Embolism, to cause symptoms, occurred in four cases of the series—in Cases III, IV, and IX in the brain with haemiplegia, Case VIII in the retinal arteries and in the spleen and kidneys. This is in striking contrast to the frequency of this complication in the more acute types of endocarditis.

One of the most interesting features of the disease and one to which very little attention has been paid is the occurrence of ephemeral spots of a painful nodular erythema, chiefly in the skin of the hands and feet, the *nodosités cutanées éphémères* of the French. My attention was first called to these in the patient of Dr. Mullen of Hamilton, whose description is admirable: 'The spots came out at intervals as small swollen areas, some the size of a pea, others a centimetre and a half in diameter, raised, red, with a whitish point in the centre. I have known them to pass away in a few hours, but more commonly they last for a day, or even longer. The commonest situation is near the tip of the finger, which may be slightly swollen.' Spots of this character occurred in seven of the cases and in three at least they were of importance in determining the diagnosis. Thus in the case of Dr. Carroll, the well-known American Army Surgeon, the collaborator with Dr. Reid in the brilliant work upon yellow fever, the presence of these spots appeared to me to clinch the diagnosis. They are not beneath but in the skin and they are not unlike an ordinary wheal of urticaria. The pads of the fingers and toes, the thenar and hyperthenar eminences, the sides of the fingers, and the skin of the lower part of the arm are the most common localities. In one case they were present in the skin of the flank. I have never seen them haemorrhagic, but always erythematous, sometimes of a very vivid pink hue, with a slightly opaque centre.

The diagnosis in this group of cases may offer great difficulties. For weeks,

indeed for several months, there may be only fever, and unless there have been special features pointing to the heart, such as the development of a diastolic murmur or the great intensification of a mitral bruit, it may be impossible to settle the diagnosis. There are, indeed, cases in which from beginning to close no heart murmur has been present. By far the most suggestive features are: (1) a knowledge of the existence of an old valve lesion. This was present in every one of my series. (2) The occurrence of embolic features, sudden swelling of the spleen, with friction in the left flank, sudden attack of haematuria, embolism of the retinal arteries, hemiplegia or the blocking of a vessel in one of the limbs. (3) The onset of special skin symptoms, purpura, and more particularly the painful erythematous nodules to which I have referred. Present in seven of the ten cases, these are of definite diagnostic import. They are in all probability caused by minute emboli. (4) The progressive cardiac changes, the gradual increase in the dilatation of the heart, the marked change in the character of a mitral murmur, the onset of a loud rasping tricuspid murmur, or the development under observation of an aortic diastolic bruit.

With carefully made blood-cultures one should now be able to determine the presence of the septicaemia. This was easily done in three of my more recent cases. An onset with chills and fever and slight swelling of the spleen almost always leads to the diagnosis of malaria, more particularly in regions in which this disease prevails, but in not one of my cases was there any difficulty in excluding this by careful microscopical examination of the blood. It was not always possible to convince the physician. With slight cough tuberculosis may be suspected, as happened in two or three cases of my series. For many weeks the patient may present nothing but a pyrexia, of doubtful origin, or a crypto-genetic septicaemia, and as he may look very well and may feel very well, and there are no special symptoms, and with a heart-condition that may have remained unchanged for years, it is not easy to reach a positive diagnosis. The blood-cultures and the presence of the painful erythematous nodules and the occurrence of embolism furnish the most important aids.

The anatomical condition in these cases is quite unlike that of the ordinary ulcerative endocarditis. In the three specimens I have had an opportunity of studying there was no actual ulceration, but large proliferative vegetations, firm and hard, greyish yellow in colour, projected from the endocardium of the valves like large condylomata, encrusting the chordae tendinae and extending to the endocardium of the auricle. The condition is quite unlike the globose vegetations of the pneumococcal and gonorrhoeal endocarditis or the superficial ulcerative erosions of the acute septic cases.

The organisms responsible for this condition have been carefully studied. In my series cultures were made in six cases. In three they were negative. In two streptococci were present, in one a staphylococcus. While, as a rule, this condition is much more commonly caused by the streptococcus other organisms may be present. Thus Fraenkel has reported one instance of a pneumococcus endocarditis persisting for nearly six months (*Deutsche med. Woch.*, 1900). Of

sixteen cases of this chronic form, the clinical course of which extended from four to eight months, Harbitz (*Deutsche med. Woch.*, 1899) found pneumococci in four, streptococci in nine, and in eight other micro-organisms. Lenhartz (*Deutsche med. Woch.*, 1901), who has reported sixteen cases with a duration of from three to seven months, found staphylococci and streptococci the common organisms, the pneumococcus once and the gonococcus once. In the majority of cases it seems to be a mild streptococcus infection, possibly by a special form. Possibly in some instances there may be a special resistance on the part of the host, but these are points which must be settled by future investigations. These are cases in which the possibility of successful vaccine treatment should be considered. It was tried in two cases of my series, but in both rather late, and in neither did it seem to have special influence. Horder has treated a case of this chronic type with a vaccine prepared from the patient's organism, but without success. The results in the acute forms are discussed by him in the *Practitioner*, May, 1908. Abstracts of the cases are here given.

Case 1. J. M., aged 28. I saw this patient with Dr. Mullen of Hamilton, Ontario, in 1888, during my occasional visits to that town, on my way to Toronto. A point of special interest is that the sister of the patient, a trained nurse, had kept a very accurate temperature chart from July 17, 1888, to July 7, 1889, nearly twelve months. Sheets of the four-hourly temperature charts, pinned up on the wall of the bedroom, provided a very remarkable picture.

The patient had had good general health, but at twelve years of age had had rheumatic fever. In February, 1888, she got cold and had pain in the chest. Early in the summer she began to feel badly and had attacks of faintness and the fever came on in the afternoon. When she returned to her home in the first week of July the temperature was as high as 104° in the evening, and she was thought to have typhoid fever. The fever persisted and she had profuse sweats. I saw her in the end of September, and though a systolic murmur was present I did not appreciate that the condition was one of endocarditis. I saw her again at Christmas time, when she seemed very much the same, except that she had been having severe rigors followed by very high fever and profuse sweating. This was the first case in which I noticed the remarkable skin lesions. She had a great many crops which were at first thought to be urticaria. Dr. Mullen's description is most characteristic: 'The spots continue to appear at intervals. They are erythematous, some as small as a pea, others a centimetre and a half in diameter with a white point in the centre. They often pass away in a few hours and rarely last longer than the evening of the day on which they appear. They are not numerous. The commonest situation is near the tips of the fingers, which for a short time become swollen.' These spots were seen more or less throughout the illness, less towards the close than at the early part. At this visit at Christmas we made up our minds that the condition was one of endocarditis. The heart murmur had intensified and there were signs of dilatation of the organ. I saw her again in April, 1889, when there was little or no change, except that she was weaker. She died July 7, 1889, more than thirteen months from the onset of the illness. Dr. Mullen very kindly sent me the heart for dissection. The mitral valves were a little thickened; the orifice admitted two fingers. The margins on the auricular side were covered with large vegetations, many of them extending on to the wall of the left auricle. The chordae tendinae were shortened and thickened and encrusted with vegetations. There were signs of old infarcts in the spleen and kidneys.

Case II. T. B., aged 43, admitted to the private ward, Johns Hopkins Hospital, March 13, 1892, complaining of weakness and fever. He had had very good health, with the exception of an attack of typhoid fever twenty years previously and chronic malaria when a lad. Early in December, 1901, he began to have loss of appetite, malaise, and fever with enlargement of the spleen. The fever was of an intermittent type, ranging from 102° to 103°. He had occasional sweats. The spleen was enlarged, and very naturally the condition was thought to be malaria. Throughout the winter the temperature persisted and he had cough, and there was a loud systolic murmur detected at the apex. When admitted to hospital the examination was everywhere negative, except in the heart, the impulse of which was in the sixth interspace, three centimetres outside the nipple line. There was a loud systolic murmur of a musical quality heard as far as the angle of the scapula. The sounds at the aortic cartilage were clear. There was no anaemia. The patient was under observation from March 15 to May 10. The temperature rose daily to between 102° and 103°; about four or five o'clock in the afternoon he sweated. He gained slightly in weight. He complained a little of pain on the left side in the splenic region. Throughout May and June the temperature range was from 97° to 103°. In July the fever was less marked. There were several days when the temperature was almost normal. Early in July for the first time the petechiae appeared. At intervals there were very profuse sweats. Throughout August and September there were groups of days in which the temperature was normal or subnormal, sometimes as low as 95°. He died September 16, about ten months from the onset of his illness. The autopsy by Dr. Block showed an extensive mitral disease. The ventricular surfaces of the valves were studded with enormous masses of vegetation. The chordae tendinae were thickened and encrusted with firm yellow outgrowths. The aortic valves and those of the right side were normal. The spleen and kidney showed infarcts.

Case III. Florence M. D., aged 21, seen March 16, 1899. The patient was well and strong as a girl; at seventeen she had severe anaemia. Through the summer she was very well, but tired easily on exertion. In October she began to have feelings of chilliness and irregular fever, and sometimes the joints were a little stiff and sore, but never red. The doctor thought she had slight rheumatic trouble and gave her salicylates, but she never got perfectly well and grew pale and nervous. She had a little cough and it was suggested that she might have tuberculosis. Early in February she had a severe chill. Subsequently she had slight ones at intervals, following which the temperature would rise to 103°. It was then discovered for the first time that she had heart trouble. As she had a cough as well, it was decided to send her South and she was brought to see me on the way through Baltimore.

She was a tall, well-nourished girl, looking a little pale. I was surprised to find the temperature above 103°. The pulse was rapid. The heart's action was violent, the apex beat in the fifth space outside the nipple line. There was a very intense apical systolic murmur, transmitted loudly to the back and also heard in the left sternal margin. There was a soft bruit at the aortic cartilage. There was no swelling of the joints, but on the radial side of the first phalanx of the right index finger were three raised red spots, each about a centimetre in diameter and very tender. They appeared that day, and she stated that they came at various places on her hands and feet and lasted two or three days. The patient was so ill that they were not able to proceed on their journey, and I saw her at intervals for the next six weeks. Symptoms of severe endocarditis increased. Early in April she had left hemiplegia and the spleen enlarged. Numerous crops of the painful spots of the skin came out, four or five at a time, usually about the hands and feet, occasionally in the forearms and legs. She could tell at once when a fresh one started because of a peculiar hot and tingling

sensation. Then it grew red, became swollen and very tender. After lasting from twenty-four to thirty-six hours they gradually faded. They were not specially connected with the tendons. They were in the skin and perhaps a larger number occurred in the palmar surfaces of the hands, particularly about the pads of the fingers. She died April 25, between seven and eight months from the onset of the illness. There was no post mortem.

Case IV. Mary B., aged 19, seen with Dr. J. K. Mitchell of Philadelphia, June 16, 1890. The patient had had rheumatic fever as a child but had got fairly well and strong. Her illness began with chills and fever which were thought to be malarial, but no parasites could be found in her blood. When I saw her there were signs of an old mitral lesion—apex beat outside the nipple, impulse forceable, and a loud systolic murmur propagated to the back. The spleen was enlarged. The temperature ranged from 102° to 103° and she had profuse sweats. Crops of painful spots appeared from time to time upon the hands and feet, and a few on the skin of the flanks. This was the second case in which I had seen them. They were red, raised, from 3 to 5 mm. in diameter, and often very painful. The fever in this case lasted about seven months. Towards the end embolic symptoms occurred, with hemiplegia.

Case V. July 16. 1902, I saw with Dr. Samuel Ward of Albany, Mr. B., of Cincinnati. I had seen Mr. B. about for several days and noticed that he was not looking very well, but was surprised to find on examining him that he had an old heart lesion, well-marked aortic insufficiency, a loud aortic systolic murmur, and a rough murmur of mitral regurgitation. The patient stated that he had been having malarial fever since the end of May. He had been subject to the disease since 1879. In 1884 he had typhoid fever. He had had attacks of arthritis which were called gout, in one of which in 1898 he had some affection of the heart. The attack at the end of May did not yield to the usual remedies of quinine and Warburg's tincture, and early in June he had a severe chill followed by fever and sweats. He had been up and about, but he had had fever ever since, the temperature occasionally rising to 103°.

From the outset I had no doubt of the nature of the trouble, and had no belief in the malarial theory of the fever, though he came from a malarial district and he had had attacks. Under these circumstances it is always possible to have malarial complications, but there were no crescents in the blood and no pigmented leucocytes. Dr. Ward ascertained that in the second week of April he had bruised his foot on one side, which became red and inflamed, and hot poultices had to be applied. He was in bed for four days. It is quite possible that this may have been a local focus of infection. I saw the patient at intervals with Dr. Ward through August. He had three severe chills. The temperature became more irregular and reached a higher point. He was removed to his home at Cincinnati under the care of Dr. R. W. Stewart. A pure culture of staphylococcus aureus was obtained from the blood. There were no embolic features. He died September 16, 1902, about four months from the onset of the fever.

Case VI. Dr. B. T., aged 33, seen September 25, 1902. Early in May while hard at work he began to have fever. As he had been to the eastern shore of Maryland, it was thought to be malaria. Once or twice a week his temperature would rise to 101° or 102°, sometimes with a chill. He lost in weight, but was able to continue work, and in July while away for a holiday he seemed better, though he still had occasional attacks of fever and sweats. For the previous six weeks he had had daily temperature from 100° to 101° and had sweated at night. Occasionally he would feel very cold and at night when getting into bed the teeth would chatter. He had consulted one or two professional

friends who thought he possibly had chronic malaria, and pulmonary tuberculosis was suggested. He had become a little thinner and paler.

He had been a remarkably healthy man with a very good family history. He never had had rheumatic fever or chorea. He had not had gonorrhoea. On close questioning he stated that in April or May, he forgot which, he had a little swelling and tenderness in some of the joints, but it was quite trifling. In 1890 in an examination for Life Insurance Dr. Chew found aortic insufficiency, but he had never had the slightest cardiac inconvenience.

The patient was a very well-built, well-nourished man, looking a little pale. The right wrist-joint was a little tender on pressure, there were no subcutaneous fibroid nodules. There was a well-marked collapsing pulse. The apex beat was outside the nipple line, not forcible. There was a little diffuse pulsation to right of sternum and second interspace. At the apex the heart-sounds were flapping and clear. At the second right intercostal space there was a short, rough systolic, and a well-marked diastolic murmur of slightly wiry quality was heard down the sternum. The spleen was not enlarged. The patellar tendons on either side were tender on pressure. He assured me that the heart features were very much like those which Dr. Chew had noted in 1900, and I felt convinced that the case was one of endocarditis. Throughout October he became worse and was confined to bed. On November 26, when I saw him, he had changed remarkably. He was very pale. Visible pulsation was seen everywhere in the smaller vessels. The spleen was enlarged. The heart had become more dilated, but there was very little change in the murmurs, except that there was now a loud apical systolic. He had had several very painful spots about his fingers and toes, lasting for a day or two. The blood-cultures were negative. I saw him again on December 8, and he was much worse. His feet were oedematous, with petechial spots here and there. He died in January, about eight months from the onset of the fever.

Case VII. Dr. R. H. T. In 1889 and again in 1890 I was consulted by Dr. T. for an old mitral lesion which was associated with slight enlargement of the left ventricle. As a boy he had had a mild attack of rheumatic fever. For the next ten or twelve years I saw Dr. T. at intervals and never found any special change in his heart. He was a man who lived a very active life and was able to do a great deal of work, though with limitations. During the year 1903 he was not very well and throughout February he had an irregular fever, never very high, not often reaching 102°. He felt very well and he had no chills. From early in March until his death, October 3 (eight months), he was confined to bed and was under the care of Dr. H. B. Thomas, to whom I am indebted for the copy of the temperature chart. I saw him at intervals. Briefly summarized, the main features were, first, fever, which rarely rose above 102°. After June it became a little higher and a little more irregular and sometimes reached 103°. In August and September it was lower, and after September 17 until his death it was normal. There were no chills. He had occasional sweats.

The condition of the heart was very interesting. In June and July when I saw him the pulse was good, heart's action regular, and there was very little change in the mitral murmur, which presented practically the same characteristics with which I had been familiar since 1889. He had no cardiac distress, as a rule, but just before he was moved in the summer there were two attacks of what were supposed to be angina.

The only embolic features were two attacks in the vessels of the retina in July. He had no painful spots on the skin, but he had painful fingers. On one of my visits he had a well-marked, localized red spot about three millimetres in extent on the pad of one finger. He died suddenly October 3, after an illness of more than eight months. The post mortem, by Dr. MacCallum, gave the

following: vegetative and ulcerative endocarditis affecting tricuspid, mitral, and aortic valves and wall of left auricle; rupture of chordae tendinae and encrustation with vegetations; embolic occlusion of anterior coronary artery at orifice; embolic necrosis of myocardium, cardiac hypertrophy and dilatation; infarctions of various ages in the spleen and kidney; focal haemorrhages in the intestines; acute splenic tumour; the vegetations everywhere were firm, yellowish white, and from the mitral orifice a great mass projected into the auricle and there were large irregular masses on the aortic valves. The cultures showed a streptococcus.

Case VIII. In November, 1906, I saw with Dr. Fuller England in Winchester Mr. W., aged 36. He had been under the doctor's care many years previously for acute rheumatism which had left his heart damaged. There was a loud mitral systolic, but there was perfect compensation. Through the summer of 1906 he was not very well and complained of shortness of breath, and in July had frequent attacks of shivering. He began to have inability to rest comfortably at night in the recumbent posture. He lost in weight and became anaemic. He had also slight fever. When I saw him he had been for some weeks in a nursing home. His temperature had ranged from 100° to 101·5°. It was very frequently subnormal in the morning. He had profuse sweats. There was some little doubt at first in the diagnosis, as he had tenderness in the region of the spleen and a dilated stomach. There was a history of tuberculosis in his family.

The patient was very pale and looked thin and ill. There were the signs of old mitral disease with moderate hypertrophy of the heart, a loud thrill and a very intense apical systolic murmur. There was slight infiltration of the bases of both lungs. The spleen was enlarged, but at the time of my visit there were no embolic features. Cultures were made from the blood and a streptococcus was obtained. Numerous injections of a polyvalent serum were made which seem to have reduced the fever slightly, and it caused a good deal of drowsiness. For a month before his death there were numerous embolic patches on the skin with purpura. The patient lingered until December 8. The temperature chart is very interesting. The fever was never high, not once passing above 102°. Towards the end, for the month before his death, it was rarely above 100°. Anti-streptococcic serum seemed to have reduced the fever very much.

The entire duration was about six months. A point of interest in the diagnosis is that the case began with symptoms of shivering, sometimes a definite chill, and as he had an enlarged spleen it was suggested at first he had malaria. Then the distension of his stomach and indefinite swelling in the left side of the abdomen aroused the suspicion of cancer. Later, a slight cough, the fever, the infiltration of both bases, and the man's general appearance suggested tuberculosis.

Case IX. May 8, 1907. I saw in Washington, with Dr. Hardin, Dr. J. C., aged 52, well known in connexion with his work on yellow fever. He had had the ordinary diseases of childhood, typhoid fever in 1886, yellow fever in 1900. He passed the physical examination for the Army in 1902. For several years he had known that there was a lesion of the mitral valve which was detected in a Life Insurance examination. On the evening of February 18 he felt chilly and did not rest well. The next forty-eight hours he was depressed, had cough, and his temperature rose to 102·8°. From that time until the day I saw him he had had regular fever, rarely reaching above 102·5°. He had sweats, more particularly in the early morning hours. As he had a little cough and had lost in weight, it was very natural that tuberculosis was suspected. Dr. Ruffin, Dr. Thayer, Dr. Barker, and others saw him and it did

not seem possible to arrive at a satisfactory diagnosis, as the physical signs were so slight and there was nothing but the fever.

He looked very well, not specially changed in appearance since I had last seen him. There was no alteration in the skin. I made a careful examination, which was negative everywhere except the heart. There was slight enlargement of the left ventricle and there was an apical systolic murmur propagated beyond the mid axilla, and there was a loud pulmonic second sound. His physicians could not determine that there had been any special change in the condition of the heart or in the murmur. He complained of very peculiar spots on his skin, chiefly about the arms and fingers, sometimes on the toes and feet. They came in crops, lasting from one to five days. Each spot was raised, a little red, and felt like a localized infiltration of the skin. They were chiefly on the fingers and on the palms of the hands, sometimes along the forearm. When I saw him, two or three were just disappearing. I did not think that there was any question as to the nature of the case. The mitral lesion, the irregular, persistent fever, and the spots suggested strongly the chronic septic endocarditis. Throughout the summer the condition remained practically the same. The fever persisted, the oscillations of temperature a little greater; he continued to have occasional eruptions of the spots on his fingers, the crops lasting for two or three days. There were no other signs, no audible change in the heart lesion. On September 15, 1907, he suddenly lost power of speech and got right hemiplegia, and he died in fourteen hours. About fifteen blood cultures were taken, all negative. The duration of this case was exactly seven months.

Case X. January 13, 1908. I saw, with Dr. Ward and Dr. Powel of Southampton, Alice A., aged 20. Five years previously she had rheumatic fever, a severe attack with cardiac complications and very slow recovery. Twelve years previously she had a very deep-seated gland removed from the right side of the neck. It was probably tuberculous. The hypoglossal nerve was involved and it had left her with atrophy of one side of the tongue. The previous winter she 'came out' and had a very busy season. She danced and skated and seemed very well. In February she had tonsilitis, not a very severe attack, but she had not been quite well since. She was pale and was often weak and nervous. This was attributed by her mother and the doctor to a love affair which had worried her. Some weeks later she began to have a slight fever and the doctor at first suspected that she might have tuberculosis, but the lungs were negative. Then through the summer she was not well, and on and off had febrile attacks, which increased in September. In October it was thought best that she and her mother should go abroad and spend the winter. On the steamer she got very much worse and it was found she had a temperature of 103°. She landed about the end of October and had been in a nursing home ever since. The symptoms had been—(1) Fever, which had ranged from 100° to 102°, only within the past week had it crossed the 103° limit; (2) she had had at times drenching sweats so that the bed-clothes had had to be changed; (3) she had lately had great irritability of the stomach, constant nausea; (4) on several occasions on the tips of the fingers there had appeared red spots, exceedingly tender swellings, looking very angry and almost, as Dr. Ward said, as though they would suppurate and then they gradually subsided.

There was no pain and no distress about the heart; the urine was clear; the sputum had been examined, as, of course, tuberculosis was at first suspected. She had wasted a good deal. I found a girl looking a little pale, but not so thin in the face as in the body. There was marked general anaemia of the skin, much more so than the face would indicate. The pulse was small, about 110. There were no petechiae. The heart was moderately enlarged, the impulse forcible, wavy, and extended from the second interspace to the fifth, an inch

outside nipple line. There was a very intense mitral systolic heard everywhere over the heart, loudly up the left sternal margin and transmitted to the spine. Though rough and harsh, Dr. Ward did not think it had specially changed in character. The second sound was everywhere clear.

Within three or four days there had been a slight infiltration at the lower lobe of the left lung. The percussion note was impaired and the breath sounds tubular. The apices and other parts were clear. The abdomen was a little swollen, nowhere tender, slightly tumid in the epigastric region; the liver was not enlarged, the edge of the spleen only just palpable. She died about seven months from the onset of the fever. It is quite possible that the onset of the attack may have been in February, when she had tonsilitis, in which case the duration was over a year.

RAYNAUD'S DISEASE
ANGIONEUROTIC ŒDEMA (QUINCKE'S DISEASE)
DIFFUSE SCLERODERMA
ERYTHROMELALGIA

BY

WILLIAM OSLER, M.D.

PART V.

VASOMOTOR AND TROPHIC DISORDERS.

CHAPTER XXVII.

RAYNAUD'S DISEASE.

By WILLIAM OSLER, M.D.

Definition.—A vascular change, without organic disease of the vessels, chiefly seen in the extremities, but also occurring in the internal parts, in which a persistent ischæmia or a passive hyperæmia leads to disturbance of function or to loss of vitality with necrosis of the parts. This definition excludes the cases of necrosis due to obliterative arteritis, and the cases of postfebrile and of multiple neurotic skin gangrene.

Introduction.—The blood supply of all parts is controlled by the vaso-motor mechanism, which regulates the amount by varying the calibre of the arteries. The centre of control is influenced by various stimuli, central (cerebral), visceral, and external. The sudden blush of shame, the instan-taneous pallor of fear, indicate the extraordinary rapidity of action, and illustrate, moreover, the extremes of vascularity in the skin. In health the vasomotor reactions are not subject to great variations, and so far as the skin is concerned the alterations in its vascularity are dependent more on external temperature than anything else. So, also, in the internal organs, there are certain physiological changes in the blood supply associated with periodic functional activities. The regional control of the circulation is analogous to that of a central distributing station in a great irrigation system, with its elaborate system of telephones to and from all the plantations. A uniform supply may be given to all, or the various streams may be diverted to a supplementary reservoir; any local plantation may be flooded at a moment's notice, or the supply may be cut off to the finest rivulets.

In the skin, one of the most vascular of parts, the blood supply varies greatly in health, particularly in the degree of normal distention of the vessels of the exposed parts. Whole nations are pallid, others are rubi-cund. There is an antagonism between the amount of pigment and the degree of permanent distention of the vessels of the skin. The darker Latin races have not nearly the same rich blood supply to the face and hands as the fair Teutonic people. How rarely one sees in France or Italy the full complexion of the English. In individuals heredity and constitutional

peculiarities have an important influence on the cutaneous blood supply; occupation, too, is a factor of the first moment, as persons who constantly work in the open air have a permanently heightened skin vascularity. As is well known, the grade of the vascularity is no indication of the amount of blood in the body—there may be anæmia with a red face, and a chronic pallor may be present, with a normal blood count.

In health the color of the skin is singularly constant—what we speak of as a person's complexion is the mean between the vascularization and the amount of pigment. But there are a great many individuals with what may be called an unstable skin circulation—the vasomotor mechanism is not under good control, but works badly, so far as the skin is concerned; that special plantation, to use again the analogy of the central irrigation scheme, is too apt to be flooded, or the supply may be cut off abruptly. How many persons, healthy enough in other respects, are constantly worried by an abnormal filling of the vessels of the face, sometimes permanently, but more often intermittently, the result of central, emotional causes. Or the vessels of the hands may be constantly congested from an instability of the vasomotor mechanism.

By far the most common vascular skin reaction is to cold, in which we see four phenomena of the first importance in the study of Raynaud's disease. A hand exposed to a very low temperature is at first flushed, then gets blue, and finally begins to grow pale; the radial artery may be felt to get small and the pulse more and more feeble. At first the anæmia may be patchy, as though some capillary areas had greater resistance, but soon the hand is of a dead white color, less sensitive than normal, and stiff from inability of the muscles to move freely. This bloodless condition, due to spastic contraction of all the vessels, is called *local syncope*. Continued exposure at a very low temperature may result in a freezing of the whole hand. Brought into the warmth, the blood gradually returns to the parts, a backward flow takes place from the veins, as a hand which has been frozen may become gorged with venous blood before a radial pulse is perceptible. It grows livid, mottled, and swollen; pressure with the finger causes a spot of anæmia, but the return flow is sluggish and almost imperceptible. Pain begins at this stage—the stage of *local asphyxia*. If the hand has not been exposed for a very long period this venous stasis gradually disappears. The radial pulse begins to be more distinct, the lividity is less intense, and the finger imprint is more quickly obliterated. Soon the fingers begin to throb, and the whole hand aches, and within half an hour or less the color is a vivid pink, the arteries are throbbing and large, and a pulse may be felt in every finger, and the capillary pulse is visible in the nails —this is the stage of *active hyperæmia*. But if the hand has been exposed for a very long time and frozen hard, the venous stasis which follows the thawing does not disappear, the fingers remain livid and cold, the circulation does not become reëstablished, and *necrosis* or *gangrene results*.

Raynaud's disease is a condition in which these four phenomena of frostbite, singly or together, are experienced *without frost*, sometimes, indeed, as a result of exposure to cold, but more frequently due to unknown internal causes, which bring about precisely similar vascular reactions in the fingers or toes, ears, and nose. In a majority of healthy persons the vasomotor mechanism works very smoothly and the reactions are within narrow limits; but many people have naturally, or acquire, a great instability of

this system, so that abnormal reactions follow slight stimuli. S. Solis Cohen has called this condition vasomotor ataxia, and it is just in these individuals with an imperfect control of their irrigation pipes that we see the phenomena of Raynaud's disease. The morbid flushing and blushing, the vascular erythism of Basedow's disease, the transitory erythemas of the neurasthenic, the arterial spasm in migraine, in certain types of angina pectoris, and possibly the vascular crises in many abdominal conditions (lead colic, tabes, angioneurotic œdema, etc.) all come under this vasomotor ataxia, either of the dilator (paralytic) or constrictor type. A scratch with the finger nail, a line drawn, say, on the skin of the chest or abdomen, is followed by a very slight reaction, usually a fine red line, but in the subjects of vasomotor instability one of three reactions follows; the most common is an intense hyperæmia on either side of the line, 4 or 5 mm. or more in width, which lasts for ten or more minutes, and is sometimes associated with a widespread erythema of the adjacent skin. This is the characteristic vasodilator reaction, and it is always an active, never a passive, hyperæmia. Much less common is it to see, following the irritation, a white line, a band of anæmia 4 or 5 mm. in width, which results from spasm, vasoconstriction, of the small arterioles of the skin. It may disappear gradually or it may be followed by an active hyperæmia. These two reactions, dilator and constrictor, represent the two vascular skin reflexes, which are as important to test as the knee reflex or the big-toe reflex, as they give an indication of the existence, degree, and type of vasomotor ataxia. The third and rarest reaction is the exudative, when in the line of the irritation, serum is poured out from the hyperæmic vessels with the production of a wheal, factitious urticaria (dermatographia).

Historical Note.—So striking a phenomena as symmetrical gangrene did not escape description until 1862, the date of Raynaud's first paper. The affection is called by the name of the distinguished French clinician, because he gave the best account of it, and a rational explanation of the cause. "I propose to show that there is a variety of dry gangrene affecting the extremities which cannot be accounted for by vascular obstruction; a variety characterized by a remarkable tendency to symmetry, affecting always similar parts of the upper or lower limbs, all four at once, in certain cases the nose and ears, and I shall try to show that this form of gangrene has its origin in a disturbance of the innervation of the capillary vessels." This was the object of Raynaud's thesis, published in 1862; a second important paper appeared in 1874 (*Archives gén. de méd.*). Both have been translated and edited by Barlow for the New Sydenham Society, 1888. The article by Barlow in the first edition of Allbutt's *System;* the monograph on the disease by T. K. Monro, Glasgow, 1899; the *Index Catalogue* of the Surgeon-General's library, and Cassirer's *Die Vasomotorish-trophischen neurosen*, Berlin, 1901, give the literature, old and new. Monro's book is the best critical study of the disease, and is a storehouse of facts relating to it.

Etiology.—It is not a common disease. Among 23,000 medical patients admitted to the Johns Hopkins Hospital in a period of about twenty years there were only 19 cases. Cassirer collected 168 cases from the literature for his monograph (1901) and Monro 180 cases for his work (1899). The last-named author estimates that about 1 case occurs among 3000 patients.

Nationality.—The disease appears to be more common in England and France than in Germany. It is not rare in America, as our figures show. It is relatively more frequent among Hebrews.

Sex.—Women are much more frequently affected than men—62.5 to 37.5 per cent. in Monro's series—and this holds good for both mild and severe forms.

Age.—More than 60 per cent. of the cases occur between the tenth and the thirtieth year. In Cassirer's statistics there were 22 cases under five years of age; from five to ten, 8; from eleven to twenty, 25; from twenty-one to thirty, 40; from thirty-one to forty, 27; from forty-one to fifty, 28; above sixty, 18. A number of cases have been described in children. Friedel saw a six months' old child attacked with swelling of the back of the hand; gradually the fingers of both hands became blue and necrosis of the tips of several of the terminal phalanges occurred (Cassirer). True Raynaud's disease is rare in the aged, and some of the cases reported have been of senile gangrene from endarteritis. F. P. Henry reports the case of a woman, aged seventy-seven years, who had typical attacks involving the nose, ears, and extremities.

Family Disposition.—In a number of cases several members of the family have been affected. In the milder forms it is not uncommon to see dead fingers in three or four sisters. I know one family in which the mother when young had recurring attacks of "white and blue fingers," and her three daughters have been greatly annoyed with vasomotor disturbances of the hands and feet. In Colman and Taylor's patient the grandfather and the great uncle had Raynaud's disease. Cases of symmetrical gangrene have been reported in sisters (Makins) and in three brothers (Bramenn).

Psychical Disturbances.—To a sudden shock, or a fright, the symptoms have been assigned in a number of cases. Nervous, highly strung individuals are certainly more prone to the disease. Some of the worst cases have been in hysterical patients.

Sexual disturbances were thought by Raynaud to play an important part. In some patients mild attacks have been more likely to come on at the menstrual period. In one instance the disease followed directly upon pregnancy (Dickinson). Sexual excesses have been thought to be of moment.

Cold and Damp.—The milder forms are much influenced by climate and by the weather. Cases of local asphyxia are much less common in America than in England, where severe chilblains leading to superficial necrosis represent a frequent type of the disease. Cold has an important influence, and there are cases in which the symptoms only occur in the winter, and, as a rule, patients liable to attacks are always worse in cold weather. On the other hand, a patient of Raynaud's was always worse in the summer. Washing the hands in very cold or in very warm water may bring on an attack.

But in a considerable number of the cases no factor of any moment can be determined—the disease begins in healthy individuals, and the actual cause remains obscure; in a majority, however, there is a marked neuropathic disposition, an instability of the nervous system, or an actual perversion as in the hysterical cases.

Infectious Diseases.—In many acute and in a few chronic infections multiple gangrene occurs, but it is of a different type to that of Raynaud's diseases and should not be included in this category. In malaria, typhoid

fever, measles, and scarlet fever local areas of necrosis may occur in various parts of the skin; in a few cases acrocyanosis has preceded the local gangrene of the finger tips, but, as a rule, the distribution is very different, the skin of the trunk or of the limbs, the lips, and the cheeks.

In syphilis true Raynaud's disease may occur, but many of the cases of gangrene in the affection are due to arteritis. A remarkable case of Raynaud's disease in congenital syphilis is quoted by Cassirer: A two-year-old child with hereditary lues after exposure to cold had attacks of cyanosis of the hands and feet, and subsequently of the ears, which had also spots of local necrosis. Recovery followed mercurial treatment. Monro's figures give only 2.8 per cent. of cases with syphilis.

Arteriosclerosis.—Vessels beginning to be diseased seem particularly prone to spasm, and a certain proportion of cases of true Raynaud's disease show widespread arterial changes, but a sharp distinction should be drawn, when possible, between the local gangrene due to obliterative arteritis and that which follows the protracted asphyxia of Raynaud's disease.

Nervous Diseases.—Gangrene occurs in a whole series of organic affections of the nervous system—neuritis, many affections of the spinal cord, acute and chronic, and in hemiplegia. These various forms of local gangrene, some of which bear a striking resemblance to Raynaud's disease, will be discussed in the section on diagnosis.

Morbid Anatomy and Pathology.—No characteristic changes have been found. After a critical review of the autopsies which have been made, Cassirer concludes that we have not, as yet, any sufficiently thorough study of all the parts in a typical case. Not one of the negative cases has been of such a typical nature, nor has the examination been of so exhaustive a character as to justify the statement that there is no anatomical basis in the disease. The positive results consist either of changes in the bloodvessels or in the nervous system, singly or combined, but none of these are in any way peculiar or constant. Neuritis has been found in several very carefully studied cases (Pitres and Vaillard, Wigglesworth, and others), but it is impossible to say whether it was causal or a complication of the disease itself. Changes in the cord have been reported, but the cases have not always been genuine instances of Raynaud's disease, and we shall refer under the diagnosis to the conditions in the central nervous system, which may induce vasomotor and trophic disturbances. Endarteritis has been found in some genuine instances of long standing, in others the vasomotor changes have been due to the chronic disease of the arteries, and the cases do not come in the category of Raynaud's disease. Endarteritis, endophlebitis, and degeneration of the nerves have been found. And lastly, the examination has been negative in a number of carefully studied cases.

The *pathology of the disease* lends itself to theoretical discussion. The key to it is found in a study of the effects of cold in the vascular system. The mild and severe types correspond to chilblains and frostbite. Every feature of the disease is mimicked by the effect of cold in the extremities, and we know cold itself is one of the potent factors in inducing the recurring attacks. We have already studied the sequence of vascular events when a part is exposed for a long time to a low temperature, the vasoconstrictor effect on the arteries, capillaries, and veins producing local syncope, which may itself pass into necrosis; but more commonly a vascular reaction takes place, the blood flows back from the veins, and a state of asphyxia or cyanosis

follows. From this, one of two events may result: if the part has not been long exposed, as the tip of the nose or an ear in ordinary mild frostbite, the asphyxia gradually disappears, the arteries begin to dilate, the parts get red, and a state of intense hyperæmia follows, with pain and throbbing, and no necrosis results; on the other hand, if the part has been exposed for a long time, no vascular reaction takes place, the local cyanosis remains, the circulation is not reëstablished, and necrosis or gangrene results. We have seen that constrictor and dilator influences pass from the controlling centres to every vascular territory of the body, and they may be excited by mental, external, or somatic stimuli. There are persons in whom the centres controlling these vasomotor actions are unstable—the machinery of the irrigation centre is in charge of an inexperienced official who has not learned to work the sluices in proper response to the telephonic demands; he turns a full head of water into one of Mr. Epidermis' farms and forgets all about it, or he shuts off the supply from another, flooding the one, parching the other, and unless a call gets through in time to correct the mistake, death of the crops is the result. This is exactly what happens in Raynaud's disease. The centres are at fault and work imperfectly. We have seen that the reaction to external cutaneous stimuli is very varied, usually vasodilator but often vasoconstrictor, which is the more important of the two in Raynaud's disease.

One cannot predict in an individual case when the skin is irritated whether the response will be constrictor or dilator. It has been suggested that when the *white line* of anæmia follows there is disturbance in the suprarenal metabolism, but of this there is no evidence, and a prolonged study has convinced me that its only indication is a morbid sensitiveness of the vasomotor centres. In the local syncope of a finger or of the hand widespread constrictor influences pass to the subsidiary centres, controlling the circulation of the part, and the arteries, capillaries, venules, and veins are thrown into a state of spasm. The contraction of the arteries may be felt (in the radial) and seen (in the retinal arteries); the spasm of the veins may be seen and has been observed by Barlow and others in cases of Raynaud's disease. The spasm of the capillaries is probably a sort of "squeeze" on the part of the bloodless tissues, and possibly the muscle fibers of the skin itself may be affected. The dead white, cold finger contains not a drop of blood, and is as exsanguine as if a small Esmarch bandage had been applied. Suddenly the sluice gates are opened and there is a rush of fluid into the empty channels, every stream is full, every pipe gorged to bursting. When you take off the Esmarch bandage from a finger, so rapid is the inundation that the eye can scarcely follow it. And this is what happens when the local syncope gives place to the active hyperæmia. The flushing is rarely so sudden, but a dead white finger may become hyperæmic in from twenty to thirty seconds. The ischæmia and the active hyperæmia are readily explained—we see them every day as the effect of constrictor and dilator influences.

The local asphyxia is another matter. In frostbite, active hyperæmia, cyanosis, syncope is the order; the cyanosis follows a transient flush of hyperæmia seen as the first reaction to the cold. In Raynaud's disease the order is usually syncope, asphyxia, hyperæmia. In frostbite it seems clear that the asphyxia is due to a backward flow from the veins, to which the local syncope yields as the part thaws, before the arteries passing to the part can

be felt to pulsate. The asphyxia of Raynaud's disease may be due to the same cause; contraction of the veins has been seen by Barlow and by Weiss, but that was when the asphyxia already existed. But the first thing must be the relaxation of the spasm of the venules and veins to permit of the blood entering the empty capillaries. The stasis and cyanosis persist so long as the arterioles and arteries remain in spasm. In moderate grades of asphyxia some little blood trickles through the sluice gates, but in the deep purple skin of a typical example of Raynaud's disease the circulation has ceased and death of the part is imminent. The necrosis is a simple matter, as simple as if a string is tied tightly about the finger tip.

The cause of this instability of the vasomotor centres, the nature of the change in them, the reason of the symmetrical distribution, an explanation of the associated hæmoglobinuria—these are questions awaiting solution. With a clear-cut symptomatology, having affinities with other affections due to angiospasm, the disease must not be confounded with a series of other disorders which have with it gangrene as the most striking feature.

Symptoms.—*General Description.*—*Mild, moderate,* and *severe types* of cases may be recognized.

(*a*) **Mild Forms** (*formes frustes*).—A girl, aged seventeen or eighteen years, subject, perhaps, for years to cold hands and cold feet, begins to have tingling in the fingers and toes, and finds that on exposure, or when the weather is cold, her hands and feet get very blue. When she comes into the house they throb and ache, get red and hyperæmic, and feel tense and swollen. It may take hours before they are normal. During successive winters these symptoms may be repeated, and the condition is regarded, and rightly so, as chilblains. There is nothing to distinguish it from scores of cases of this common affection, but one day, following perhaps a longer exposure to cold or after a week or two of cold weather, in which she has had to work in a room insufficiently warm, the cyanosis is more persistent, the skin over the knuckles swells and turns black, blebs form, and half a dozen or more areas of superficial necrosis occur. The knuckles may be the only parts affected, or the extreme tips of the fingers. The patient may be incapacitated for a week or two, and a series of attacks may come on with changes in the weather. Winter after winter the trouble may recur, and, while never reaching a high grade, and only causing very superficial necrosis, the suffering and incapacity may be very great. In the cold, damp climate of the British Isles such cases are common. England is the land of chilblains, mild and severe, owing to the damp cold and to the insufficient heating, particularly of schools and institutions. Cold in itself is not the only factor, else these vasomotor disturbances would be more common in Canada, where, on the contrary, they are rare. If of transient duration, cold hands and cold feet have not the same import as the all-day-long lividity of these parts caused by working in rooms at a low temperature.

The "beefsteak" hand, a source of great annoyance, often of discomfort, is a permanent vasomotor disturbance, met with chiefly in young girls. While there are cases that persist throughout life, the condition may be transitory and associated with menstrual disorders. I have twice seen it with the slight hypertrophy of the thyroid gland of puberty. The color varies with the outside temperature—either cyanotic or hyperæmic. The hands may be permanently swollen, and the cold, clammy feeling is very disagreeable. The hands alone may be affected, more often hands and feet, and there may be

the "beefsteak" cheeks with permanent dilatation of the small veins, which are sometimes unpleasantly distinct. There are men of full habit, often of gouty stock, who have this same permanent engorgement of the bloodvessels of the extremities and of the face in a degree that passes the limits of health. In the winter the cyanosis may be extreme, and when there is much exposure the hands become very stiff and there may be numbness and tingling. In these cases it is a question altogether of cyanosis or hyperæmia, not of local syncope; the extremities are either blue or red, not white, and they do not come into the category of the *formes frustes;* but there is a mild type of the disease, in which all these vascular disturbances recur in remarkable sequences. On the morning of the opening of the Johns Hopkins Hospital a young woman applied who presented in a typical manner the vasomotor changes of Raynaud's disease. The fingers alone were affected, and usually only in the daytime. Without any warning they would become "dead," and, as she expressed it, "go to sleep;" sometimes three or four of one hand or two of one and one of the other—never the thumb. The stages were always pallor, a dead white, which would last an hour or longer, and then the finger became cyanosed, and afterward of a vivid red, and the throbbing became unpleasant. The fingers were often in different stages, and when I first saw her the middle finger was of a dead white, in local syncope, the ring finger was cyanosed, while the little finger was red and in a state of intense active hyperæmia. She was a nervous girl, much over-wrought mentally, and this condition had been a source of great anxiety. The attacks had occurred at intervals for several years, but the cyanosis had never persisted long enough to cause local necrosis of the finger tips. I saw this patient at intervals for many years, often in most typical attacks, but necrosis never took place, and she gradually got quite well.

In middle-aged women, in connection with the paræsthesia and numb-ness of the hands and feet—the acroparæsthesia—there may be vascular changes, sometimes dead fingers—syncope most often, and slight grades of cyanosis.

(*b*) **Moderate Severity.**—A woman, aged twenty-five or thirty years, after perhaps a period of worry and ill health, begins to feel pain in the fingers or in only one or two fingers of each hand. Or it may be only a numbness and tingling, not actual pain, and the fingers feel stiff. Then she notices that they have changed in color, are white and cold, and remain so for an hour or two at a time, gradually getting red and warm. Within a day or two a change occurs—they remain permanently blue, asphyxiated, per-haps to the second joint. The pain becomes more severe, and may require morphine. The tip of one finger or the terminal joint of another gets darker, and perhaps a few small blebs form. The other fingers show signs of restored circulation, but necrosis has occurred in the pad of one and in the terminal inch of another. The eschar of the pad of the finger gradually separates and healing takes place, with much less loss of tissue than had been anticipated. The necrotic phalanx shows a line of demarcation, and after a couple of weeks the bone is snipped off, but it takes a couple of months before healing is complete. The general health improves and the patient gets quite well. She may never have another attack, or, what is more common, in six months or a year there is a second. In many of these cases of moderate severity after two, three, or even four slight attacks complete recovery takes place.

(c) **Severe Forms.**—No more terrible malady exists than the severe type of Raynaud's disease. A man, aged twenty-five or twenty-six years, of a neuropathic disposition, begins to have numbness and tingling in the hands and feet, with local syncope. The feet become painful, and one morning he notices that they are livid to the ankles, slightly swollen, and so tender that he cannot put them on the ground. At the same time the ears become swollen and red, with the margins very blue. The tip of the nose changes in color; within a few days the cyanosis has deepened, the toes are black, the feet purple, and about the ankle is a zone of a bluish red color; it looks as if both feet would become gangrenous. A black line has formed at the margins of the ears and there is a small black spot at the very tip of the nose. The pain in the feet is atrocious. Pulsation is felt in the arteries. About the end of ten days the feet begin to look better, the circulation is reëstablished as far as the bases of the toes, which remain black, and a line of demarcation begins to form. Instead of losing both feet, only two or three toes of each foot may be lost, and a small rim of the ear and a superficial abrasion of the tip of the nose. Within three or four months the patient is well. The greatest difficulty has been in the separation of the necrotic parts. The following winter the patient notices that the urine is bloody; the fingers begin to feel stiff and painful, and in a few days an attack is in full swing; this time he loses a finger or two. Three months later, before the hands have quite recovered, the right foot gets cyanotic and painful, the lividity extends above the ankle, and the gangrene is so extensive that the leg has to be amputated. For a year there may be good health, and suddenly the other foot becomes affected, the gangrene extends, and this leg, too, is lost. After a six months' respite the unfortunate victim may have an attack of such severity in the hand that the arm has to be amputated. I saw a woman who had had just this sequence and had lost within five years one hand and both legs. The attacks had begun in the fingers like the ordinary type of Raynaud's disease. In a few cases serious internal complications occur. The hæmoglobinuria persists and the patient may die of it, or there may be attacks of severe abdominal colic. Cerebral symptoms may recur with each attack in the extremities, epilepsy, aphasia, transient hemiplegia, and the patient may die in coma. Fortunately, these very severe forms are exceptional, and yet in attendance at every large hospital there is usually one case of this sort, and the maimed victim finally drifts into an almshouse.

The Symptoms in Detail.—The local *syncope*, the first stage, is the most characteristic single symptom of Raynaud's disease; the others, cyanosis, active hyperæmia, and gangrene, we see in many conditions; but the *dead white anæmia* of a finger, of a toe, of one ear, is a rare phenomenon. Occasionally, in arteriosclerosis one sees spasm of the peripheral arteries and pallor of hand or foot, but such a persistent ischæmia as that seen in typical cases is not met with in other pathological states. The fingers are most often affected, then the toes, the ears, and the tip of the nose. The whole foot or hand is not often involved. The anæmia may be induced in a few minutes, giving a dead white appearance to the skin. At first it may be patchy and gradually extends. Areas of slight discoloration may be seen before the ischæmia is complete. Once fully established the finger looks "dead," and is cold and sometimes clammy like the finger of a corpse. The temperature may be 20° to 30° below that of the adjoining finger or of the palm of the hand, and the part feels cold. The patient may com-

plain of numbness or a heavy, painful feeling, sometimes of pins and needles. At this stage the pain is rarely extreme. The motility is impaired, and on attempting to move it the finger feels stiff. The duration of the ischæmia is very variable—from a few minutes to an hour or more—very much less than the cyanosis or active hyperæmia. The attacks may recur eight or ten times in a day. Mild grades of local syncope are often seen in the "dead fingers" of nervous and neurasthenic individuals, but the ischæmia is not complete, the color is not often of a dead white, and it is not associated with the reactions of the attack of Raynaud's disease. The paræsthesia may be marked, particularly in the cases of "waking" numbness. Occasionally in healthy persons local spasm of the arteries causes a patchy ischæmia of the skin. It is sometimes seen under emotional excitement, and Hochenegg mentions a case of a healthy man whose nose became of a chalky white color under excitement.

A good imitation of this condition may be had by making artificial anæmia of one finger with a rubber ring. Within a minute the temperature drops and there may be numbness and tingling. The sensation is not nearly so unpleasant as if the light ligature is placed around the finger while full of blood. A useful demonstration when lecturing on the disease is to produce the local syncope with a rubber ring rolled up the index finger from the tip; tie a ligature tightly about the middle finger, and in a minute cyanosis will be present; then if the circulation is reasonably active there will be the pink skin of the ring finger in active hyperæmia, the cyanosis of the middle, and the ischæmia of the index finger. The local syncope may disappear in one of two ways—the taps may be turned suddenly and the vascular areas are immediately flushed with blood, just as happens when the ring of rubber is removed, the anæmia of the finger is instantaneously obliterated, but much more frequently it is a slow process, and a mottling appears and gradually the *second stage* of the process is produced.

Local Cyanosis or Asphyxia.—This has been called by various names —local apnœa, acrocyanosis, acro-asphyxia—but the first names are the most appropriate. This may come on without a previous stage of syncope; at any rate, syncope is not always seen. The color is variable, from a reddish blue to a blue black, sometimes an ashen gray, and if it persists for a long time, an intense indigo blue. The finger nails may be of an inky black color. There may be shades and mottlings of color from a light grayish blue to an intense blue black and an inky black. Pressure with the finger causes an area of anæmia which is very slowly obliterated. With the cyanosis the finger is swollen but not œdematous. The temperature is lowered— 8° or 10°. Riva measured the temperature before the attack between the thumb and index finger at 35.8° C.; in the attack it was 20.6°, and that of the hollow of the hand 23.4°. Even in a warm bath the part may remain cold and cyanotic. The asphyxia may be intense in one finger while the adjacent one is in syncope. The color is due to the fact that the circulation is so slow that the capillaries are filled with red corpuscles, the hæmoglobin of which is deoxidized. Normally in the capillaries of the skin the circulation is so active that the corpuscles have not time to discharge their full load of oxygen, but when from any cause there is stasis the corpuscles unload all they possibly can and the change in color is noticed immediately. Two events may follow the local asphyxia—active hyperæmia or necrosis.

Active hyperæmia is an important stage in Raynaud's disease. It may follow directly upon the syncope, more often it follows the asphyxia. After persisting for several hours, or even for a day or more, the color begins to change, the patient feels a throbbing, and gradually the circulation is restored and the cyanosis is replaced by a bright pink. The finger gets hot and throbs, the pulse is to be felt in it; the radial is full and large, if the hand has been affected, and a capillary pulse may be seen in the nails. This stage lasts a variable period, usually bearing some proportion to the duration of the cyanosis. While the sequence of white, blue, and red is the rule, there are exceptions; the process may begin in one finger with a transient hyperæmia, and then the syncope follows and the cyanosis, a sequence of red, white, and blue. Monro gives the case of a physician who had had various vasomotor phenomena and whose hands in the morning, after he had washed them, were very red, then they became white and afterward blue. When the hand and fingers are involved, all three processes may be observed together—the hand may be of a deep red, one finger white and the others cyanotic, or adjacent fingers may be red, white, and blue. Persons subject to attacks, particularly of the milder forms, may bring on an attack of local asphyxia by going out in the cold, when the hands become blue, sometimes at once, sometimes with a stage of preliminary syncope; then when in the warmth the active hyperæmia is quickly established and the hands get hot, throb, and are painful. If the asphyxia persists and the circulation is not reëstablished, there is danger of the final stage—*necrosis* or *gangrene*. This may follow the local syncope or more commonly the asphyxia. The fingers or toes or the whole foot remain cold and dead without any attempt at recovery of the circulation; the color grows darker and one or two of the fingers, or the tip of one, in mild cases, becomes black. Small blebs with serum form and break, leaving excoriations, or the bullæ break and leave a dry, black skin. The extent of the gangrene is generally much less than the appearance of the part would indicate; a foot which looks hopeless at the end of the first week may by the tenth day show great improvement and the toes alone be gangrenous. The necrotic part is gradually marked off by a definite line, and the skin of the proximal part is inflamed, often with a dull, cyanotic appearance. The process of separation of the parts is very tedious and accompanied by great pain. It may take weeks for a big toe to slough off and months for the anterior part of a foot. When the sloughing reaches the bony parts it is well to help the process by surgery. In the ears the necrosis is usually very superficial, forming a black eschar along the edge of the helix. In successive attacks a considerable portion of the margins of the ears may be lost. It is rare to see much necrosis of the nose, and even when the asphyxia is very pronounced and gangrene looks threatening, recovery may take place with a very superficial loss of substance.

Symmetrical parts are usually but not always involved. The process may begin in both hands or both feet and extend to gangrene in only one foot or one hand. When the ears are involved superficial necrosis occurs, as a rule, in both. A typical attack may occur in only one extremity. Of the distribution of the gangrene Munro gives the following figures: In 43 per cent. of the cases one or both of the upper extremities was attacked; in 24 per cent., the lower extremities, and in 22 per cent., upper and lower limbs. Parts other than the extremities may be involved; in severe attacks in which

the ears are affected the cheeks may be dusky red and swollen and threatened with gangrene. The chin may be the seat of local syncope or asphyxia. In rare instances the tongue is attacked. In Powell's case the tip became deeply cyanotic, and a superficial ulcer formed. The lips have been the seat of both syncope and asphyxia; the nates and the labia majora have been attacked. Raynaud describes a case of local and painful asphyxia of the nipples. The eyelids have been involved. The cases in which local gangrene occurs on the trunk and the proximal parts of the extremities are rarely Raynaud's disease, but the postfebrile and other forms. In a few cases the areas of local asphyxia may be present, as in Tannahill's remarkable case: A seven-year-old child subject to cold hands and cold feet had numerous attacks of local asphyxia of the extremities and of the ears, with hæmaturia, and later a severe attack in the left foot, with gangrene. The child had also well-marked local asphyxia in areas on the extensor side of the left forearm and one on the inner side of the leg.

Other Local Changes.—With recurring attacks of local asphyxia the hands may get thick and coarse. Rolleston describes a case in which they became visibly larger. Marked thickening of the skin of the fingers and a parchment-like induration may occur suggestive of scleroderma. In a few cases this disease has directly followed repeated attacks of local asphyxia. I have had a well-marked instance of this kind which is reported under the section on Scleroderma. The nails may be much altered in color, of a dark brown or brownish black, rough, ribbed longitudinally, and where partial necrosis of the phalanx has occurred they are greatly deformed. Suppuration may take place at the root and prove very obstinate. Desquamation of the skin of the fingers occurs if the cyanosis has lasted for a day or two.

Disturbances of Sensation.—Pain is an element of the first importance in all severe forms of the disease, particularly when the stage of gangrene is reached. The patient dreads to have the parts touched, or the slightest contact of the clothes causes agony. It is not confined to the affected parts, but may pass up the legs or arms, and may reach an intensity that causes the patient to cry out. Extreme local cyanosis may occur without much actual pain, and one rarely sees the pain of erythromelalgia unless necrosis has taken place. The worst attacks I have seen were in hysterical subjects and in very neuropathic Hebrews. In the severe attacks of local asphyxia the fingers may throb and ache as in chilblains. The local syncope may be painless, but in instances preceding gangrene the pains may be the first symptom and even antedate the ischæmia. Occasionally the whole course of the disease is painless. One of my patients lost the tip of one index finger without any pain, but in other attacks during the three years in which he was under observation the pain was often atrocious. In another case the index finger was not painful, only numb, but the adjacent middle finger, in very much the same condition and with one gangrenous bleb, was very painful; and after he recovered, although the pads of the two fingers looked very much the same, glossy and bluish white, that of the index finger felt only a little numb when touched, but the skin of the middle finger was exquisitely tender.

Anæsthesia, a dull numb feeling, is usual with the local syncope; paræsthesia, tingling, and prickling are present during the asphyxia, sometimes an unpleasant throbbing and burning. Following the attacks there may be

extreme hyperæsthesia of the affected fingers or toes, and for months the patient may not be able, for example, to use the hand, on account of the sensitiveness of the finger tips. The cases with dissociation of sensation are usually syringomyelia.

Sweating may be present in the stage of local syncope; the finger may be covered with a cold sweat. In the active hyperæmic reaction the whole hand may be moist, and in the protracted asphyxia a clammy moisture may cover the skin.

Motor Disturbances.—With the fingers dead and cold, motion is impaired, and they feel stiff, but, as a rule, there is not much motor disability apart from that caused by the pain. In a few cases wasting has been described in the interossei and in the thenars and hypothenars.

Complications.—If, as we suppose, the symptoms of Raynaud's disease are due to an angiospasm of the peripheral vessels, evidence of similar changes should occur elsewhere in the body, and in two regions at least, the eye and the brain, such is the case.

Eye.—Raynaud himself noticed that there were coincident alterations in the retinal arteries. In a man with typical attacks of local asphyxia, during the period of reaction, the central artery of the retina and its branches had very clear contours, and were definitely narrower around the papilla than at the periphery, and here and there was a sort of partial constriction; the veins were dilated, elongated, and pulsated. In another case Panas observed a definite relation between the state of the arteries of the fundus and the cyanotic attacks, contracted when the fingers were cyanosed, widened when they returned to their natural color. These are exceptional events; as a rule, there are no changes in the retinal vessels corresponding in any way with those in the peripheral arteries.

I have looked in vain for signs of constriction in several very typical cases, in one when the local syncope of the hands was extreme. In the two cases with marked cerebral symptoms there were no visible alterations in the retinal vessels. In a remarkable case reported by Weiss, with symmetrical gangrene of the fingers and reddening with superficial gangrene of the skin of the left side of the face in the zygomatic region, there was retraction of the eyeball in the same side, narrowing of the palpebral fissure, and slight ptosis, phenomena which Weiss referred to the cervical sympathetic.

Brain.—We have learned to recognize angiospasm as an important factor in cerebrospinal lesions. Sclerotic arteries are particularly prone to spasm, and the multiform clinical picture in certain cases of arteriosclerosis can only be explained by a transient contraction of the bloodvessels, causing an ischæmia and loss of function. The temporary amblyopia has been seen to be due to spasm of the retinal vessels, and the transient monoplegias, hemiplegias, aphasias, and even paraplegias, from which rapid and complete recovery takes place, cannot possibly be due to organic lesions, and are most likely the result of angiospasm in definite vascular territories. I have known twenty or more transient attacks of aphasia and monoplegia from which perfect recovery has taken place. Identical symptoms occur in Raynaud's disease. Raynaud himself reports a case in a woman, aged sixty-two years, but the transient hemiplegia occurred two years before the symmetrical gangrene. Weiss reports transient aphasia, and Simpson temporary hemiplegia, both in patients having well-marked features of

Raynaud's disease. One of the most remarkable cases on record came under my care at the Johns Hopkins Hospital.[1]

The patient, a woman, aged forty-eight years, was admitted with the complaints of difficulty in speaking and peculiar sensations in the fingers. For five or six years she had occasional attacks of numbness and mottling of the fingers. In April, 1891, she had dizziness and perhaps loss of consciousness. A month later there was a second attack, with pain and local asphyxia in the little and ring fingers of the right hand. In January, 1892, there was another attack of dizziness, with asphyxia and superficial necrosis of the terminal phalanges of the index and little fingers of the right hand. On February 2 there was an attack of aphasia, with loss of power in the right hand and paresis of the right foot. Recovery from this was rapid. On March 31 there was a second attack of complete aphasia and spasm in the right hand. After this she had good health until the summer of 1894, when there was slight pain and aching in the right leg and toes. In February, 1895, there was local asphyxia, with necrosis of the terminal phalanx of the middle finger of the right hand. On April 4 she had a severe attack, with headache and slight paralysis of the left arm and leg. There were severe local symptoms in the right hand and fingers. On July 19 there was a third attack of aphasia with hemiplegia of the right side, local syncope, and asphyxia of the right hand and fingers. In January, 1896, there was intense pain in the right hand, with rapid gangrene to the elbow; after this coma and death.

A somewhat similar case is reported by Dukeman: A woman, aged fifty-seven years, began to have local cyanosis and necrosis of the left ring finger. During the convalescence from this attack the fourth finger of the right hand became involved, and she had a right-sided hemiplegia and died in coma. It seems only reasonable to regard these attacks as due to vascular changes in the brain of the same character as those which occur in the peripheral vessels. True, the arteries of the brain itself have not been found in spasm, but the ephemeral character of the attacks can scarcely be explained in any other way, and we have the visible demonstration in the eye of the transient loss of function in connection with spasm of the arteries of the retina.

Epilepsy.—A number of cases have been reported in which convulsions have occurred; in some the epileptic seizures have been independent of the local cyanosis, in others the association has been very close. The case reported from my clinic by H. M. Thomas,[2] one of the most extraordinary in this respect, illustrates the wide symptomatology of the disease. A man, aged twenty-three years, had typical Raynaud's disease—fingers, toes, ears, nose—and the cyanosis often proceeded to superficial necrosis. The attacks only occurred in the winter; in the warm weather he was perfectly well. Epileptic attacks accompanied the outbreaks of local cyanosis, but only in the winter, when he also had hæmoglobinuria. We followed his case with great interest for more than three years. The local cyanosis was very marked, but the necrosis was never widespread. He lost a little of the ear margins, of the tip of the nose, and of the pads of the fingers. After three years the epilepsy ceased, but the winter attacks of cyanosis came on as

[1] *American Journal of the Medical Sciences*, 1896, cxii, 522.
[2] *Johns Hopkins Hospital Reports*, 1891, ii, 114.

usual and were associated with crises of abdominal pain, just like those of angioneurotic œdema, and he had swelling of the spleen. Unfortunately we lost sight of him.

Mental Troubles.—The subjects of Raynaud's disease are very often neurasthenic and subject to great depression. In hysterical patients, during the attacks the mental symptoms may be aggravated. There are no psychical disturbances peculiar to the disease. In a large number of mental disorders attacks of Raynaud's disease have been described— mania, amentia, melancholia, circular insanity, and progressive paralysis of the insane.

Organic Lesions of Brain and Cord.—Except the complications referred to above, there are no features of Raynaud's disease suggestive of coarse lesions of the central nervous system. On the other hand, local cyanosis and trophic disturbance are exceedingly common in many organic diseases of the brain and cord. These have often been described as cases of Raynaud's disease, but they are the vascular and trophic lesions well recognized as occurring in myelitis, syringomyelia, and tumor of the cord. These forms will be discussed under Diagnosis.

Urinary Changes.—*Hæmoglobinuria.*—Albuminuria may occur during the attacks in paroxysmal form, or it may be permanent. Actual nephritis is rarely present. Hæmoglobinuria is the most remarkable complication of the disease, and occurs in a considerable number of cases. It was first described by Jonathan Hutchinson, and has been specially studied by English authors. The well-known surgeon Druitt described his own case.[1] The attacks were brought on by worry or exposure to cold, and were associated with local cyanosis, numbness, and tingling of the extremities, and at times these features were suggestive of imminent gangrene. He died in 1883 of hæmaturia.

Monro, who deals very fully with this complication in his monograph, notes the peculiar fact that hæmoglobinuria is much more common in males. In Raynaud's disease only 37.4 per cent. of the cases are in males, but in the cases of hæmoglobinuria with Raynaud's disease the proportion is 71.4 per cent. of males. As a rule, the urinary changes are only met with during the existence of the local cyanosis, and the attacks are more liable to occur when the patient is up and about. When put to bed the hæmoglobinuria may cease, although the paroxysms of local cyanosis recur. The influence of cold is the most remarkable feature in the attacks; a patient may be free during the warm weather, as in one of the cases mentioned above, but with the onset of cold weather the attacks begin and may recur at intervals through the winter. As Barlow pointed out, this is exactly what happens in the cases of ordinary paroxysmal hæmoglobinuria. During the attacks the spleen may be enlarged. Abdominal colic occurred in my case. So far as I know, jaundice has not been described in these cases. Various changes in the blood have been described—hæmoglobinæmia with irregularity of the corpuscles and disinclination to form rouleaux. I do not know that the fragility of the corpuscles has been studied in these cases by the new methods, but we may suppose that from some unknown cause this has been greatly increased. The connection with the vasomotor phenomena remains obscure. Possibly in the cyanosed areas changes occur in the

[1] *Medical Times and Gazette,* 1873.

serum of the stagnated blood which give to it a foreign hæmolytic quality, but we have in reality no reasonable explanation of the remarkable phenomenon.

Skin.—In a few cases purpura has occurred. Urticaria has been present and has recurred with the paroxysms. The relation between true Raynaud's disease and scleroderma has been much discussed. Repeated attacks may give a hard sclerosed aspect to the fingers. It is certainly rare for generalized scleroderma to follow the recurring attacks of Raynaud's disease; there are a few cases, however, with this sequence. Barlow mentions a case with typical local syncope of the finger tips which ended in symmetrical gangrene of the tip of each index finger. She recovered, but the fingers presented an atrophied and contracted appearance; subsequently, extensive scleroderma of the skin of the chest walls came on and she died marasmic. I have reported a typical case of this kind. Much more commonly as the scleroderma develops on the hands and feet there is local cyanosis and trophic changes in the finger tips and in the knuckles. Local necrosis occurs, and the terminal phalanges become shrunken and contracted.

Heart and Arteries.—In a few cases organic heart lesions have been present. The extraordinary acrocyanosis of congenital heart disease never goes on to necrosis. Occasionally in mitral and tricuspid lesions in children the cyanosis of the fingers and toes may be remarkable, and in the cold the lividity may be extreme. Embolic gangrene has in some cases of organic heart disease been mistaken for Raynaud's disease; in others there appears to have been a combination of the two conditions, as in Colson's patient (quoted by Cassirer), a four-year-old child with an organic valve lesion. Sudden swelling of the left hand occurred with gangrene of the fingers. Three months later there was a second attack of swelling of the fingers of the left hand, with blueness, which disappeared in a few days, but at the same time the left ear became swollen and cyanotic. This seems to have been a case of genuine Raynaud's disease complicating a heart lesion.

Arteriosclerosis is not a common feature, but it may be present, and a number of typical cases have been reported. In a majority of the patients the arteries are healthy, and the pulsations may be felt in the vessels of the affected limbs even to the smaller branches. In long-standing cases definite changes in the arteries may be found. A patient of Barlow's had typical attacks of local syncope and cyanosis, and in his second winter a little gangrene of the second and third toes of the left foot. Two years afterward the toes of both feet became very blue and gangrene involved the left foot and ankle. Amputation of the thigh was done. The arteries were found to be diseased. The right toes showed signs occasionally of local asphyxia, and two years later the foot became gangrenous and necessitated amputation of the right leg. The arteries were found diseased. Barlow remarks that this case approximated to one of Friedländer's obliterative arteritis, and it seems reasonable to suppose that the recurring spasmodic contractions of the vessels brought about a permanent alteration in the walls and lumen. In the very large group of cases of local gangrene due to arteritis it is by no means easy to say whether the condition is one of Raynaud's disease or not.

Joints.—In recurring attacks in the fingers the terminal joints may be ankylosed by peri-articular thickening, and in long-standing cases the last phalanges may be bent at right angles. Effusion may take place

into the larger joints (knees), as in a case reported by Southey. The most remarkable case is one reported by Weiss: "There was effusion in the joint cavities and infiltration of connective tissues above and below the joints; once there was synovitis of the metacarpophalangeal joint of the right middle finger followed by tenosynovitis of the flexor tendons of the finger."

"On one occasion there was effusion into the knee-joint associated with exudation into the cellular tissue of the thigh and knee. . . . The skin was only reddened once, namely, in the case of effusion into the shoulder-joint; the temperature was not raised at the outset and the curve was afebrile throughout" (quoted by Barlow). The occurrence of Raynaud's disease with arthritis deformans is discussed elsewhere in this volume (McCrae).

Diagnosis.—Let me define again the main points: Raynaud's disease is an affection of the vasomotor (and trophic) centres, the anatomical basis of which has not yet been determined. The symptoms are associated with pain and vascular disturbances of the extremities—fingers, toes, hands, feet, ears, nose—local syncope, hyperæmia, asphyxia, local necrosis, usually occurring symmetrically and in recurring attacks. Sensation and motion are not involved, but in some cases there are symptoms indicative of involvements of the vascular territories of the brain (aphasia, hemiplegia), kidneys (hæmoglobinuria), and intestines (colic). The disease is most common in neuropathic individuals and women are much more frequently attacked than men. Few affections have more striking characteristics, and yet the difficulties in diagnosis are often very great.

Mild Forms.—If we could make necrosis the criterion and call no case Raynaud's disease unless the vascular changes had proceeded to gangrene, the diagnosis would be simple enough, but we cannot possibly exclude the milder forms, which escape this final stage. For years a patient may have recurring attacks of local syncope and asphyxia, with pain and great disability, but each time the cyanosis yields or disappears in an active hyperæmia. Then in an attack, it may be the tenth or twentieth, the cyanosis of one finger does not yield, necrosis occurs, and the tip of a finger or an entire phalanx is lost. Or, what is still more common, the local asphyxia persists long enough to cause a slight superficial necrosis of the pads of the fingers or of the tips of the knuckles, a bleb forms, and there is left a superficial scar. Many cases go no farther—typical cases, which never reach the stage of severe gangrene. But here arises the difficulty—where are we to draw the line in these mild forms? It is not possible—Nature draws no hard and fast lines. Thus, there are cases of chilblains with every feature of Raynaud's disease; indeed, we may say that this remarkable affection represents the typical *forme fruste* of the disease; but we very properly hesitate to group all forms of chilblains under Raynaud's disease, and yet some of the most typical and serious cases of Raynaud's disease have been preceded by ordinary chilblains, and the attacks have never come on except in the winter months, after exposure. It is the sequence of events and the periodicity that characterize the disease, not the individual elements.

Two affections with many points of similarity to Raynaud's disease, erythromelalgia and scleroderma, will be considered separately. Of many forms of local necrosis which have to be distinguished, the more important may be grouped under four headings—organic disease of the nervous system, obliterative arteritis, postfebrile necrosis, and multiple neurotic skin gangrene.

Diseases of the Nervous System.—*Syringomyelia.*—In no other organic affection of the nervous system is the condition of the fingers and toes more similar to that in Raynaud's disease, and yet in the majority of cases the added disturbances of sensation and motion make the diagnosis easy. It is more particularly in the form with sclerodactylism (Morvan's disease) that the mimicry is seen. The following differential table, modified from that of Castellino and Cardi, quoted by Cassirer, gives the essential points:

Syringomyelia.	*Raynaud's Disease.*
1. Begins gradually.	1. Begins suddenly.
2. Course very chronic; ten to fifteen years.	2. Course more acute; one to three months.
3. Begins usually in one extremity and extends slowly to the others.	3. Symmetrical onset the rule.
4. No previous vasomotor changes.	4. Vasomotor changes marked.
5. Recurring painful panaris.	5. Dry gangrene.
6. Skin cyanotic and cold.	6. Skin black and cold.
7. Dissociation of sensation.	7. Anæsthesia or paræsthesia.
8. Atrophy of muscles.	8. Atrophy very rare.
9. Ulceration common.	9. Ulceration rare.
10. Nails lost, and when reformed much curved and thick.	10. Nails dark, not deformed.
11. Necrosis and separation of bone.	11. } Atrophy of terminal phalanges
12. Fingers much curved and contracted.	12. } only.

Diseases of the Brain.—In hemiplegia the hand and foot of the paralyzed side may show marked vasomotor changes, great congestion, œdema, and occasionally necrosis of the fingers or toes. I have already referred to the cerebral complications of the disease, the transitory aphasia and hemiplegia which may accompany or precede the other manifestations, and in some of the cases in which Raynaud's disease has been said to complicate hemiplegia the peripheral and central symptoms have been due to one and the same cause. The hemiplegia of Raynaud's disease is usually transitory, and occurs in the subjects of repeated attacks of local syncope or of symmetrical gangrene. In organic hemiplegia the trophic changes leading to gangrene have rarely the same distribution as the necrosis of Raynaud's disease; the heel or the inner part of the ankle or the sole of the foot is as likely to be attacked as the toes, and there is not the same sequence of vasomotor changes.

Diseases of the Spinal Cord.—In many affections of the cord, acute and chronic, the most marked trophic changes may occur, leading to gangrene, and while the picture may resemble somewhat that of Raynaud's disease, there is rarely any difficulty in diagnosis. With chronic affections, in tabes and in tumor, trophic lesions of the toes and of the skin of the feet may occur, with a striking similarity to the lesions of the disease under consideration. Much more common is the trophic change without any vasomotor phenomena. I have seen extreme asphyxia of the feet in tabes precede the appearance of the perforating ulcer. Schlesinger has reported a case of sarcoma of the cord with symmetrical gangrene of the toes. In acute myelitis the trophic changes have rarely the features of Raynaud's disease; the toes may not be affected, but the heels or multiple patches on the legs. The gangrene comes on with much greater rapidity. I reported a remarkable case of

syphiloma of the cord with acute central myelitis and widespread trophic changes. Following trauma and in all varieties of acute compressive myelitis local gangrene may occur, but the "acute bedsore," as it is called, is a very different lesion in distribution and in appearance, and could never be confounded with Raynaud's disease.

Multiple Neuritis.—Remarkable vasomotor and trophic changes may occur in neuritis. One of the most common is the loss of control (paresis) in alcoholic neuritis, with an extraordinary cyanosis of the hands and feet. Still more remarkable changes may be seen in the acute neuritis of the infectious fevers—the hands may be swollen and cyanotic, but I have never seen necrosis. In the neuritis of the arm which sometimes follows arthritis of the shoulder-joint I have seen the whole forearm and hand swollen, painful, and red, except the finger tips, which looked livid, as though about to become necrotic. There are cases in which a multiple neuritis with motor paralysis and vasomotor changes has been associated with local gangrene. Cassirer, after a careful analysis of the literature, concludes that genuine instances are very rare. Occasionally with the polyneuritis of beriberi there is extensive gangrene. Monro reports the case of a man admitted with œdema of the legs, hyperæsthesia, loss of the tactile sensation, and absence of the knee-jerk. He had had beriberi. The tips of the toes became gangrenous, the process spread upward, and both legs had to be amputated. In the obliterative arteritis group, pain, paræsthesia, and disability may precede the gangrene and the picture may suggest a neuritis. Still more suggestive are some of the diabetes cases with anæsthesia, or paræsthesia, and a sudden onset of the gangrene. On the whole, it is not difficult to separate the vasomotor and trophic changes of neuritis from those of Raynaud's disease.

Obliterative Arteritis.—The local gangrene of this condition has many points in common with that of Raynaud's disease, and the two are often confounded. The cases, which are by no means uncommon, are met with in elderly people, in young persons who have well-marked arteriosclerosis, in syphilitic subjects, and in diabetics. Preceding the gangrene there may be attacks of the most extreme vasomotor changes. A lady, aged seventy-six years, the wife of an old friend, asked me one day to look at her right foot, which became swollen and red when she walked upon it. When at rest the feet looked alike, but after she had stood for a few minutes the affected foot became a little paler, and then, in a minute or two, got deeply cyanosed. After persisting for a few months she had a very severe attack, in which the foot became painful, the toes very dark, and it looked as if gangrene would occur, but prolonged rest restored the circulation, and with massage of the foot night and morning she escaped further trouble. No pulse could be felt in the dorsal artery of either foot, and she had well-marked senile arteriosclerosis. These are the cases which are often confounded with Raynaud's disease. They are nearly always in elderly people and are not infrequently associated with diabetes. They are very obstinate and distressing, and the pain may be atrocious. A man, aged sixty-eight years, who had had excellent health, a year before I saw him began to have pain in the right big toe and then in the right foot, which at first was pale, the doctor said definitely paler than the other. Then it began to get red and very painful at night, and from midnight to 5 or 6 A.M. he would suffer greatly. When he walked about the foot got

swollen and blue. At times he has been better, but he had spent a year of great misery. He looked a very healthy man, with good color, and his arteries were not more sclerotic than one would expect in a man of his age. The right big toe was swollen, not red; the metatarsal joint was large. The tarsus looked normal. The big toe was a little flushed, otherwise there was no difference between the feet. When he stood there was at once an extraordinary change. The right foot immediately got red, and in thirty seconds by the watch the whole foot to the ankle got congested, of a vivid red color, the veins stood out with great prominence, and the foot began to throb and ache. If he continued to walk about the toes got blue or blue-black, and on several occasions it had looked as though gangrene would follow. The most extraordinary change followed when he held the foot above the level of the body—the blood could be seen to run out of it, and in half a minute it was pale, even paler than the other, only the big toe remained of a dusky hue. Pulsation was well felt in the left, none in the right dorsal artery, and no pulsation in the posterior tibial on either side. This is a typical case of extreme vasomotor and sensory changes in connection with arterio-sclerosis.

From this stage to necrosis is an easy step, and many of these cases present the interesting combination of obliterative endarteritis, intermittent claudication, paræsthesia, and pain, with necrosis of the toes or of the whole foot. There is not often difficulty in distinguishing them from Raynaud's disease, but in a few cases in young persons the arteriosclerosis may not at first be very evident and the picture may be very suggestive. There may be marked preliminary spasm of the arteries, so that the foot looks white, and attacks of local asphyxia may come at intervals of a month or six weeks before necrosis supervenes. Barlow gives a case of a man with typical Raynaud's disease with recurring attacks which necessitated the amputation of both legs at intervals of a couple of years; the arteries showed decided thickening of all their coats.

Diabetes.—The relation of *diabetes* to Raynaud's disease is of great interest, as cases of this disease have been reported with local syncope and asphyxia. In one of Raynaud's cases the first signs of local asphyxia preceded the diabetes eight years, and it is quite possible the two diseases may co-exist. In a majority of the cases the symptoms are due to arteritis, and there is an absence of pulse in the dorsal arteries or the posterior tibials. The onset may be sudden. A man, aged sixty years, very healthy and robust, came to see me one Monday morning very much alarmed about the condition of the toes of his right foot. He had taken a long walk on Sunday, and he complained to his brother that he felt something "splashing in his right boot." To his surprise, on taking it off, his stocking was soaked with blood, which had come from a large blood blister on the outer side of the big toe. All the toes of the right foot were black, which he thought due to the staining with blood. There was no pain. The toe bled again in the night. When I saw him there was extreme cyanosis of all of the toes of the right foot, the big toe looked black, and on the other side a large bleb had burst. The toes were anæsthetic, no pulse could be felt in the dorsal artery. The urine contained a large quantity of sugar. Superficial necrosis occurred in the pad of the big toe. This was not true Raynaud's disease, but an extreme local asphyxia and necrosis in a case of obliterative endarteritis, induced directly by the prolonged exercise.

Gangrene of the Acute Infections.—This form, which is very rarely confounded with Raynaud's disease, may be due to arterial or venous thrombosis, in which case it is usually confined to one limb; or it may be associated with a very profound infection or a cachectic state, when it is often multiple. Many of these cases have been described as Raynaud's disease, but the existence of the infection and the distribution of the gangrene are sufficient for the diagnosis. The embolic and thrombotic forms involve the limbs, usually the leg and foot or the whole hand, rarely the fingers and toes alone. Pneumonia, typhus and typhoid fever, and septicæmia are the most common infections with which gangrene is associated. In some epidemics of typhoid fever it has been a more common occurrence than in the ordinary forms, and when due to a peculiarly virulent infection there may be multiple areas. The same holds true of malaria, in which the gangrene may be very widespread, as shown in the accompanying figures from a case admitted to the Johns Hopkins Hospital. There are cases in the literature which, as Barlow remarks, "are indistinguishable from Raynaud's disease, symmetrical, terminal, dry, and limited," but gangrene is an exceedingly rare complication of malaria, and the case from which the figures were taken was the only one admitted to the Johns Hopkins Hospital.

Multiple Neurotic Skin Gangrene and Pathomimia.—This is one of the rarest forms and has been variously described as *acute multiple skin gangrene*, *neurotic excoriations, gangrènes disséminées et successives de la peau d'origine hystèrique*, and by Dieulafoy as pathomimia. Cassirer, whose account is admirable, could only find 13 cases (1901), 10 women and 3 men, but there are many more if we include the cases of simulation. Many of the patients have been hysterical, but not all. The question of simulation has always to be considered. I saw in Paris, in Dieulafoy's clinic, a man who had this type of gangrene, which became so severe in the left arm that a surgeon amputated it in August, 1906. The spots had appeared at intervals for nine months; some of them were 5 and 6 cm. in extent. In February, 1907, the spots began to appear in the right arm—areas of gangrene which took two or three weeks to slough off and left a deep scar. Many physicians were consulted, and the case attracted widespread notice. He came to the Hôtel-Dieu in April, 1908; the "disease" had lasted two and one-half years, and he had ninety-eight scars on the arms. A few days after admission eschars began to form on the left leg just above the malleoli. Nothing could be determined as to the cause—he had not had syphilis, he was not hysterical, there was no diabetes, and nothing to suggest a special trophic lesion. The rapidity with which the eschars formed suggested simulation —one would be in full progress in an hour or an hour and a half. He confessed to having made them with caustic potash, dominated by a fixed idea which so far possessed him that he consented to have the arm amputated. Professor Dieulafoy has suggested the name *pathomimia* for this simulation of the effect of disease.[1] The cases are of interest in connection with Raynaud's disease, as a condition very similar may be produced. Anschutz has published five cases of gangrene of the big toe in military recruits, caused by car'.olic acid; the toes had to be amputated. The view is gaining ground among neurologists that all of the so-called trophic hysterical lesions—the hysterical pemphigus, the hysterical ulcerations, and the hys-

[1] *Académie de Médecine*, June, 1908. Separate Brochure. *Histoire d'un Pathomime.*

terical gangrene—are simulated. In any case the form of multiple neurotic skin gangrene has little in common with Raynaud's disease, and any difficulty in the diagnosis should not often arise.

Ergotism.—In chronic poisoning with ergot a local gangrene may be caused which bears the closest possible resemblance to Raynaud's disease. The fingers and toes are chiefly affected and the gangrene is dry. Vasomotor changes with paræsthesia and sometimes contractions of the muscles may precede it. The cause is the same, namely, spasm of the arteries; but ergotism is exceedingly rare, occurs only in certain countries, and usually in endemic areas. I do not know that a gangrene similar to Raynaud's disease has ever been caused by the medicinal use of the drug.

Treatment.—The general health of the patient should be carefully studied. Sometimes it is only with the removal of some source of worry that the disease is cured. Neurasthenic and hysterical conditions must be carefully treated. In the mild forms, more particularly, the general may be more important than the local measures. When influenced by cold and damp the patient should keep the hands and feet warm, and avoid, as far as possible, getting chilled. When attacks recur in the winter only, a residence in Florida or southern California should be recommended, or if residents of Great Britain they should arrange to winter in Egypt. One of my patients, after years of suffering, had great relief in southern California.

The milder forms which do not reach the grade of necrosis are best treated by massage, electricity, and hydrotherapy. Systematic friction of the fingers and hand, morning and evening for half an hour, helps to give tone to the bloodvessels. A dead white finger may be made of a vivid pink color in a few minutes, or the cyanosis may be made to disappear quickly. There is no one measure more useful in these cases than massage if one can get it thoroughly carried out. It may be combined with hydrotherapy such as the alternate hot and cold douche to the hands or wrapping them in wet cloths for an hour or two twice a day. A general course of hydrotherapy at an institute or at one of the spas may he helpful.

Electricity may be used, and was highly recommended by Raynaud, either as galvanism or the high-frequency currents. In the severe types it is of little or no service, but in cases of paroxysmal local asphyxia and syncope it is a useful adjunct to other measures. Barlow recommends the following procedure: "Immerse the extremity of the limb, which is the subject of local asphyxia, in a large basin containing salt and tepid water; one pole of a constant current battery is placed in contact with the upper part of the limb above the level of the water, and the other pole in the basin, thus converting the salt and water into an electrode. As many elements as the patients can comfortably bear should be employed, and the current should be made and broken at frequent intervals, so as to get repeated moderate contraction of the limb. The patient should also be instructed to make voluntary movements of the digits while the galvanism is applied." In many cases a great and even insuperable difficulty in carrying out the local treatment is the pain, which is increased by the movements and by the electricity. Sometimes the radiant heat baths are most satisfactory; in one instance the pain was greatly relieved, so that the patient could sleep, and the local cyanosis was replaced by an active hyperæmia, which gradually subsided.

In the severe forms with necrosis in progress there are three indications: (1) To relieve the pain, for which local sedative applications may suffice, but very often morphine has to be given. The radiant heat may be tried. (2) To reëstablish the circulation in the asphyxiated area so as to restrict the progress of the necrosis. Massage and other local measures are impracticable on account of the pain and the presence of the gangrene. Hot douches, immersing the limb in hot water, a hot-air bath, or the radiant heat may be tried. In a case of great obstinacy and recurring attacks of gangrene of the toes and fingers Harvey Cushing suggested the use of Esmarch's bandage, so as to get the good effect of the active hyperæmia following its application. A simple tourniquet may sometimes be used. The limb is bandaged lightly and made completely anæmic; the tourniquet is then applied and kept on for a variable period. The process is usually so painful that in half a minute the patient is crying out, and the tourniquet has to be loosened. In other cases the anæmia may be maintained for a minute or two. When the limb is free the blood surges into it and causes an intense hyperæmia, which may invade the cyanosed areas of the foot or leg. Carefully practised, if the patient can stand it, this procedure gives the best results I have seen in these severe forms. It may be tried three or four times a day. The venous hyperæmia alone, by Bier's method, may be employed, but one does not get the intense active hyperæmia which follows Cushing's method. (3) Local treatment of the gangrenous part: The separation of the necrotic parts is a slow, tedious affair, and in the case of a digit may take months. Antiseptic poultices and lotions and aiding nature at times with a little surgery is as much as can be done. The parts adjacent are rarely fit for any more radical procedure. Putting the patient in a continuous warm bath for two or three weeks may be tried, particularly in cases with excessive pain. The heat also favors the separation of the slough.

Medicines are of very little service in Raynaud's disease. One would suppose that amyl nitrite and nitroglycerin would be helpful. I have seen in a paroxysm of local syncope and asphyxia the spasm gradually relax and the affected fingers grow red and hot after an inhalation of nitrite of amyl, but it is not always effective, and there are cases in which the spasm of the arterioles is not affected in the slightest degree by the drug. In the severe paroxysmal forms neither it nor the sodium nitrite appears to be of much service. For the pain opium in some form has to be used, at first locally with the other measures spoken of, and if insupportable it must be given by the mouth or hypodermically. There is great danger in the recurrent form in women of the morphine habit. I have seen three cases with this grievous complication, and it was impossible to say just how much suffering existed. In persons of middle or advanced age, with daily paroxysms of pain and cyanosis and threatened gangrene, Monro recommends opium, in pill form, in moderate doses. Antipyrin, phenacetin, and other analgesics may be tried. Ergotin has been recommended, but in cases with threatened gangrene I should say its use was contra-indicated; on the other hand, there is no more useful drug in the mild types of vasomotor ataxia in young girls—the dead hands, with puffiness, and cyanosis or redness depending on the external temperature.

CHAPTER XXVIII.

ANGIONEUROTIC ŒDEMA: QUINCKE'S DISEASE.

By WILLIAM OSLER, M.D.

Definition.—Localized swellings of the skin and subcutaneous tissues of the face and limbs, appearing spontaneously, and lasting from a few hours to a day or two. The mucous membranes of the lips, pharynx, larynx, gastro-intestinal canal, and genitals may be simultaneously involved, or they may be affected alone. The lesions in the skin are usually painless, but may be associated with itching and a sense of tension. Recurrences are the rule, and the swellings may appear at intervals throughout life. The affection may occur in many generations, and in many members of a family. In the majority of cases it is not serious, but the gastro-intestinal form causes severe colic, and in a few instances death has been caused by œdema of the glottis. The affection is closely related to urticaria.

History.—A disease with such marked peculiarities is not likely to have escaped the notice of the older observers, and Joseph states that cases were reported in 1778 by Stolpertus and by Erichton in 1801. Graves gave an excellent description in 1848, and Milton[1] reported cases under the excellent name of giant urticaria, but general attention was not called to the disease until the description by Quincke in 1882,[2] since which date there have been scores of communications on the subject. The literature is fully given in the *Index Catalogue of the Surgeon-General's Library*, 2d series, vol. xii, and in Cassirer's monograph.[3]

Nomenclature.—The name here adopted is the one in general use by English and American writers. Others are: Giant urticaria (Milton); urticaria œdematosa, urticaria tuberosa, wandering œdema; intermittent œdema, acute recurrent œdema; œdème rheumatismal essential; œdème rheumatismal à répétitions; and hydrops hypostrophos (Schlesinger). The nodosités cutanées éphémères of Févérol, as I read his description, belong to the rheumatic subcutaneous nodules.

Etiology.—The disease is not uncommon. The writer has notes of 18 cases in private practice. There were 16 cases at the Johns Hopkins Hospital in a period of nearly twenty years among 23,000 medical cases. It is more frequent among the better classes. In my series women were much more frequently attacked—14 to 4. In the cases collected from the literature by Cassirer there were 70 men and 63 women. A majority of the cases are in persons under twenty years of age, but it may occur at any period. J. P. Crozer Griffith reports cases at one and one-half months, and the grandfather of one of my patients who had suffered from boyhood had occasional attacks

---

[1] *Edinburgh Medical Journal*, 1876.
[2] *Monatsheft. f. prakt. Dermatologie*, 1882.
[3] *Die Vasomotor-trophischen Neurosen*, Berlin, 1901.

after his ninetieth year. With advancing age the tendency to attacks lessens. In one man the attacks began after his fortieth year.

In a majority of the cases no exciting cause can be discovered. Unlike ordinary urticaria, digestive disturbances and errors in diet play a very small part. One of the writer's patients thought that the eating of fish was sometimes the cause of an attack. In one case strawberries and coffee would at once bring out the œdema, a peculiarity which had persisted for twenty-two years. On the other hand, some of the most obstinate cases are entirely uninfluenced by diet.

Nervous Influences.—This appears to be the most important factor. In the first patient I saw with the disease, a young dentist, who had recurring attacks in the eyelid and forehead, worry, overwork, or any depressing influence was liable to bring on the œdema. A nurse, subject to the malady, had at times to give up a patient, who caused her much anxiety, on account of the recurring attacks.

Infections.—Rheumatic pains, swelling of the joints, tonsillitis, and, in a few cases, definite rheumatic fever have accompanied the outbreaks. Giant urticaria may occur alone or with other skin manifestations. In children there may be fever, with constitutional disturbances, pains in the joints, severe colic, vomiting, and polymorphous skin rashes; in one attack, purpura; in a second, ordinary urticaria; in a third, angioneurotic œdema; in a fourth, colic alone. In my series of 28 cases, reported under the title (for want of a better) "The Visceral Lesions of the Erythema Group," there were several cases of this character.

Malaria has appeared to be a factor in a few cases (Matas). The intoxications have played no role in my series. Alcohol has been mentioned by a number of observers. In a man, aged forty-four years, addicted to morphine for many years, and believed to be cured, though he was taking three grains a day, œdema of the legs came on without any obvious cause, and had persisted for nearly three years. There was no albumin in the urine and no corpuscular anæmia—only the ashen pallor of the morphine *habitué.* The œdema had given him great trouble, and had been the cause of much discussion among his physicians. It came on while he was taking as much as twenty-five grains of morphine a day, and he thought that it had diminished within the past years when he had reduced the quantity to about five grains daily.

Of the endogenous poisons the result of perverted metabolism—anywhere from the moment the morsel of food is rolled round the tongue until its constituents have been through the furnaces and are cast out as ashes and smoke—we talk a great deal, but we know nothing, so far, at least, as this disease is concerned. In organic affections of the nervous system œdema is not uncommon, but the cases scarcely come in this category. In poliomyelitis anterior, in compression paraplegia, in peripheral neuritis, in monoplegias, œdema may occur, but the whole limb is, as a rule, involved, and it has not the transitory character of the form under consideration. In the neuritis of typhoid fever or of arsenical poisoning the œdema may be very localized. But in none of these conditions is the œdema exactly like the Quincke form—it is more permanent and often more extensive, and the same may be said of the posthemiplegic œdema. In rare cases œdema may occur in the region affected with the lightning pains of locomotor ataxia.

As already mentioned, emotional disturbances are very apt to bring on

an attack, and some of the most obstinate cases are in neurasthenic subjects. At least one-half of the cases in my series belong to this type. One patient who described herself as "a bundle of nerves," and with "pain wherever I have a nerve," had had œdema for more than twenty years, scarcely ever passing a week without an outbreak. When I saw her the back of the left hand, the ulnar side of the right hand, and the skin over the left elbow were affected. The ears often became stiff, swollen, and red. She had had colic, and as a younger woman was subject to "bruises"—blue spots which came out spontaneously. The irregular distribution of the swellings in these neurasthenic patients separates the condition clearly from the hysterical variety.

Many of the patients have had other nervous affections—migraine, neuralgia, and exophthalmic goitre. In the last-named disease, erythema, urticaria, spontaneous and factitious, are common, but very rarely giant urticaria; a persistent œdema of the legs may occur which may have the tense, indurated aspect of scleroderma. In the psychoses, angioneurotic œdema is occasionally met with. The patients are very apt to be depressed and a settled melancholy may ensue. The first case I saw, the young dentist already referred to, committed suicide.

Menstrual disturbances may be associated with transitory œdema. As is well known, at each period there may be puffiness of the hands or of the face. In at least six of my cases the attacks were more likely to occur at this time, and in individuals strongly predisposed, or with the hereditary bias, the association is common. At the climacteric, vasomotor disturbances are frequent, and occasionally the waking numbness and the acroparæsthesia are accompanied by swelling of the hands and feet and puffiness of the face.

In susceptible individuals a slight trauma may suffice to bring on an attack. Cold, which is an important factor in certain cases of ordinary urticaria, does not seem to play any part in angioneurotic œdema. In a few cases only the uncovered parts—face and hands—have been affected. In very sensitive subjects, placing the hands in cold water, a cold breeze on the face, or exposing the buttocks in a cold water-closet, have sufficed to bring on a local attack. In none of my patients did the season make any special difference.

Heredity.—Heredity plays a very important rôle in the disease, and the cases in this category are of unusual severity. Quincke, Dinkelacker, Strubing, and others have reported families in which it has occurred. In the family I have described,[1] the table of which is given on page 651 (hereditary angioneurotic œdema), the disease occurred through five generations and affected more than twenty people, causing at least two deaths. I have since seen incidentally two other members of this family, both with very severe forms of the disease. The serious nature of the trouble may be gathered from the following account: Mrs. W., aged fifty-four years, is of the fifth generation of the family. Her mother had attacks, and also one sister; one brother is well and strong. She has had three children, two sons and one daughter, none of whom has had attacks. The angioneurotic œdema began in her twenty-seventh year, after the birth of her second child, with colic and swelling of the skin of the abdomen. Then the arms and legs

---

[1] *American Journal of the Medical Sciences*, 1885, xcv, 362.

began to swell at times, but never very badly. Seven years ago the face was affected, the eyes closed, the throat was swollen, and the breathing obstructed, so that the wheezing could be heard all over the house. From this time her life has been one of great misery from the frequent recurrence of the attacks in the face, arms, legs, and chest, and occasionally in the throat. In August, 1904, with an attack in the face and throat, she had colic and vomited blood. The swellings are usually white, sometimes a little red. In the severe attacks there is fever. The duration is from ten to thirty-six hours. The recovery is very rapid. Strawberries or coffee will at once cause an attack. Fatigue or emotional disturbance is sure to be followed by a swelling. When I saw her she had a large infiltrated œdema, with redness of the region of the right elbow and well-marked lines of demarcation. On the left arm there was a white swelling on the inner aspect of the elbow and two black and blue spots from an attack a few days before on the outer surface of the left arm. The severe attacks are always accompanied by erythema, and she has at times large ecchymoses, but never the ordinary wheals. The neck has swollen so as to obliterate the outlines of the chin.

GENEALOGICAL TABLE SHOWING ANGIONEUROTIC ŒDEMA IN THE
FAMILY OF T.

I.	II.	III.	IV.	V.
	Samuel,	3 children all affected; 1 (John) died of it.	One girl affected.	
	Stacy,		*Hamilton,*	*Thomas, Lizzie.*
			Rebecca, died of it.	2 children, aged 17 and 11, one of whom has recently had her first attack.
Margaret,[1] b. 1762, d. 1834.	*Allan,* 10 children, 3 affected,	*George,*	Almira, *Mary, Julia,* Katie, *Edward, Maggie,* George.	
		Emma, single.		
		Sallie, married; no children.		
	John M.	4 children; 1 (*Angey*) affected.		

[1] Those in italics have suffered with the disease.

In the other member of this family, in the sixth generation, attacks of colic occurred for years before any local skin swellings made the diagnosis clear. Meanwhile, she had had her appendix removed, as the recurring abdominal attacks were believed to be due to appendicular colic. The severity of the hereditary form is illustrated by the cases of Griffith;[1] both father and daughter died of the acute œdema of the larynx.

I do not think any of the families have been studied with sufficient care to get details as to the frequency of transmission through the mother or the father on the value of Mendel's law. In the family reported by me it was impossible to get accurate details, as the members had scattered far and wide, and one of those just referred to did not know of the existence of a peculiar disease in her family.

Hysteria.—Sydenham first recognized an œdema associated with hysteria. Charcot and his pupils made it the subject of several important studies. The common variety bears very little resemblance to the ordinary angio-neurotic œdema, except that in both there is infiltration of the subcutaneous tissue. The affection is usually superimposed on some well-marked hysterical manifestation—a paralysis or a contracture. It is not paroxysmal or transitory, but persists often for as long as eighteen months or two years, and, as a rule, is accompanied by disturbances of sensation. The areas affected usually correspond with the natural divisions of the body, an arm, a leg, a mamma, *i. e.*, they are "geometrical" or "segmental," or conform to areas covered by articles of clothing, stocking, sock, or glove. The ordinary type of Quincke's œdema may occur in hysterical subjects, and many cases of the kind are reported; but the association is not so common as with neurasthenia. In not one of my cases did hysteria co-exist. Edge-worth has reported a series of cases[2] in which transitory œdema of a seg-mental destribution occurred in young subjects, and in three of the seven cases there were disturbances of sensation suggestive of hysteria. In one instance the duration of the attacks ranged from two days to thirteen weeks.

Pathology and Relation to Other Affections.—Is Quincke's œdema a disease *sui generis* or is it only a symptom complex with relations more or less close with other affections and a varied etiology? It is not easy to determine. An affection which "breeds true" through six generations and presents in each identical features seems worthy of special designation. But the œdema itself is only a symptom, behind which is the effective cause for which we have so far no clue. Œdema, like arthritis, is caused by a number of different agents, and as in many forms of arthritis we have to be content with anatomical and clinical features, so in this special variety of œdema it may be urged that even in the absence of a definite etiological factor the clinical features and the remarkable heredity suffice to raise it to the dignity of a disease. The chief difficulty arises when we consider its close relations. The special lesion is nothing but a wheal of urticaria "writ large." The difference is one of degree and amount of exudation, not of kind. The erythema of an ordinary wheal is often present, and while the plasma plus leukocytes forms the chief part of the effusion, red blood corpuscles do pass out of the vessels and a staining may be left.

[1] *British Medical Journal*, 1902, i, 1470.
[2] *Quarterly Journal of Medicine*, 1909, ii, 135.

Milton's phrase, "giant urticaria," was most happily chosen. Ordinary urticaria has its visceral manifestations, and there are cases which Doctor A. will diagnose Quincke's œdema in this attack, and Doctor B. simple urticaria in the next outbreak, and both may be right.

Another interesting relationship is with purpura—which has an identical lesion—an exudate of blood, with a qualitative difference, the red blood corpuscles being in excess, and, as a rule, there is not serum enough to raise a wheal; but in every spot of purpura the three elements of the blood are poured out. Gastro-intestinal crises are common in certain forms of purpura, and as in angioneurotic œdema, they may antedate for months the cutaneous features, or may occur quite independently of them. It is additionally difficult to label Quincke's œdema as a special disease when we consider that in the same subject at different periods the skin lesions vary. In papers in the *American Journal of the Medical Sciences*[1] I have reported a series of cases, 28 in number, illustrating the visceral complications of a group of skin lesions characterized by erythema, purpura, urticaria, and œdema. In individual cases followed for a number of years, with the gastro-intestinal crises, various lesions occurred, so that in one attack the disease could be called Henoch's purpura, in another a multiform erythema, in a third simple purpura, in a fourth angioneurotic œdema. Certain cases of Quincke's œdema present this variability, and even in the hereditary form, as illustrated by the patient referred to on p. 650, the lesions may be those of a diffuse erythema, with exudation. The skin lesions are too unstable to be of value except for a most superficial classification, and the visceral manifestations are practically the same in the whole series. Indeed, there are cases of hæmophilia which clinically come in this category. I have seen spontaneous ecchymoses, purpura, and intense colic so severe that appendicitis was suspected in a well-known "bleeder." In the absence of fuller knowledge we are really in a quandary, and have to be content with a clinical classification of the cases. An attempt to group them etiologically is very unsatisfactory, as we really know so little about the true causes, and there are few departments in which speculation is so easy and at the same time so useless.

There are four conditions in which exudative skin lesions (erythema, purpura, urticaria, œdema) are met with in connection with gastro-intestinal crises and sometimes more serious internal complications, as acute nephritis.

I. **Acute Infections.**—The clinical picture of Henoch's purpura or of Schönlein's disease or of an acute exudative erythema may be met with in rheumatic children, sometimes with arthritis, endocarditis or pericarditis, and there may be fever and the general features of an acute infection. The skin lesions may be associated with some other infection, as gonorrhœa, or with a local ulceration.

II. **External Poisons.**—A large group of substances, animal, vegetable, and mineral, possess the power of causing exudative skin lesions. All are sensitive and react to certain of these, but in a majority of cases it is not a general but a special condition of the recipient, a sensitiveness, an idiosyncrasy, as we say. Quinine will cause an erythema, iodide of potassium

[1] 1895, cx, 629, and 1904, cxxvii, 1; *British Journal of Dermatology*, 1900, xii, 227; and Jacobi *Festschrift*, New York, 1900.

a purpura, strawberries, urticaria, shell-fish a local œdema, and the capa-
bility thus to react to certain substances may be inherited or "run" in
a family.

III. **Endogenous Poisons.**—In diseases characterized by profound dis-
turbances of metabolism exudative skin lesions are rare. In gout and
diabetes the types of auto-intoxications, these complications are not often
seen; they are more common in chronic Bright's disease. There is more
evidence in favor of hepatic poisons—the oft-recurring urticaria in some
cases of gallstones (even without icterus), and the frequency of purpuric
and allied skin rashes in jaundice. The cases in children with recurring
colic and gastro-intestinal disturbance associated with outbreaks of purpura
or purpuric urticaria suggest an auto-intoxication, but we have no positive
data, not a clue as to the nature of the poison or the locality of its for-
mation.

IV. **Heredity.**—Certain persons are born with a special susceptibility
to exudative skin lesions. There are families all the members of which
present these reactions to particular substances; there are families some
members of which are liable to attacks of local œdema, a peculiarity which
has been traced through six generations; and lastly, there is an hereditary
œdema of the legs (Milroy's disease) which has probably nothing to do with
the forms under consideration. These are the main facts in connection
with heredity and exudative affections of the skin and mucous membranes.
There are all sorts of difficulties in the way of any satisfactory explanation
of the remarkable phenomenon of localized œdema occurring in several
generations. It is not like a chemical anomaly, as cystinuria or alcap-
tonuria—the susceptibility is only in certain individuals, and may be delayed
until the forty-seventh year; it may occur early in life and then disappear,
or it may last to an advanced old age. The inconstancy, the irregularity,
is the most striking feature, both in distribution and in the incidence of
attacks in affected families.

If we understood the pathology of an urticarial wheal we might discuss
intelligently these remarkable varieties of local œdema. Gilchrist has
shown us how easily the anatomy of a wheal may be studied in factitious
urticaria. Here a direct irritant, a scratch, is followed by a vasomotor
hyperæmic reaction, a perfectly normal phenomenon on a healthy skin;
but in a sensitive person along the line of the irritation something else
has happened; the capillary walls have been made permeable, and an exudate
of all the elements of blood, but chiefly of the serum, forms the wheal.
We have no idea why the same sort of scratch will in A cause hyperæmia,
in B anæmia, and in C factitious urticaria. The vascular change is a
vasomotor phenomenon—vasodilator or vasoconstrictor—but what is the
change which permits of the exudate? Is it neurotic, an alteration under
nervous influences of the rate at which the vascular cells secrete the fluid,
or is it a physical change under the influence of the irritation, which permits
a more rapid osmosis through the capillary membranes? If we could
answer these questions for simple factitious urticaria we might approach
the problems of the other exudative lesions in a hopeful mood. In the case
of Quincke's œdema we have to suppose in certain areas a vulnerability
of the capillary walls which permits of an exudate at so rapid a rate that the
efferent channels cannot deal with it, and in consequence the lymph spaces
are distended and the skin swells. Why this should occur in the lip to-day,

in the gastric or intestinal mucosa next week, and on the hand next month—why it should come on in a perfectly healthy person and recur at intervals for a year or two and disappear completely, or why the liability should occur in families but only in certain members, and be transmitted for six generations—these are questions for which we have as yet no answer.

Symptoms.—There are three groups of cases, mild, moderate, and severe. A young woman who has been overworked or has had worries awakens one morning with a sense of itching over the forehead, and on looking in the glass is surprised to find one eyelid swollen and the side of the face and forehead puffy. By noon the swelling has gone. The lip may be œdematous, or there is a puffy swelling of the back of one hand, or a local infiltration the size of a saucer on the skin of one leg. The attacks

Fig. 11

The larynx and neighboring tissues in angioneurotic œdema.

recur at intervals for five or six months, or for a year or two, and then disappear. The œdema may always recur in the one place—the eyelid, a finger, or the back of one hand. The general health is not disturbed, and the outlook for complete recovery is good.

In a second group of cases the manifestations are more severe, and the disease lasts for a much longer period, even for a lifetime. The swellings are more voluminous, and troublesome by bulk alone. The hand may be like a boxing glove; the under lip may be so swollen that it is difficult to feed the patient; both eyes may be closed, the neck may be obliterated, both feet may be enormously swollen, or the penis may be so infiltrated as to impede micturition. In these forms the mucous membranes may be affected and the hemorrhagic œdema of the walls of the stomach may cause

colic and vomiting, or in the intestines severe cramps or crises with diarrhœa. The mucous membrane of the mouth and throat may be involved, and in these cases the skin lesion is not always a simple œdema, but there may be erythema, with hemorrhages. The frequent recurrences of these manifestations may render the patient's life a burden. The attacks may begin in childhood, and persist even to advanced old age, or they may not start until adult life, and then only persist for a few years.

In a third group of cases the localization of the œdema in the throat and larynx threatens life with each attack, and there are now in the literature half a dozen or more fatal cases. The case reported by Roger Morris[1] illustrates the serious character of some of these cases. A man, aged twenty-one years, had had repeated attacks of swelling of his feet and hands. Then he began to have the larynx affected, and twice tracheotomy had to be performed. In the fatal attack he was found sitting up in bed, with urgent dyspnœa, and before the doctor could reach the house he was dead. The illustration, Fig. 11, gives, for the first time, I believe, a picture of the extent of this form of sudden œdema of the glottis.

Character of the Skin Swellings.—As a rule, it is a simple œdema without erythema—an infiltration of the subcutaneous tissues and of the skin itself. The appearance depends in the degree of laxity of the tissues—the eyelid and the lip are the two types. In the former there is a gelatinous œdema, soft and puffy, which pits deeply, and which has a bluish white tint. In the lip the swelling is firmer, may not pit at all, and has an opaque-white aspect. The skin is usually anæmic and smooth; when the œdema is persistent, blebs may form. The appearance varies greatly with the stage—at the height of the exudation the areas are tense and opaque-white, contrasting sharply with the surrounding skin; as the swelling subsides the skin becomes relaxed, and even flabby and wrinkled.

The size and extent of the swellings vary greatly and both hands may be as big as light-weight boxing gloves. There may be areas of infiltration as big as saucers or the size of a soup plate on the trunk or thigh; the under lip and chin may be so swollen as to render the features unrecognizable and make eating and even breathing very difficult; or the outlines of the neck may be obliterated. In mild cases small areas, 2 to 5 cm. in extent, are present, or the back of the hand, one finger, or an eyelid swells, or there are half a dozen large wheals on the trunk. In all varieties the outlines are usually well defined, and in the case of the swelling of the hand, there may be a ridge of the wrist an inch or more in height.

The color is not always opaque-white, but may be translucent or waxen, sometimes with a slight yellow tint. Erythema may be present even in large areas of œdema, as in the hereditary case already mentioned; and so marked may this be as to give an appearance of an acute inflammatory œdema. A transient efflorescence may be seen in an acute swelling of the lip or of the penis. In the smaller areas, which resemble rather large wheals of ordinary urticaria, there may be a zone of erythema. In regions were the skin is very loose, eyelids and prepuce for example, blebs may form.

The temperature is not raised; indeed, in the large areas with a deep œdema and much anæmia it may be 6° or 10° below the skin of the corre-

[1] *American Journal of the Medical Sciences*, 1905, cxxx, 382.

sponding part. In the form with erythema there may at first be an increase in the temperature, readily perceptible to the touch. In a case of Starr's, in which the œdema of the hand followed immersion in cold water, the temperature rose more than 20° in fifteen minutes.

Subjective Sensations.—Subjective sensations may be absent altogether. One of my patients could not tell whether the forehead was swollen until she looked in the glass. She could tell immediately on waking whether the eyelids or the lower face were swollen by the stiffness and restraint in motion. Prickling sensations, a sense of burning, heat, and itching are common, but intense itching, such as is so distressing in ordinary urticaria, is very rare.

Regions Affected.—The face and extremities are the common situations. Among 71 cases, in 29 the first swelling was in the face, in 22 in the extremities (Collins). The irregular asymmetrical distribution is very characteristic of this type—an eyelid, one hand, the side of the thigh, the dorsum of a foot, the chin, one finger. In one of my patients, in whom the swelling was usually in the hand, as a rule both were affected, but sometimes only one. The segmental distribution is not common, but, as Edgeworth has pointed out, it may occur in Quincke's œdema and be quite as marked a feature as in the chronic hysterical form. There are cases in which the swelling is always in the same place, usually the eyelid, a form to which ophthalmic surgeons have given special attention. A peri-articular variety has been described, and Rendu has reported the sudden onset of supraclavicular swellings resembling those of angioneurotic œdema. The intermittent hydro-arthrosis and the intermittent parotid swelling scarcely come in this category, although Schlesinger regards them both as closely related affections.

Mucous Membranes.—One-half the cases in my series had involvement of the mucous membranes. By far the most common is swelling of the inner aspect of the lips and cheek, either alone or with the tongue. This may be in connection with a local œdema of the face, or in a person subject to attacks the mouth may be affected alone. The swelling may be diffuse or very localized. I have seen the very tip of the tongue involved. Very serious are the attacks in which the whole mouth, with the sublingual tissues and subcutaneous structures of the neck, is involved. The cavity of the mouth may be almost closed, and for some hours it may be impossible to take food or drink. The throat may be the seat of a local œdema confined to the uvula and the arches of the palate. The uvula may be as big as the thumb. The tonsils are rarely involved.

Respiratory Passages.—Much more serious is the œdema of the respiratory passages. The nose is not often affected. I have seen the external orifices nearly closed, and the mucosa involved with the skin. Isolated swellings of the turbinated bones or attacks like hay asthma are of rare occurrence. Bloodgood has described a case which he called angioneurotic œdema of both accessory sinuses and of the cheeks. The condition persisted for months. The sinuses were opened and a condition of intense œdema of the mucous membrane was found.

Œdema of the larynx is a rare event. It does not often occur alone, but usually in association with swelling of the pharynx or with some external manifestation. The onset is sudden, very often in the night, and the patient wakens with dyspnœa and a feeling of heat and irritation in the

throat. The condition may become rapidly worse and death may occur before help arrives. In Roger Morris' case, already referred to and the illustration of which is given, the man's life had twice been saved by tracheotomy, and in the third attack the doctor arrived too late. In Griffith's cases father and daughter died of œdema of the larynx. One case, and possibly two, in the family I reported died with this complication. T. H. Halsted[1] has discussed fully these complications in the upper air passages. It has been suggested that certain forms of asthma belong to this disease, but I do not think this is very likely. None of my patients had asthmatic attacks, and I do not see any cases in the literature in which asthma alternated with well-marked skin lesions of the pure angioneurotic œdema type. On the other hand, the association of asthma with ordinary urticaria is well known, and I have seen one case in which, in repeated attacks, a crop of urticaria came out, with intolerable itching, over the spine in the region of the third and fourth dorsal vertebræ.

Conjunctiva.—The conjunctiva is rarely affected alone, but in the cases of œdema of the lids it is not uncommon to see the mucous membrane greatly swollen. Cases are reported with chemosis and little or no involvement of the skin.

The Gastro-intestinal Canal.—This is involved in about 34 per cent. of the cases (Collins); ten of my patients had attacks of colic. We know now the nature of the local trouble, as exploratory operations have confirmed the view that it was an œdema of the wall of the bowel, and in a case reported by Morris, in washing out the stomach to relieve the severe vomiting, a portion of the mucosa was removed, and on examination was found to be in a state of acute œdema.

Colic is the common abdominal symptom, coming on suddenly, and often reaching an extreme grade. As a rule, it occurs with the skin manifestations, but it may be the only feature, and there may be no clue to the nature of the trouble. In a majority of cases it is a "dry colic," the pain central, more or less continuous, with paroxysms of greater intensity. The patient may roll about in the bed or be doubled up in an agony of pain. The abdominal walls are tense, there is not often tympanites, and there may be no local tenderness. Appendicitis, gallstone colic, or renal colic is suspected, and in a considerable number of cases laparotomy has been performed.[2] There are many instances in which the abdominal symptoms have preceded for months the onset of any skin lesions. In severer attacks with the colic there is vomiting coming on with the pain and lasting for many hours. The patient may look very ill, with pallor, small pulse, and features of collapse; and at the end of ten or twelve hours the symptoms may all disappear, and an outbreak of local œdema gives the diagnosis. The gastric crises may be the most troublesome feature of the disease, and may recur after the attacks of œdema of the skin have ceased.

With the gastric symptoms and colic there may be intestinal symptoms, diarrhœa, meteorism, and even the passage of blood. In my experience these have not been so common in the cases of pure angioneurotic œdema as in the group of closely allied cases known as Henoch's purpura. The abdomen may be swollen and tender, and the picture—sudden onset, vomiting,

[1] *American Journal of the Medical Sciences*, 1905, cxxx, 863.
[2] Osler, *Ibid.*, 1904, cxxxvii, 751.

pain, diarrhœa, pallor, with feeble pulse—may suggest perforation of a gastric or a duodenal ulcer. The passage of blood in children may suggest intussusception. In no case in my series of angioneurotic œdema was there melæna.

Renal Symptoms.—Renal symptoms are not common. Albuminuria has been met with, and in a case of Oppenheim's the state of the urine suggested an acute nephritis. Paroxysmal hæmoglobinuria occurred in a case of Joseph's. When the abdominal pain is lateral or starts toward the pubes, renal colic may be suspected.

Cerebral Symptoms.—Cerebral symptoms have been reported, particularly in connection with the family form—headache, somnolence, vertigo, and marked depression.

Fever rarely occurs, but after a severe gastric crisis there may be a slight elevation of temperature, and for a day or two the tongue is furred and there is loss of appetite. It is surprising with what rapidity recovery may take place, and within twenty-four hours after the most alarming symptoms I have heard a patient ask for solid food and have an appetite for a good meal.

Diagnosis.—Quincke's œdema is easily recognized—it is localized, white, transitory, and recurrent. Only in the few cases, such as those reported by Edgeworth, when it is segmental and in the legs, could any difficulty arise. Ordinary intelligence is required to distinguish the various œdemas of stasis and of cachexia. The hysterical form is more chronic and has the characters already given. Milroy's œdema is confined to the legs and is hereditary. In a large majority of cases the lesions are the same in different attacks, and there is a predilection for the same locality; but in children and in young adults the lesions are polymorphic, and the case may be a typical angioneurotic œdema to-day, but next week there is a severe attack of hives, or an outbreak of purpura, or a peri-articular region is erythematous and infiltrated. Severe recurrent generalized hives may have many of the features of Quincke's disease. A girl, aged twenty-two years, had from her fifth year every three or four months attacks characterized by nausea, vomiting, a constricted feeling in the chest, and an outbreak of urticaria of the most extraordinary character. The face was uniformly swollen, the eyes closed, the hands and feet greatly swollen, the skin of the body thickly set with hives. The mouth and throat were also swollen. In her twenty-first year she was almost free. I saw her recovering from an attack in which the face alone was attacked and the swelling had very little redness. Diet had nothing to do with causing the outbreaks.

It is not always easy to distinguish from the swelling of a local thrombosis, particularly the recurring form in young persons which Briggs described from my clinic. In a young chlorotic girl with multiple cutaneous swellings on the skin of the trunk the diagnosis of angioneurotic œdema was suggested, but there were thrombi in the veins of the legs. Where the thrombus is deep and the swelling very localized, as in the calf of the leg, the difficulty may be very great. I saw such a case with Dr. Ruffer, of Washington, in an exceedingly neurotic young man. It is rarely a white œdema, and it is much more persistent than the ordinary giant urticaria.

In one case the preliminary œdema of scleroderma was mistaken for Quincke's disease, but it was permanent and the hardening and change in color of the skin were soon apparent.

As a rule, with the skin lesions well defined, there is no difficulty in recognizing the cases, but it is a very different matter when the gastro-intestinal symptoms are dominant. I have reported cases in which for years colic antedated the skin lesions, in others the rashes are of so trifling a nature that no account is taken of them. Appendicitis is naturally suspected. The pain, as a rule, is much more severe, and the patient writhes about in the bed in a manner very unusual in appendicitis; local tenderness is rarely met with in the right iliac fossa; there is no fever, and lastly the attack is over in a few hours, from three to six or eight. In severe cases there are vomiting and diarrhœa and sometimes blood is passed per rectum. There are cases in which these attacks recur with great frequency, once a week or once in ten days, and in the absence of any skin manifestations it may be very hard to reach a diagnosis. A number of patients have been operated upon, either for appendicitis or for intussusception. In one case stone in the kidney was suspected, as the colic was always in the flank. One patient was operated upon for gallstones and afterward for appendicitis.

The most serious internal complication, œdema of the larynx, is easily recognized, as it rarely occurs alone, but commonly in association with swelling of the lips or face. Mild grades of obstruction usually occur before a serious attack, but as in the case mentioned there may be very little warning. The features of acute obstruction are only too evident, and tracheotomy or intubation may be necessary to save life.

Prognosis.—The attacks usually recur—this is the rule. Many patients after having the disease for eighteen months to two years get quite well. The duration in my series ranged from eighteen months to a life of exceptional duration. The younger the patient the better the prognosis. The family form seems peculiarly obstinate, and may persist to advanced age. When diet has a marked influence on bringing on attacks the outlook is good. The disease is only occasionally dangerous to life, and that always through the œdema of the glottis.

Treatment.—The general condition must be carefully studied. Many of the patients are neurotic, and a suitable course of hydrotherapy, massage, and electricity may be given. An outdoor life is an important element in the cure. In young persons the outlook is usually good, particularly in children in whom the œdema is associated with colic, etc. Several patients in my series have now been quite free from attacks for eight or ten years. The angioneurotic œdema of the face, particularly of the eyelids in young persons, is singularly obstinate, and may resist all forms of treatment.

Careful inquiry should be made as to the influence of diet, and, as a rule, some change should be made or certain articles cut off. Coffee or tea may be the offending substance, or the patient may be eating too much meat. One patient in whom the attacks were very frequent was benefited by a milk diet. In strong, full-blooded persons the use of laxatives may be helpful. I tried a salt-free diet with one patient without any success. On the whole, my experience has been against any special influence of diet in the disease. In this respect it resembles certain forms of protracted urticaria, as in the young girl whose case is mentioned under diagnosis. She had been "dieted" by nearly every physician of distinction in Europe and the United States, and she had had all the cures, without the slightest help.

In children some of the very protracted forms seem to be associated with gastro-intestinal trouble, which should be carefully treated. Many cases

have been dealt with on the view of intestinal intoxication. In a woman with great flatulency, irrigation of the large bowel was helpful. Many medicines have been recommended, strychnine, the bromides, alkalies, the salicylates, antipyrine, ergot, belladonna, etc.; and in the chronic cases it is only natural that all sorts of drugs should be tried. I have only found two of service: nitroglycerin or the nitrites, given in ascending doses until effects are felt, *i. e.*, until the patient feels the flushing and the headache. It is useless to order simply one or two minims of a freshly made 1 per cent. solution of nitroglycerin. The dose must be gauged to the individual, who should be told to increase it gradually until he feels the effects, and then let him continue the treatment for periods of ten days, with intervals of five days. The other drug is calcium, recommended by Wright. In this group of cases I have given it a thorough trial, and in two out of five cases it seemed most helpful. In Case 18, a young man who had had very severe attacks, and had been under treatment for eighteen months, was rapidly relieved, and although he had a few recurrences he has now been a year without any œdema. He took calcium lactate, 20 grains (gm. 1.3) three times a day.

In children with attacks of colic and periodic outbreaks, gray powder, given for a week or ten days at a time, has seemed helpful.

The gastric and intestinal crises require prompt treatment—a hypodermic of morphine gives immediate relief; but it is well to be careful in the hereditary and recurrent forms, and, if possible, use strong carminative and local applications.

In a case with recurring attacks of œdema of the larynx, an intubation apparatus should be in the house, and some one should be taught its use in case of emergency.

HEREDITARY ŒDEMA OF THE LEGS (MILROY'S DISEASE).

In 1892 W. F. Milroy, of Omaha, reported, under the name of "An Undescribed Variety of Hereditary Œdema,"[1] a remarkable series of cases, characterized by persistent œdema of the legs. The disease affected 22 individuals among 97 persons in six generations. Dr. Milroy wrote to me about the cases, which I at once recognized as peculiar, and, so far as I could ascertain, undescribed. A note in the condition was made in my text-book under angioneurotic œdema. Meige, in 1898, described eight cases in four generations,[2] and a good many cases have been reported in France. In 1902 Rolleston[3] reported 3 cases in two generations, and in 1908 Hope and French[4] described a remarkable family in which 13 members were affected out of 42 persons, traced through five generations.

The following are the important features:

Heredity.—The genealogical table of the Tucker family, described by Hope and French, and reproduced on page 662, gives a good idea of the persistence of the affection through five generations.

[1] *New York Medical Journal*, 1892, lvi.
[2] *Presse Médicale*, 1898.
[3] *Lancet*, 1902, ii.
[4] *Quarterly Journal of Medicine*, 1908, i.

GENEALOGICAL TABLE OF THE TUCKER FAMILY.

WILLIAM TUCKER (SENIOR)
died in 1854, a very old man

WILLIAM TUCKER (JUNIOR)
died in 1870, an old man

HANNAH TUCKER,
married a Mr. Wherrell, died
in 1864, aged 70

ELIZA, died childless in 1860, of scarlet fever

Alfred, still alive, an old man; children said not to be affected

ELIZABETH, drowned

HENRY, alive, aged 75

Mary Hunsley

William, died of phthisis

HARRIET, had 1 child stillborn; died in childbed

Lucy

George, alive now; weak intellect

THOMAS, alive, aged 48

Henry

Silas

Alfred

BESSIE

Ellen

Normal
Normal

Rose

Emily

Normal

Normal

ELLEN,

Normal

Infant, normal
Infant; normal

ALICE

Mary

Edith

EMILY

James, has epilepsy

Normal
Normal
Normal
Normal

AFFECTED

Boy of 10, normal
Boy of 1, normal

Normal

The individuals whose names are printed in small capitals had, or have, the family complaint of "swollen legs,"
mostly with "acute attacks" as well.

The percentage of persons affected varies from only 2 or 3 in certain families to nearly 20 per cent. among 97 persons in Milroy's family. Males and females are about equally affected, and we have no explanation of why one individual rather than another is attacked. As in other diseases chiefly familial, cases occur sporadically, and no doubt some of the forms of persistent brawny œdema of the legs, beginning in childhood or early adult life, belong in this category.

Absence of all Local and General Causes of Œdema.—There are no evidences of thrombosis in the veins, or of lymphatic obstruction, nor are any of the constitutional causes of œdema present, and the patients are usually in good health.

The Local Condition.—The legs alone are involved. The œdema may appear shortly after birth or the onset may be delayed until puberty or even until adult life. Once established it is permanent. The extent is variable; it usually stops at the knees, and may only involve the ankles. In longstanding cases the swelling reaches the thighs, and the feet and ankles become œdematous, as shown in the accompanying figures (Plate XIX). The swelling is painless, increases in the standing posture, and naturally tends to become very hard and brawny. The veins are not enlarged, and there is no redness. By careful bandaging the swelling may be kept under control, and a patient may do hard work until an advanced age.

Acute Attacks.—In many cases, particularly noticed in the Hope-French series, there are remarkable attacks (usually following the onset of the œdema), possibly angioneurotic crises such as occur in the ordinary angioneurotic œdema. The following is a description of one of these attacks:

"It began on July 6, at 6 A.M., with a shivering fit which lasted until 8 A.M. She vomited, complained of headache, and had a pain along the outer aspect of the right thigh. At 9 A.M. her temperature was 101°. At 4 P.M. her temperature was 103.2° and her pulse rate 116 per minute. Her visceral systems all seemed natural. Her right foot was red and swollen. An irregular circle of redness, about nine inches wide in front and two inches wide behind, surrounded the right calf, and felt much hotter to the touch than did the surrounding skin. It did not project like erysipelas. The veins on the thigh and leg became unduly visible, but they were not prominent. A single lymphatic gland, not very big, could be palpated in the groin, and little pellet-like nodules could be felt in the skin around the reddened area. Next day, July 7, the temperature was 102° and the pulse rate 96 per minute. The redness of the right leg was more general, the foot more swollen, and a red patch was present over the patella. The patient was very sick, being unable to keep even water in her stomach. On July 8 the temperature was 98.4°; the swelling and redness were still present, but considerably diminished. On July 9 the leg and foot were still swollen and faintly red, but not painful. The red patch that had been on the calf was surrounded by minute raised spots, bright red in color, discrete, and rounded. On July 10 the leg began to ache during the afternoon; during the night it "burned," and on July 11 it was red and swollen, as at first. By July 16 the redness and pain had almost gone."

Diagnosis.—The diagnosis is never in doubt, once the family character is established, and the absence is determined of all the ordinary causes of œdema—cardiac, pulmonary, renal, leukæmic, or local in the pelvis, veins, or lymphatics. A point to which several observers have called

attention is the existence of other nervous troubles in members of the family, as epilepsy, insanity, or imbecility.

Treatment.—The acute attacks require opium for the pain, and locally, soothing lotions to the legs. It is doubtful if anything can control the tendency to the œdema. By far the most successful measure is persistent bandaging, which keeps the swelling in check. This was well illustrated by several members of the family described by Hope and French, who had in this way kept the swelling under control and lived for more than sixty years. Unless bandaging is done, the œdema gradually extends, and when it reaches the extent shown in the figures, it is impossible to do much for it.

CHAPTER XXIX.

DIFFUSE SCLERODERMA. ERYTHROMELALGIA.

By WILLIAM OSLER, M.D.

DIFFUSE SCLERODERMA.

Definition.—A nutritional disturbance of the skin, patchy or diffuse, leading to induration and atrophy. The pathology is unknown, but it is usually considered to be a trophoneurosis.

A local and diffuse form is recognized; the latter only is here described.

Incidence.—The disease is more common in the United States than the published reports indicate. From May, 1891, to May, 1905, I had under my care 18 cases, and I saw incidentally 2 others. To May, 1905 (a period of sixteen years), there had been 18 cases of scleroderma in the medical wards of the Johns Hopkins Hospital. The cases are more numerous in the general medical and the departments for diseases of the nervous system than in the dermatological clinics. Crocker states that of 10,000 cases of skin diseases in out-patient practice, there were only 8 cases of scleroderma: 2 diffuse and 6 circumscribed. It is more common in some countries than in others. It is stated to be rare in Germany. Lewin and Heller in 19,000 patients and 1800 skin cases saw only one instance of scleroderma. At the Vienna Dermatological Society in 1902, Neumann made the remarkable statement that scleroderma had only been known in that city for eighteen to twenty years, and that Hebra "had never seen a single case!" In Oppenheim's clinic, in Berlin, among 7000 cases of diseases of the nervous system there were 7 cases.

Etiology.—*Sex.*—Women are more frequently affected than men, 67 per cent. in the collected cases given in the monograph of Lewin and Heller (1895).

Age.—A majority of the cases are between the ages of twenty and forty years. A considerable number of cases occur in children, in whom the disease is more apt to be acute.

Heredity.—In a few cases, members of the same family have been attacked. A woman, aged twenty-eight years, had a brother and a mother who had had the disease, and Cassirer gives four or five cases from the literature in which relatives were affected.

Acute Infections.—These are believed to play the most important role in the etiology. Cases have followed influenza, acute otitis media, diphtheria, pneumonia, typhoid fever, erysipelas, scarlet fever, tonsillitis, tuberculosis, and syphilis. In several of my cases the disease was supposed to begin with rheumatism, but the joint troubles were really the initial symptoms. In one the severe arthritis antedated the scleroderma five or six years—the joints were swollen, hot, and red, and there were several attacks before the final one in the elbows and wrists, after which the scleroderma began.

(665)

The cases after the infections have often been more acute, and large areas of skin may be involved in a few days. In a few cases the disease has followed a septic puerperium.

Among favoring causes which have been mentioned are disturbances of menstruation, neuropathic disposition, protracted cold, emotional disturbances, trauma, psychical shock, migraine, alcoholism, etc. In looking over the histories of the eighteen cases in my series, it is not possible to say that there was any one etiological factor of special moment. That in two or three cases the symptoms followed an acute infection may have been quite accidental. In a majority of the cases the disease attacks healthy persons who had had only the ordinary wear and tear of life.

Pathology.—In only one case of the series, No. X (Julius Friedenwald's patient), did I have an opportunity of having a postmortem examination. Dr. Flexner made the autopsy, and the histology was very thoroughly studied under his direction by Dr. Bates Block. The following is a summary: There were no evident changes in the brain or spinal cord. The hypophysis was normal. The thyroid gland was healthy. The adrenals showed central cavities, due to hemorrhage, but no finer alterations. The arteries showed extensive arteriosclerosis (he was a man of forty), with marked thickening of the walls of the small vessels, and atheromatous changes and areas of calcification in the aorta and femorals. The peripheral nerves showed thickening of the connective-tissue sheaths, but no alteration in the fibers themselves. The skin presented the changes which have been so often described—sclerosis of the arteries, particularly of the smaller ones, which showed endarteritis and in places obliteration. There was an increase in the elastic fibers below the papillary layer, extending into the subcutaneous tissues. The connective tissue was present in coarse homogeneous bands, running parallel to the surface of the skin. This formed a hard, dense layer, measuring from 3 to 4 mm. in thickness. There was some hypertrophy of the smooth muscle fibers of the skin. There were no extensive changes in the muscles, but here and there were areas of fibrous invasion very different to the normal structure.

Practically these are the changes which have been described by all authors who have written on the subject, but we do not know how far they are primary, or whether they are secondary to undiscovered lesions in the nervous system. We have no clue as yet to the essential nature of the disease. The analogy of myxœdema, to which scleroderma is the cutaneous antithesis, suggests that it may be caused by some alteration in an internal secretion, or some disturbance of that nice balance between the various internal secretions of which we are just beginning to learn, and which seems to play such an important role in nutrition. The disturbances in pigmentation, as intense as any which we see, may depend in some adrenal inadequacy. The frequency with which the acute forms follow an infection is paralleled by the thyroid insufficiency and atrophy caused by myxœdema after a fever such as measles or scarlet fever. There are a few cases, as the one reported by Grünfeld, which suggest strongly thyroid disease, and in his case a cure followed the use of thyroidin, but it cannot be any simple inadequacy or more uniform results would follow this plan of treatment.

The view that scleroderma is due to a terminal endarteritis, which has been much advocated, has the anatomical basis of the widespread vascular changes which have been met with in every autopsy. Dinkler regards it

as an interstitial inflammation consecutive to the arterial disease. Lewin and Heller and many others regard the disease as an angiotrophic neurosis depending upon unknown changes in the trophic centre. These are the three important theories which have been advanced, each one of which only serves to throw into stronger relief our real ignorance of the true pathology of this remarkable disease.

Distribution.—The face and extremities are most frequently involved. Of the 420 cases collected by Lewin and Heller, the upper extremities were attacked in 287, the trunk in 203, the head in 193, and the lower extremities in 122. In only 3 cases in my series was the face not involved. A universal scleroderma is rare, occurring only in 16 per cent. of the cases.

Symptoms.—There are three modes of onset—the simple atrophic, the œdematous, and the erythematous. The *atrophic* is the most common. Case X of my series illustrates it very well, and gives a good picture of the course of the disease in a severe case. S. G., aged forty years (seen with Dr. Julius Friedenwald), a healthy man, of good habits, began to notice in October, 1897, that his hands were a little stiff. In January, 1898, some of the nails festered at their bases, and his hands would get red and blue. In November his legs felt stiff, and he went to Hot Springs, Va., for rheumatism. The feet became blue and swollen, so much so that he had to wear larger-sized shoes. He began to feel the cold very much. When I saw him in April, 1898, his face looked smooth, and the skin was everywhere firmer than normal. Both hands were congested, and felt firm and cold. There were scars at the roots of the nails and on the pads of several of the fingers. It was impossible to pick up the skin on the back of the hands. The feet were in the same state. The skin of the arms, legs, and trunk was not involved. He had lost thirty pounds in weight in six months. During the next four months the disease progressed rapidly, and by October 1 had involved the skin of the entire body. The movements of the limbs were much restricted, and, although looking natural, the skin was everywhere tense and firm. He had constant pains in the arms and legs; the nerves were not tender, nor were the joints swollen. The face was shrunken and mask-like, and he moved the lips with difficulty. The temperature was always about 101°, sometimes reaching to 103°. Through the winter he got progressively worse. The sclerosis of the skin of the trunk became extreme. He could move neither head nor limb, nor could arm or leg be flexed. He could scarcely open his mouth, and the face had become mummified. He wasted rapidly, and the whole body was as rigid and stiff as a statue. The back became bowed, so that the trunk could not be extended. He had recurring attacks of diarrhœa of great severity. During the last months this poor man presented an appalling picture—literally a breathing mummy. He retained his intelligence until near the end, which came March 14, 1899, less than two years from the onset of the disease. In two other cases which showed this atrophic type from the outset there was extreme pigmentation.

In only one case in my series was the onset with *œdema*, in the midst of which were depressed areas compared by Erasmus Wilson to the effect produced by pressing the finger into a bladder filled with lard. A girl, aged fourteen years, was seen with Dr. Pole November 11, 1900. In July she had had pains in the knees and ankles, and was in bed five weeks. In September she again had pains in the joints, and the legs became swollen, and Dr. Pole noticed the peculiar depressed spots. When I saw her the

legs to the knees looked swollen and œdematous; the joints were normal. On both there were remarkable depressed areas (shown in Plate XX, Fig. 1), as if the œdematous skin had pressed upon something. On the outer aspect of the left leg were four of these depressions, the larger one 6 cm. in length. These areas had a slight purplish discoloration. The skin in the intervals between them was raised and of white color. To the touch, the skin was everywhere smooth and hard, that in the depressed areas impossible to pick up, and a firm ridge could be felt at the margins. The swollen skin between the patches was not so hard, but was infiltrated, although it did not pit. Both the mother and patient stated that the trouble began as raised red areas, corresponding to those now depressed, and at a subsequent visit I saw three of these spots—one 1.5 cm. in diameter, the others 2.5, raised, erythematous, and tender. In this case the skin of both legs was swollen and looked œdematous, although it did not pit at any point. Once formed, the depressed areas gradually extended, and although there was a very definite ridge, there was never any redness. Several of the patches coalesced, and large areas of the skin became sclerotic and of a light brown color.

The *erythematous onset* is of two types: in one, a diffuse erythema and swelling occurs in the face or in parts of the trunk; in the other, the picture is that of the vasomotor disturbances of the hands and feet, like Raynaud's disease.

In Case XV the erythema and swelling were more marked than in any one of the series. S. J., aged forty-seven years, a healthy man of good habits, was seen December 29, 1900, with Dr. Urban Smith. The trouble began three years before, with swelling of the face and of the left wrist and arm, and these parts would be at times so red that he had to remain at home. The hands became painful, and within the last year the skin of the chest has become red and swollen. When seen the face was smooth, without wrinkles, and the skin everywhere parchment-like. The entire neck was hidebound. Over the front of the chest the skin was reddened, a little darker than normal, and swollen. Toward both axillæ there was a distinct line of demarcation. In the upper part of the axillæ, and extending over the scapular regions, there were the same erythema and swelling. The hands were sclerotic and stiff. The anterior surface of both forearms was swollen and red. I followed this case for more than two years. The general sclerosis became more marked, and the hidebound condition was universal. The hands and feet became purple. I never saw more persistent or deeper cyanosis; it took more than thirty seconds to obliterate the anæmia of a finger mark. Toward the end he had remarkable attacks of tachycardia. He died five years from the onset of the disease.

In several cases the onset was with symptoms suggestive of Raynaud's disease, so much so that in Cases XI, XVI, and XVII the diagnosis of this affection was made. In Case XVI, a woman, aged thirty-two years, the hands and fingers became swollen and red. "At times they were more blue than red, and again they would be perfectly white and cold. Usually all the fingers would be affected, but the middle right finger was the most frequently involved. The change in color to white, blue, and red occurred within a few hours. These attacks came on irregularly, at intervals of about a month." Could anything be more typical of the onset of Raynaud's disease? This patient had a most severe attack, with widespread involvement

of the skin and the most extensive pigmentation, and death followed three and one-half years from the onset. In Case XVII, also a most severe, diffuse form, "he first noticed that the fingers and hands would become purple or almost blue; then at times they would be swollen and white. They were much worse in cold weather." In Case XI, a woman, aged twenty-eight years, the disease began with local asphyxia of the fingers and toes. As it was winter, she thought at first they were frostbitten. The pads of the fingers split open and were very sore, and the feet became so swollen and tender that she could not walk. In the summer she was better; then as the cold weather came on the hands and feet would ache, and, as she expressed it, she was "half crazy with the pain," and at times the fingers and toes got so black that gangrene was feared. I saw her four years after the onset of these symptoms, and she then had well-marked features of scleroderma. The movements of the face were restricted, the nasolabial folds were obliterated, and the nose had become sharper. The skin, which could not be picked up, was hard and parchment-like. The hands and feet had a natural color, but they looked large and flabby. The middle finger of the right hand was cyanosed. The movements of the fingers were stiff, and she could not pick up small articles easily. The hands felt cold, and the skin was everywhere firm. The pads of the fingers were puckered and scarred. I saw this patient at intervals for nearly three years, and she had a very thorough treatment with thyroid extract, with decided benefit. For a time the face was worse, but the skin became softer and the hands were less stiff.

Several writers have called attention to the onset with arthritis, and in my series there were three cases in which this was a special feature. Thus, in Case XVII, following a severe attack of influenza in March, 1898, the joints began to be painful and stiff, and by June nearly every joint in the body felt sore, although there was neither swelling nor redness. In another case severe attacks of arthritis occurred at intervals for three or four years before the skin was affected.

In many cases the earliest stage is an œdema, with slight efflorescence, a firm, solid infiltration which does not pit. The appearance is not unlike the erythema of leprosy, and I saw a case at the dermatological section of the British Medical Association, in which a number of distinguished specialists were in doubt which of these two conditions was present. It may be diffuse, or in small patches, and in Case XIII of my series there were raised spots not unlike erythema nodosum. It may last for weeks or months. Then the skin begins to get hard and tense, the stage of induration, and the color changes to a dead white, or it has the tint of old marble or of parchment. The consistence changes, and it feels firm like a bit of frozen skin, and it may be impossible to pick up a fold. This is a very characteristic test, as everywhere, even in the fingers, the normal skin can be picked up in folds. In some cases there is not a bit of skin that can be pinched between the finger and thumb. The folds are obliterated, the wrinkles disappear, and the face has a mask-like aspect—Gorgonized. The face grows smaller, the lips thin, the nose pointed and narrow, the cheeks smooth, the ears shrunken, the eyes expressionless, and the diagnosis may be made at a glance. The hands look smooth, the fingers are semiflexed, the terminal joints may be shrunken and involved in a sclerodactylism of the most advanced type. The hands are converted into rigid, immobile organs. In severe cases the unfortunate victim is as though he

had been put in the fabled shirt of Nessus, which had gradually contracted upon him. The back is rigid, the neck is fixed, and he may resemble a frozen corpse or a mummy, without the power of motion, save in eyes and tongue, which alone gives witness to remaining life.

As the disease progresses three changes occur: (1) Atrophy follows the induration and the skin becomes thinner, although not softer. At the lines of extension this gives a ridge in which three zones may sometimes be seen: an inner, yellowish brown, corresponding to the atrophic portion; a white, indurated portion; and beyond it a narrow zone of erythema. In the gradual extension, weeks or months may elapse before a distance of an inch is covered. In other cases, by the coalescence of contiguous areas, large portions of the skin may be involved. The atrophied skin may gradually grow more natural looking and softer. (2) The second change is in the involvement of the subcutaneous tissues, which become sclerotic and bind the skin tightly to the subjacent parts. The mobility of the skin is in this way lost, and it can no longer be moved freely upon the muscles or bones. When atrophic and smooth the skin may fit on the bones of the hand like a glove. (3) And the third change is in the color, most frequently an increase in the pigmentation, giving to the skin a parchment-brown appearance. My series afforded most interesting studies in this change, which I have dwelt upon fully in my paper.[1] There may be the muddy brown discoloration which is common in the atrophic areas, or there may be a curious mottled or freckled appearance, such as we see so often in the arsenical pigmentation about the abdomen. But the most remarkable instances are those in which the entire skin becomes of a deep brownish black, like the most extreme form of Addison's disease. In Cases VIII and XVI the diagnosis of suprarenal disease was suggested, and I do not know that there is any other condition in which we meet with a more intense melanoderma.

Atrophy of the pigment causing areas of leukoderma almost always accompany the pigmentation. They are well shown in the colored plate illustrating my paper. In the midst of almost black areas there may be scattered patches of normal looking or dead white skin. On the abdomen the alternation of lines with hypertrophy and atrophy of the pigment may present a very curious appearance. In Case IX the inner aspects of the thighs and the popliteal spaces were very dark—in fact, as black as the skin of a negro. This had come on gradually, as the disease had extended. In the atrophic areas the pigmentation became very intense, but within two years it had changed to a light brown, and here and there were a few spots of leukoderma. In none of my cases was there pigmentation of the mucous membranes.

An interesting change in the sclerotic skin is the development of telangiectasis. The following is the note on a case, No. II, a very chronic one, in which they did not occur until the fifth or sixth year. They gave a most unusual appearance to his face. "Everywhere on the skin of the face are spider angiomas of a bright red color, varying in size from 3 to 5 mm. On the forehead, nose, and cheeks they are very thickly set; on the bridge of the nose are several very large ones. There are none on the mucous membranes of the mouth or nose. Each one has a central vein, with three to five branches and a deep red capillary zone. On the extensor surface of the left wrist

[1] *Journal of Genito-urinary and Skin Diseases*, New York, 1898.

is a large 'mat-nævus,' 4 x 5 cm. in diameter, of a deep rose color, which disappears entirely on pressure, and the backs of both hands are covered with the smaller variety." These have all appeared within the past two years. It is interesting to note the similarity in appearance of these telangiectases to those in the sclerotic tissue of the *x*-ray burns.

The secretory functions of the skin may be undisturbed. In several of my patients there was hyperidrosis, and the skin of the hands and feet was always moist. When touched, the hard, cold, clammy sensation of the sclerodermatous hand feels like that of a corpse. There is no special change in the secretion of the sebaceous glands. The skin is not often dry and scaly.

Trophic changes other than the scleroderma itself are not uncommon. Several of my patients had local suppuration about the nails, and in Lewin and Heller's collection there were forty-eight with *ulcers* about the fingers or knuckles. They have occurred in my series either in the early stages in connection with the vasomotor changes, or late when the knuckles and finger-joints were hidebound. Sclerodactylism is a not uncommon event, occurring in three of my eighteen cases. It comes on gradually with or without previous local asphyxia and trophic changes in the pads of the fingers. In Case II, at the end of the fifth year both hands presented a typical condition of sclerodactylism; he could not make a fist, the motion at the metacarpophalangeal joints was very slight, and there was complete immobility of the first and second joints of the fingers; the thumbs could be opposed to the first and second fingers, so that he could still use his hands to dress and undress himself. The fingers were bent and the terminal phalanges at right angles to the others. There was a gradual wasting of the end-joints, which were thin, pointed, and about half the length of an ordinary phalanx. The nails were curved, ribbed, and shortened. There were scars over all the finger-joints, and on the knuckles there had been troublesome open sores.

The hair may fall out from the sclerotic skin or get very thin, and this seems the usual course; in a few cases with the pigmentation there is an increase in the growth of the hair, as is very well shown in the colored plate illustrating my paper. Loss of the pigment of the hair has been observed.

Trophic changes may occur in the deeper parts. The *bones* may be affected, and, as in Case XIV of my series, all those of the left upper extremity, including the scapula, were atrophic. More often the change is confined to the fingers. In a few cases local hypertrophy of bone has been observed, thickening of the tibiæ or of the malar bones. The *muscles* beneath the sclerosed skin may be involved. The deltoid and anterior group of muscles of the forearm were hard and fibroid in Case XIV. Muscle atrophy has been described in connection with sclerotic changes in the skin covering it; in other instances the muscle has been sclerotic beneath a normal skin. A widespread myositis has been met with in connection with scleroderma of the thorax and nates (Kaposi).

How far the *joint troubles* of the disease represent an arthropathy is a question. They are common, particularly in the early stage. There may be pains alone, and disability from this cause. In one of my cases there was inflammation of the right ankle for weeks before the onset of the scleroderma in the hands. Deformity and osteophytes have been met with,

but, as a rule, it is a painful arthritis of onset. Subsequently the joints become fixed by the sclerotic skin, and toward the close not a single joint of the body is mobile. In the postmortem in Case X no changes were found in the joints.

Changes in sensation are not common; numbness and tingling may be present, but there is not often pain, except when the disease begins with the features of Raynaud's disease. Case XVI had severe pains in the hands and feet. As a rule, scleroderma is a painless affection and sensation is well preserved, even in the atrophic skin. In the early stages, as was well marked in Case XIII, the acuteness of the sensation was duller in the affected areas. There may be great sensitiveness to cold, and, as a rule, the patients are more comfortable in summer.

The general health may remain very good. Case II, Levi B., came back year after year to the clinic, and although his face, hands, and legs were affected, he was very comfortable, and could even dress himself. The erosions over the knuckles gave him the most trouble. In the severe cases a cachexia comes on, the patient gets thin, there is fever, diarrhœa, and death follows from exhaustion. One of my patients died suddenly, another from pneumonia. Fever is not a constant feature; as the sclerosis progresses actively there may be a degree or more, but, as a rule, the course is afebrile. The pulse is usually unaffected. In two of my cases there were attacks of tachycardia. Arteriosclerosis may be present, but there may be extreme scleroderma without much, if any, change in the arteries. No special changes have been met with in the heart.

Blood examinations were made in eight or ten of my cases. There were no special alterations. In Case XVI the leukocytes were 10,500 per cmm., the eosinophiles 3.3 per cent., and the small mononuclears 19 per cent. In Case XVII the eosinophiles were 2.4 per cent.

The urine is, as a rule, normal. Albuminuria is present in a few cases; sugar has been detected.

Association with Other Diseases.—A number of cases have been reported of scleroderma in Graves' disease. One patient in my series presented a typical instance of this combination. It is usually of the legs, and not often generalized. Thyroid enlargement has been present in a few cases, and the association with atrophy has been noted.

One of the greatest difficulties is in the association with Raynaud's disease—whether the scleroderma begins as a complication of this affection or whether the local asphyxia and trophic changes may be regarded as part of the scleroderma. In five of my cases the vasomotor changes were most marked; in two the symptoms of onset were those of Raynaud's disease. The case reported under modes of onset is most typical, and Case VI presented very similar symptoms. In none of the cases did the asphyxia pass on to severe gangrene, although there were superficial losses of substance. The vasomotor changes in the disease are extraordinary. In Case VII there was the most remarkable vasomotor ataxia I have ever seen—the cyanosis of the legs when he stood up was most extreme—they became plum-colored in half a minute; when on his back and the legs held up the skin at once became anæmic. One could literally see the blood fall into the legs when he stood up. The same extreme cyanosis was present also in another case.

Cassirer makes a good division of the cases with these marked vasomotor

phenomena: First, instances of Raynaud's disease, in which in the late stages, besides the gangrene, there are trophic changes in the skin of the fingers and hands, which become smooth, glossy, and hard; the fingers may be immobile, and a well-marked state of sclerodactylism is produced. The process is limited to those parts which have been frequently the subject of attacks, and there is no extension to the arms or legs or trunk. Secondly, cases in which the scene opens with marked vasomotor changes—local syncope and asphyxia, and acroparæsthesia. Gradually, without progressing to local gangrene, these symptoms are succeeded by a typical scleroderma, which is not limited to the parts which have been affected with these vasomotor changes, but extends widely. Thirdly, there are the rare cases in which in a typical sclerodermic case Raynaud's symptoms supervene with gangrene.

Local Panatrophy in Scleroderma.—In Case XIV the entire left arm was atrophic and the skin sclerosed; some of the muscles were firm and hard. Plate XX, Fig. 2, shows the condition very well. The patient was aged fifteen years, a strong healthy boy. When seven years old the mother noticed that the left wrist was a little stiff, and from that time he has had constant trouble with the arm, in which there has been a progressive disability without pain. The whole extremity was involved, the left shoulder blade being smaller than the right. There was a difference of an inch in the length of the limbs; the left was atrophic, and the hand smaller; as shown by the radiographs the bones were much smaller. The skin of the forearm was hidebound, in places pigmented; that of the arm was thin and wasted. The muscles of the forearm were hard and firm, very different in consistence to those of the other side. The biceps was hard and fibrous, while the triceps was soft. There was a definite line of demarcation between the normal and diseased skin extending over the pectoral fold in front, the clavicle, and obliquely down the back to the posterior axillary fold. There was an isolated patch at the root of the neck on the left side, 6 x 5 cm. in extent, sharply defined, and the skin was pigmented and thin. The movements could all be made, but the flexion and extension of the wrist were restricted. The fingers were not sclerotic, but the skin was in some places thin and glossy, in others pigmented. The condition was very like the local panatrophy described by Gowers and by Harry Campbell. In Gowers' case, a woman, aged thirty-three years, "presented in certain areas of the trunk, limbs, and face areas of wasting of all the subcutaneous tissues down to the bone with thinning and discoloration of the skin. They were irregularly distributed without apparent relation to muscles or to nerve distribution." One patient, aged thirty-two years, had atrophy about the shoulder, with wasting of the skin and involvement of the subcutaneous tissues and muscles, and in one place the bone also was atrophied.

Course and Prognosis.—There are acute and chronic forms. The acute cases are usually in children, and have followed an infection. In the *Archiv f. Dermatologie*, 1900, Band li, Müller reports a case in a girl, aged sixteen years, coming on six weeks after otitis media. In three days the arms, cheek, back, and neck were as hard as wood, and the head was immobile. The skin could not be pinched up. The face was only slightly involved. There was no disturbance of sensation. The affected regions were tender to the touch. In Marsh's case, a two-year-old child, the acute onset followed diphtheria, and within two weeks the hands and face and trunk were involved. Some of these cases have subsequently had a chronic

course. In the most rapid case in my series, No. X, death occurred within two years. As a rule, the course is very chronic. Lewin and Heller found ten cases in which the disease had lasted more than fifteen years; one of these had a duration of forty-eight years, another of thirty. The longest case in my series, Levi Bear, well known to so many of the graduates of the Johns Hopkins Medical School, has had the trouble for more than fifteen years. The disease became stationary after about five years' duration.

The arrest may leave the victims in the stage when they are fairly comfortable, or there may be great disability. In Case XII, a woman, aged forty-six years, the scleroderma began in 1898, and when I saw her in 1900 there were extensive areas of pigmented and atrophic skin in the abdomen and thorax. In the lateral regions of the chest there were areas of erythema, with slight swelling, and there were efflorescences at both elbows and on the anterior surface of the arms. In places the skin was very hard and impossible to pick up. The hands, feet, and face were not affected. Four years later the disease had made no further progress, but the patches of erythema had disappeared. The skin of the affected parts was thin, pigmented, and closely adherent to the adjacent tissues. In two other cases the disease seems to have been arrested. In no instance in the series did complete cure take place—an experience which does not bear out the hopeful view of some dermatologists, Crocker, for example, who says, "The disease, as a rule, tends to get well spontaneously." Lewin and Heller give 16 per cent. of recoveries. The outlook in children is better even in the acute cases; the percentage here in the statistics of these authors is 31. Recovery has followed in a month or six weeks. The cachexia carries off a majority of the patients; others died of bronchial, renal, or pulmonary complications. Death may occur suddenly.

Diagnosis.—Dermatologists recognize two forms of the disease—a local, often called morphœa, and the general or diffuse. Hutchinson makes an interesting classification of the cases—an herpetiform, which, like herpes zoster, is distributed in bands and streaks, and may be bilateral; an acroteric, beginning in the extremities with symptoms like Raynaud's disease, and leading to acroscleroderma; and lastly, a generalized scleroderma, a hidebound condition of the skin. The local disease presents identical anatomical characters, but there are certain differences—it often follows nerves, distributed accurately in their course. Lewin and Heller have collected many cases illustrating this. In a patient of Brissaud's the sclerotic bands corresponded accurately to the seventh and eighth cervical segments, the first and second dorsal, the fifth lumbar, and the first sacral segments. There is a much greater tendency to complete recovery; pigmentary anomalies are not so common; and sclerodactylism does not occur. The local form may occur on arm, leg, or trunk, less often in the face. It begins in the manner already described, and only the limitation in area separates it from the more severe form. A case may start in one or two spots, and gradually spread and become diffuse.

The diagnosis is rarely in doubt. In not one of the cases in my series was there any difficulty in recognizing the existence of scleroderma, but in two the question arose of the co-existence of Raynaud's disease, a point which has been discussed sufficiently under the symptoms. The sclerodactylism may suggest syringomyelia, but the absence of sensory and other changes is sufficient to differentiate the two conditions.

The local panatrophy of Gowers resembles scleroderma, and some of the cases, as I have mentioned, may be this disease. Only in the early stages do the cases offer any difficulty. The preliminary erythema and infiltration may strongly suggest leprosy, and I mentioned a case shown at the British Medical Association in which different opinions were expressed. A point of moment is that the sclerodermatous erythema is never extensive for a long period without the other changes; the hard œdema begins to disappear in places and the skin atrophies and changes in color. On the whole, generalized scleroderma is a disease easy of recognition. A glance at the face or the hands may suffice; difficulties only rise in a few rare instances when the vasomotor disturbances are extreme and when the local asphyxia leads to changes suggestive of Raynaud's disease.

Treatment.—I doubt if any remedy has an influence on the course of the disease, unless it be the *x*-rays, which, with the new and more accurate methods of application, should be given a thorough trial. In the acute cases hot baths and massage should be tried, and in all forms systematic hydrotherapy should be used. Massage is helpful, and in any case keeps the skin softer and promotes nutrition. These measures with electrical treatment should be carried out thoroughly as early in the course as possible. A stay at one of the baths, Hot Springs, Va., or Mt. Clemens, or one of the alkaline and sulphur baths in Europe, should be advised. Of remedies, I have given a very thorough trial to nearly all on the list, the iodides, salol, and the salicylate preparations, and the various thyroid preparations. In my paper describing the first eight cases of my series I give the details of six cases treated with thyroid extract. Of the remaining ten cases, nearly all received a full trial of this remedy. Possibly to it the arrest in three or four of the cases may be attributed, but in Case X the disease made rapid progress under its use; and the best that can be said is that in some cases it appears to retard the progress. The remedy is well borne for years in doses of grs. v of the extract three times a day. I saw no ill result. In neither of the cases in which tachycardia occurred was this due to the extract. It is well to omit the use for a week or ten days at the end of each period of six or eight weeks. Various other thyroid preparations were tried without any special effects. Thymus extract, adrenalin, and suprarenal extract were also used. I have seen no report of the use of fibrolysin —but scleroderma would be an ideal disease in which to test its claims.

ERYTHROMELALGIA (WEIR MITCHELL'S DISEASE).

Definition.—"A chronic disease in which a part or parts of the body, usually one or more of the extremities, suffer with pain, flushing, and local fever, made far worse if the parts hang down" (Weir Mitchell).

Introduction.—In 1872 Weir Mitchell described in the *Philadelphia Medical Times*, under the title "On a Rare Vasomotor Neurosis of the Extremities," a peculiar red neuralgia. In 1878, in the *American Journal of the Medical Sciences*, he still further elaborated his views on the subject. Other papers by him are to be found in the *Medical News*, 1893, and the *American Journal of the Medical Sciences*, 1899 (with Spiller). He gave to the condition the name erythromelalgia, signifying a painful red state of a limb.

Cases had previously been described by Graves, Paget, and others. The literature is very fully given in Cassirer's monograph (*Die Vasomotorisch-Trophischen Neurosen*, Berlin, 1901) and in the *Index Catalogue*, Series II. Much discussion has taken place as to the existence of erythromelalgia as a separate disease, apart from Raynaud's disease, affections of the spinal cord, obliterative endarteritis, and the various forms of peripheral neuritis, in all of which pain and redness of the extremities may occur. These conditions should, I believe, be excluded, and the name limited to a vasomotor neurosis with the features above given, a small but perfectly definite group of cases.

Etiology.—The disease is rare. I have seen only one case in private practice in which the diagnosis seemed clear. At the Johns Hopkins Hospital in twenty years (to 1909) there were three cases.

Cassirer has collected 90 observations which have been reported as erythromelalgia, but a great majority of these belong to other conditions.

Age and Sex.—Men are more subject to the disease than women—46 to 32 in Cassirer's figures. His age table is: from one to ten, 2 cases; eleven to twenty, 2; twenty-one to thirty, 21; thirty-one to forty, 13; forty-one to fifty, 11; fifty to sixty, 12; sixty to seventy, 2; above seventy, 2. Graves' case was in a woman aged eighty-two years; Henoch's in a teething child.

Among *predisposing causes*, puberty, menstrual disturbance, and the climacteric are mentioned. In a few cases the disease has followed an infection—rheumatic fever, gonorrhœa, syphilis. Cold and damp are important *exciting causes*. Weir Mitchell's first case was a sailor who had been much exposed; Elsner's patient had had to do a great deal of washing; Paget's patient was much given to cold douches and hydrotherapy, standing with the feet in cold water. In several cases the disease has come on after exposure. In my case the girl got her feet wet and had to sit for some hours without changing. Overexertion or a sudden strain has been an important factor—overuse of a hammer, prolonged use of the legs in working a sewing machine, or a protracted march. In a few cases a blow or an injury to the limb has preceded the onset of the symptoms. Several cases have been in highly strung neuropathic individuals.

Pathology.—Cassirer, whose study of the condition is very thorough, recognizes two groups of cases of erythromelalgia—one in which the symptoms are localized in a definite nerve territory, the other in which they are distributed over the distal portion of a limb. The first group has many points of resemblance to neuritis, but may exist without the positive signs of neuritis, anæsthesia or other disturbance of sensation, disturbance of motion, or painful points along the course of the nerve. In the second group no basis exists for the diagnosis of any special lesion, arterial, neuritic, spinal, or cerebral; although from the distribution and general features we may suppose that in the one the trouble is peripheral, in the other central. This is about as far as our knowledge goes of the pathology of erythromelalgia, and it is not very far! The postmortem reports are not in accord: "Once changes were found in the peripheral nerves (Weir Mitchell and Spiller); once changes in the posterior roots (Auerbach); in three cases the peripheral nerves were intact (Weir Mitchell, Dehio); the arteries were found diseased in three cases (Sachs and Wiener, Dehio, Weir Mitchell, and Spiller)." Cassirer thus summarized the results. It is very probable that the cases with local distribution are due to changes in the peripheral

nerves; the symptoms resemble closely those caused by certain forms of peripheral neuritis. When the whole limb is involved the vasomotor centres are probably at fault, but what the nature of the change and where, we have at present no clue. The pathology will be found to be much the same as that of Raynaud's disease, with which erythromelalgia has very close affinities.

A more careful study of the nerve centres in cases of spinal cord and cerebral lesions associated with a congested and painful state of one or more extremities may throw some light on this dark chapter in neurology. The arterial cases should be cut out of the category altogether, as forming a separate and remarkable malady (with which we may well honor the memory of a good pathologist by associating the name of Friedländer) worthy of the most careful study. The researches of Erb and others have shown how common are these cases of endarteritis of the vessels of the extremities, and how diversified are the symptoms; one group has a striking similarity to the condition under consideration.

Symptoms.—Redness, pain, and swelling are the cardinal features of the disease. A very bright, healthy-looking girl, aged about twenty years, walked into my consulting room on crutches. When she removed the felt shoe and stocking from the left leg it was seen to be swollen and red, as high as the middle of the tibia. The toes were a little blue, but in a few minutes, as she rested on the sofa, they, too, had the vivid pink appearance of the foot and leg. The swelling was moderate and most evident about the ankle and tarsus. When she sat up and hung the foot down the redness became more marked, and the toes again became livid. If she attempted to put the foot to the ground she winced, and said it hurt very much, but on insisting she stood alone on the foot, but the pain increased and was chiefly in the sole and in the toes. In the recumbent posture the color was less intense and the pain ceased. When the foot was elevated the redness almost disappeared, but not entirely from the toes. To the touch the leg and foot were hot, and the temperature was 6° higher than on the corresponding parts of the other leg, much less than the hand suggested. It was nowhere painful on pressure, except at one or two spots in the sole, the worst near the heel and at the ball of the big toe. There was no pitting. The pulsation in the arteries was much fuller and more evident than in the sound leg. There was no tenderness along the course of the nerves. The veins were not visible except on the dorsum of the foot. In every other respect the girl was healthy. About three months previous she had got her feet wet, and had to sit for several hours without changing. In a few days she began to feel pain in the sole and toes of the left foot, but only when walking. Then she noticed the toes were of a bright red color. The condition has gradually grown worse, and extended first to the whole foot and now half way up the leg. She has very little pain except when she puts the foot to the ground, or if it has hung down for a long time. She is not disturbed at night, and her general health is excellent. Careful bandaging, rest, massage, and hydrotherapy were advised, but months passed without much change; then for no very obvious reason the condition began to improve, and about a year after I saw her she wrote that she was practically well.

Among the score or more of cases of painful red extremities that I have seen due to various causes—organic lesions of the spinal cord, endarteritis,

neuritis, and Raynaud's disease—this case stands out as the only one in which the diagnosis of erythromelalgia seemed justified.

Parts Affected.—The feet are most often involved. In Cassirer's analysis the involvement was: both feet, 20 cases; one foot, 7; both hands, 10; one hand, 3; all four extremities, 13; and hand and foot of the same side, 2. In 12 cases the pain and redness were limited to the distribution of a single nerve. The fingers and toes are usually involved first, and the trouble spreads upward, and may cause swelling of the lower leg or of the forearm. It rarely reaches above the elbow or knee, but the pain may extend to the hip or the shoulder. One or two toes may be affected for weeks or months before the disease extends, or the trouble may begin in the sole of the foot or the palm of the hand. After persisting for months or for a year or more in one foot it may extend to the other. In marked contrast to Raynaud's disease, the ears and nose are not affected. In a few cases painful red spots have appeared in other parts of the body, and Mitchell remarks that he has seen this distribution and suggests, indeed, that similar vasomotor disturbances may occur in the muscles and bowels. I have seen no case reported with abdominal colic, such as is so common in angioneurotic œdema, and occasionally in Raynaud's disease.

The most striking objective feature of a case is the *redness*, which in typical instances is the color due to an active hyperæmia—a deep pink or violet-red, diffuse, not mottled, and sometimes sharply limited above. The veins may be swollen, but the general appearance is that of an inflammatory congestion, not of a venous stasis. One of the most remarkable features upon which Weir Mitchell lays great stress is the influence of change of posture; when the foot hangs down the congestion increases at once; when placed above the level of the patient's body, as he is recumbent, it grows pale, and the congestion may almost completely disappear. Not that this is peculiar in any way to erythromelalgia, but one does not often see it in the acute hyperæmia. In the cold and in long-standing cases there may be blueness or asphyxia, but this is rare. The temperature is always higher, 4° to 6° or more, less than the hand suggests, as the affected part feels hot and the arteries of the foot may be felt to throb. *Pain* is almost always present, either an intense burning sensation or a sharp, stabbing sensation of a less continuous character. When at rest there may be nothing more than an unpleasant hot feeling, but on movement, as in attempting to put the foot to the ground, the pain may be severe. The slightest pressure with the finger may cause pain. Very rarely is the pain of the maximum intensity seen in Raynaud's disease. *Sweating* is a common feature, and it may be hyperidrosis. Thickening of the skin, pigmentation, and changes in the nails may occur. More or less swelling is almost always present, but there is no pitting on pressure. Disturbances of sensation are not common, but there may be hyperæsthesia or pain along the course of the nerves. *Atrophy* of the muscles of the affected part may occur, as in the small muscles of the hand or foot; occasionally, as in one of Mitchell's cases, the muscles of the affected leg may waste. In the protracted cases there is always some wasting from disease. Serious trophic changes leading to gangrene do not occur. The cases that have been described belong to the category of Raynaud's disease, or are due to obliterative endarteritis, and it may be very difficult to say in a given case which condition is actually present.

Diagnosis.—There are four chief conditions in which "pain, flushing, and local fever," to use Weir Mitchell's words, occur, and which may be confounded with erythromelalgia, or which may simulate it so closely that it

will depend altogether on the conception one has of the disease where an individual case is placed. I would limit the term to a small but well-defined group conforming clinically to Weir Mitchell's original description, and of which at present we do not know the anatomical basis. A "red, painful neuralgia" of an extremity may be associated with Raynaud's disease, with certain affections of the spinal cord, with endarteritis obliterans (Friedländer's disease), and with peripheral neuritis.

Raynaud's Disease.—Many cases simulate closely erythromelalgia, in others the two conditions appear to have been associated, or the one may pass into the other. Objectively, every case of Raynaud's disease becomes one of erythromelalgia in the stage of active hyperæmia, when the part is red and hot and painful, and yet typical cases have features which suffice to separate the two diseases, although it must be confessed by a very thin partition. Weir Mitchell's differential table may be given here:

Raynaud's Disease.	*Erythromelalgia.*
1. Sex—four-fifths females.	1. In 22 cases 2 were women.
2. Begins with ischæmia.	2. Little or no difference in color is seen until the foot hangs down in upright position, when it becomes rose-red.
3. Affected part becomes bloodless and white. In certain cases there is a deep, dusky congestion of a cyanosed part with or without gangrene.	3. The arteries throb and the color becomes dusky red or violaceous in tint.
4. Pain may be absent or acute, and comes and goes; has no relation to posture; may precede local asphyxia.	4. Pain usually present; worse when the part hangs down or is pressed upon. In bad cases more or less at all times.
5. Unaffected by seasons. In many cases all the symptoms are brought on by cold.	5. Worse in summer, and made worse by heat; eased by cold.
6. Anæsthesia to touch.	6. Sensations of all kinds preserved
7. Analgesia.	7. Hyperalgesia.
8. Temperature much lowered and unaltered by position.	8. Temperature above normal. Dependency causes in some instances an increase, in others, a lowering of the temperature.
9. Gangrene local and limited, and likely to be symmetrical.	9. No gangrene; lesion asymmetrical.

Some of the cases are very difficult to classify. Rolleston reports one in a man, aged twenty-nine years, who for a year had weakness in the hands and feet and for six months pain, and a great sensitiveness to cold, so much so that they would become swollen and red. If the parts hung down they throbbed, swelled, and "went dead." Even in summer the hands were swollen, red, and hot, and very sensitive to all sorts of impressions. At times they were very painful, and pains passed up the arms to the shoulders. The feet, too, were red and hot, and thick, and very sensitive. Both hands and feet were thickened and acromegalic in shape. What was this? Rolleston reports it correctly under the title "A Case Showing Some of the Features of Erythromelalgia and of Raynaud's Disease."

Elsner reports a still more remarkable instance in which the features of the two diseases were combined. A woman, aged thirty-eight years, had in the winter of 1893 numb feelings in the hands and headache. In the following winter there was burning in the palms and backs of both hands, and attacks of pain associated with an erythema of the hands and arms. In 1896 there was an increase in the pains in the hands to an intolerable degree,

with great sensitiveness of the parts, and copious sweating. In September, 1896, the redness disappeared suddenly from the thumbs. A red spot appeared in the right tragus, which passed on to asphyxia and gangrene. A second gangrenous spot appeared over the middle of the left sternocleido-mastoid muscle. On the 16th of September cyanosis and gangrene of the top of the thumb occurred, with gradual separation of the phalanx; there was gradual recovery. Certainly, at first this would have been regarded as a typical instance of Weir Mitchell's disease, but three years later the severe trophic changes put it into the category of Raynaud's disease. The affections are closely allied, and it is not surprising that they should be associated or that the one should follow the other.

Affections of the Brain and Spinal Cord.—I have already spoken of the vaso-motor and trophic changes simulating Raynaud's disease, which are met with in organic diseases of the spinal cord. A condition of painful erythema, with swelling, may occur, and many cases have been described as erythro-melalgia. In hemiplegia the forearm and hand may become red, painful, and swollen, a vasomotor change very like Weir Mitchell's disease, and the condition may persist for months. I saw a hemiplegic whose hand and arm had been painful and the hand red and œdematous for more than six months; and at the Infirmary for Nervous Diseases, Philadelphia, I had a patient whose sufferings from this cause were atrocious. A number of cases have been reported in locomotor ataxia, and Collier has recorded five instances in multiple sclerosis. Altogether, Cassirer has collected 22 cases in this group. The clinical picture is often a vasomotor paresis, as in the hemiplegic arm, but it may resemble Weir Mitchell's disease very closely. One of Collier's patients was a woman, aged twenty-nine years, who had had multiple sclerosis for nine years, spastic paraplegia, etc. Two years after onset she had attacks of burning pain in both feet, with redness and heat, lasting three hours. A year later the feet were per-manently red, and when the legs hung down they became red to the knees. Later, when she stood, the legs became purple and hot, the skin swollen, the veins distended, and the arteries throbbed and the legs and feet were painful. It is very difficult to say just where these cases should be placed. Some of them simulate erythromelalgia closely, others are more like Ray-naud's disease, and others again have a dull, dusky congestion, with swelling. They belong to a very definite group of vasomotor disturbances in organic lesions of the brain and cord, and I feel that it is better not to group them with erythromelalgia, however much the features may simulate this disease.

Endarteritis Obliterans.—Pain, redness, and swelling are common symp-toms in one or both feet in Friedländer's disease—the progressive sclerosis of the arteries of the legs. It is a common affection, often confounded with erythromelalgia. A woman, aged sixty—about whom the doctor had written suggesting the diagnosis of erythromelalgia—began to have pains in the left leg and foot, and when she walked any distance the foot became swollen and red and the sole was very tender. At rest she was comfortable, although at night the leg was sometimes painful. Then she noticed a pecu-liar inability to walk more than a certain distance, after which she had to stop quite suddenly and felt as if her legs would give way; after a few minutes' rest she would go on again. When I saw her, five months after the onset of the symptoms, the symptoms of intermittent claudication were present in a typical form. The left leg and foot were swollen and painful, and of a dusky red color, which increased to a purple when the leg hung down.

After rest or if the leg was placed upon a pillow the color became almost normal. No pulse could be felt in the arteries of either leg, both dorsal arteries were sclerotic, and there was general arteriosclerosis. This was a typical case of intermittent claudication and the vasomotor disturbances associated with endarteritis obliterans. The pain may be most severe and persistent, as in a case I give in the chapter on Raynaud's Disease. The color is often less marked than in the case here mentioned, and a preliminary spasm of the vessels may cause ischæmia. The arteries are not always obliterated. As Erb[1] has pointed out, these cases are very common, and while they occur, as a rule, in elderly people, this group of symptoms may be met with in young or middle-aged men, the subject of syphilitic or other forms of endarteritis (Parkes-Weber). Three features distinguish these cases from true erythromelalgia—the presence of arterial changes, the tendency to gangrene, and the occurrence of intermittent claudication. Minor points are the greater liability to asphyxia and the great variability of the pain. There are cases without any disturbance of sensation, particularly in diabetes.

Neuritis.—A "red neuralgia" is often the best description of a local neuritis. I have seen two cases in which a neuritis of the arm caused a condition very similar to erythromelalgia. A woman, aged fifty-six, began to have pain in the left shoulder and limitation of movement, and within a few weeks the joint was immobile, but with very little swelling. Soon the pains began to spread down the arm, and the fingers and hands became red and swollen. The pains were most intense and required morphine for their relief. The swelling and redness extended nearly to the elbow. The course of the chief nerves was painful to the touch, and the skin was everywhere hyperæsthetic. The late Dr. Seguin, of New York, saw the patient and made a diagnosis of arthritis and consecutive neuritis. The patient recovered after more than four months of swelling and redness of the arm, and it was nearly a year before the shoulder-joint could be moved freely. In this type of local arthritis of the shoulder, pains along the course of the nerves are not uncommon, but redness and swelling of the forearm are rare. I saw a second case with Dr. H. M. Thomas. The other condition is pressure on the brachial plexus. In connection with Raynaud's disease, reference was made to cases described as due to tumors pressing upon the cauda equina or the lumbar nerves. In a woman, aged forty-three years, with secondary carcinoma of the supraclavicular and axillary glands, the fingers became numb and painful, then a vivid redness spread over the whole hand, and gradually extended to the middle of the forearm. There was little or no swelling, and no sign of venous obstruction. The pains in the arm, particularly along the inner side, became very intense, and for weeks the picture was that of an acute erythromelalgia. As the tumors increased there was pressure in the veins and great swelling of the arm and hand.

The alcoholic polyneuritis may be associated with marked vasomotor changes, rarely the active hyperæmia, more often an extreme passive congestion, particularly when the limb hangs down. In a number of cases described as erythromelalgia the pain and redness have been in the course of individual nerves, the posterior tibial, the right internal plantar, the median, or the ulnar. It is by no means easy to say in these cases whether an actual

---

[1] It is a mistake to call intermittent claudication and endarteritis *Erb's disease* as Cassirer does. The condition was well recognized in man and horses years before Erb's admirable paper, which only served to call our attention to its frequency.

neuritis exists, but we know that with inflammation of a nerve very severe pain and redness may occur. A nurse in the fourth week of a severe typhoid fever began to have pains in the front of the left arm, and in a few days there was a definite swelling between the elbow and wrist, with redness extending to the latter and severe pains on movement or when the parts were touched. The fingers were not involved. The post-typhoid neuritis is usually a motor affair without much pain, but occasionally there are marked vasomotor features, redness, swelling, and pain.

Under Raynaud's disease the question of scleroderma has been sufficiently discussed. It would not be possible, I think, to mistake erythema exsudativum multiforme for erythromelalgia, or any of the forms of acroparæsthesia or of podalgia.

There is one painful state of the arm and hand to which I may refer, as it may be associated with a transient erythema. In 1888, at the Philadelphia Neurological Society, I showed a man whose right arm on exertion became painful, hot, and swollen. In all other respects he was healthy. The symptoms had lasted for years. No explanation could be offered except that it was some sort of vasomotor disturbance. A second case, a woman, presented identical symptoms. Again I was puzzled. She had much redness and swelling and the arm became very painful when the exertion was continued. Last year (1908) I found the explanation of these cases which had stood out in my memory so vividly. A very healthy woman, aged about thirty-five years, consulted me for pains in the left arm and hand, swelling on exertion, which if long continued resulted in a flushing of the whole arm and hand. At once I saw a familiar picture. But this time I was wiser. She was stout, and I could not well determine the presence of cervical ribs, but the x-ray photographs left no doubt as to the cause of these remarkable symptoms. The pressure of a cervical rib may be either on the nerve cords or on the subclavian artery. The pulse was not altered in this case, but the disability on exertion suggests intermittent claudication, as if the subclavian admitted enough blood with the arm at rest, but extra demands could not be met, and the muscles failed to act for want of blood. The flushing and swelling suggest irritation of nerve cords, but in none of these cases was there atrophy of the muscles of the hand so common in connection with cervical ribs.

Treatment.—An obstinate chronic affection, very resistant to all forms of treatment; such is the universal judgment of writers. It is best to carry out a systematic plan of treatment. Rest of the parts relieves the congestion and allays the pain, but not in all instances, as the redness may disappear without the pain. The rest should be protracted for six weeks or if necessary, three months. Massage, daily if it can be borne, very gently at first and afterward more vigorously. Many patients prefer cold, and some form of hydrotherapy may be tried, either cold packs or douches, or if grateful, a local steam bath. Radiant heat should be given a thorough trial. The procedure suggested by Cushing, mentioned under Raynaud's disease, should prove helpful. Various forms of electrical treatment have been advised, and may be used. Locally and internally the resources of the pharmacopœia may be taxed to the uttermost without much relief. It is best, if possible, to avoid the more powerful narcotics, as morphine. In the local form, where the pain is limited to a single nerve territory, section or excision of part of the nerve may be practised.

in 135 patients treated and 690 untreated, all of whom stayed over ninety days and had tubercle bacilli in their sputum, show that of 100 patients in the incipient stage treated with tuberculin 79 are alive, of the untreated 63 are alive, while in the advanced stage 61 of the treated patients are alive and 36 of the untreated.

Loss of Tubercle Bacilli.—Of all patients with tubercle bacilli in their sputum who undergo sanatorium treatment, only about 42 per cent. lose them. Any factor that can be introduced into sanatorium treatment to increase this figure is of great importance. Accordingly, if it could be shown that tuberculin caused the disappearance of tubercle bacilli in a greater number of patients, its value would be unquestionable, even if it did little else. The disappearance of tubercle bacilli from the sputum depends directly upon the length of sanatorium residence. Tuberculin treatment can rarely be completed under five months, and in most institutions the patients receiving tuberculin remain on the average longer than the untreated. At the Adirondack Cottage Sanitarium the average residence for patients so treated was considerably longer than for the untreated. The care and accuracy with which the sputum is examined, as well as the frequency, has much to do with these result at the Adirondack Cottage Sanitarium. Kreuser selected 110 patients with tubercle bacilli in their sputum and treated 55 without and 55 with tuberculin. Of the latter 22 lost their bacilli, of the former 16. Philippi compared 98 patients without tuberculin treatment with 28 so treated (all afebrile), and found in the second stage (Turban) 19 per cent. of the untreated and 58 per cent. of the treated lost the tubercle bacilli from their sputum, while of the third stage 7 per cent. of the untreated and 31 per cent. of the treated lost their bacilli. Turban found at the end of from two to six years that 48 per cent. of the treated and 27 per cent. of the untreated had sputum free from tubercle bacilli.

The treatment of pulmonary tuberculosis with tuberculin may therefore be said to be of value. It is of more permanent benefit to patients in moderately advanced than in incipient stages, and of slight if any value for those with far-advanced disease. The general nutrition of patients is little affected, but more lose their tubercle bacilli.

CHAPTER XII.

SYPHILIS.

By WILLIAM OSLER, M.D.,

AND

JOHN W. CHURCHMAN, M.D.

Synonyms.—Lues venerea; bad disorder; pox; morbus gallicus; French, vérole; German, Lustseuche; Krankheit der Franzosen; Italian, sifilide; Spanish, sifilis; Swedish, radezyge.

Definition.—Syphilis is an infectious disease, acquired by contagion or transmitted by inheritance, which runs a chronic course and exhibits both local and general constitutional manifestations. Its signs and symptoms are protean, but they are usually exhibited in a determinate order, on the basis of which several distinct clinical stages are recognized. The lesion produced is an infectious granuloma, similar to that seen in tuberculosis and leprosy.

History.—It is rather absurd to call attention, as is so often done, to the obscurity which enwraps the origin of syphilis; for it is an obscurity about which there is nothing odd and one which syphilis shares with many diseases. In a few instances—the English sweating sickness is an example— we know with exactness the whole history of a disease; but inquiries of this kind lead, as a rule, by way of increasingly inaccurate data to a labyrinth of confusion for which incomplete medical information, insufficient medical equipment, and fantastic medical hypotheses are responsible. That such is also the end of effort in the case of syphilis is, then, a pronouncement which, although made with all the seriousness of disappointed Teutonic industry, is in no way striking. It is, on the other hand, equally true that many contagious diseases have at some point in history spread at such a rate and over so great a territory that the names "pest" and "plague" have been applied to them; their phenomena have been so obvious as to be described as new; and attention has been so generally drawn to them that subsequent authors have been tempted to regard this unusual assertion of the disease as in reality its first appearance. Here, again, syphilis has shared the fate of many contagious diseases; and if one keeps in mind these two facts—the obscurity surrounding the first appearance and early manifestations of the disease, on the one hand, and its well authenticated spread at a definite point of history, on the other—he has only to fill out this skeleton with a few data in order to sketch the history completely.

There is surely no reason to imagine, *a priori*, that mankind in its infancy was free from syphilis. The positive evidence that such was not the case, afforded by the discovery of syphilitic bones of great antiquity, was discredited by Virchow; but there is scattered mention by medical and lay writers, of symptoms which, although often misinterpreted at the time and never collated

(436)

as the phenomena of one clinical entity, nevertheless strongly suggest the existence of the disease in ancient times. As long ago as B.C. 2637[1] Nusi King, a Chinese writer, described the phenomena of venereal disease and among them the symptoms of lues. In India it seems probable that syphilis existed centuries ago; and in the Hebrew Scriptures one meets many references, some of which may, others of which undoubtedly do, contemplate venereal disease. There are, for example, the "emerods in the secret parts," the "botch of Egypt," the "scab," the "itch whereof thou canst not be healed;"and the unclean man with a "running issue out of his flesh." One finds ground, therefore, for feeling certain that antiquity was to a degree, at least, syphilized. And if it was syphilized at all it seems likely, from the well-authenticated license of the times, that the disease was fairly rampant. We know what *could* happen on occasion, as when the daughters of Moab vexed the Israelites with their wiles, and Zimri and Bozbi, the Midianitish woman, perished together; "and those that died in the plague were twenty and four thousand." Nor is it anything less than history that in various countries cults were flourishing which, under the cloak of religion, were lending to the most lascivious of orgies the dignity of worship. There was the Lingam and Phallus cult; there was the Baal and Astarte worship in Assyria and elsewhere; there was the Aphrodite and Dionysus sect in Asia Minor; there was the Venus and Bacchus and Priapus worship in Rome. Here were religions not merely tolerating and countenancing sexual excess, but incorporating in their liturgies the wildest license and eliminating not only chastity, but even continence, from their rubrics. Surely syphilis found in this state of affairs at least no obstacle to its advance.

And yet there seem to be good grounds for supposing that syphilis was, on the one hand, less easily acquired in antiquity than at the present time, and that its symptoms, on the other, were different in character and less serious in degree. The prevalence of circumcision, the observance of depilation, the use of baths and other cleansing processes after intercourse, and, in certain countries, the strict protection of the women, these were some of the things which checked contagion; while the universal belief, in ancient times, that the initial lesion was a serious affair, probably led to an early and heroic intervention that prevented the tragic sequelæ of a placid faith in the triviality of the early signs.

In the centuries between remote antiquity and mediæval times, venereal diseases flourished and were subjected to gradually improving medical observation. Hippocrates (B.C. 459–377) wrote (De ulceribus) of ulcers of the foreskin; Celsus (B.C. 25 to A.D. 45) mentions sores of the foreskin, glans, etc., and notices the association of buboes with them; and in the writings of Oribasius (A.D. 326–403), Aetius (about A.D. 550) and Paulus Aeginata (about A.D. 650) there are pretty clear references to venereal diseases. In Asia syphilis seems to have been in these times less frequent and less severe than in the West; and there is scanty reference to it in the writings of the Arabists. In Europe, on the other hand, syphilography began to take on dimensions with the advent of the fourteenth century. This was due in part to the immorality following the black death, in part to the influence of Arabist theories that chastity was harmful, in part to the spread of the disease by the crusades, but chiefly to the improvement in medical observa-

---

[1] The date is not beyond dispute.

tion. The conditions of life in the dark ages were surely favorable to the spread of venereal contagion. Since the time of Charles the Great no large city in France had been without its brothels; and the streets of Paris, observes an early writer, swarmed with prostitutes at night as they had swarmed with dogs in the day. It was not infrequent for one and the same house to contain a school on the first and a brothel on the second floor; and as early as 1163 municipal laws had been drawn up against women afflicted with "the perilous infirmity of Burning." Add to these circumstances the prevalence of war, with its invasions on one part of the world by notoriously loose characters from another, keep in mind the opportunity for transmission afforded by the crusades, and it becomes plain that existent venereal disease could not long remain a local pestilence.

But it was not until the end of the fifteenth century that syphilis became pandemic; and when it did so it broke loose with such violence and over such a large area that its spread took rank as one of the notable events in medical annals. The source of this great pandemic and the circumstances which made it possible have long been debated more or less fruitlessly. This much is established. Toward the end of the fifteenth century Europe experienced excessive heat, heavy rains, amounting in many districts to floods, and a famine from failure of the crops. Disease of one sort or another became rampant. There were epidemics of ergotismus, of various "pests," of bubonic plague, and of influenza (?). Petechial typhus appeared in the South and the sweating sickness in England. Last of all, Saturn and Jupiter were in conjunction (1484).[1] In 1494 the army of Charles VIII, 32,000 strong, was setting out on its wild scheme of aggrandizement with the conquest of the Italian peninsula in contemplation and a highly pious ambition to reach Jerusalem. The soldiers were French; and the French soldiers were luetic. They invaded France, and pushed their way to Naples. Charles established himself on the throne, and his army syphilized the city. Before long the whole European prairie was aflame. The Portuguese got the disease from Spain; the Poles from Germany; Russia from Poland; while France spread it to the Orient and Turkey passed it on to Persia. Nor was it a "mild syphilis" which was thus transmitted. Malignant types that are now curiosities were then the regular form of the disease and the mortality was enormous. "Many patients were completely covered from the head to the knees with a dreadful, foul, black eruption which, with the exception of the eyes, left no portion of the face, neck, chest, or pubic region free. They presented such a repulsive and pitiable aspect that, deserted by their friends and left in the open air a prey to every need, they longed for nothing but death. Others in whom the disease caused scabs, harder than the bark of trees, on the scalp, the brow, the neck, the back of the head, the chest, the back and other parts of the body, tried, by scratching, to free themselves from their severe pains. Still others were so covered with papules and pustules that it was impossible to determine their number. The face, the ears, and the nose of most of the patients were the site of thick, scabby pustules which were elevated like little rods or small horns or teeth and discharged a pestiferous ichor" (Grünpeck). Phagedenic ulcers destroyed the genitalia, the lips, the chin, the region of the eyes and the bones. The ulceration even involved the œsophagus and many perished from starva-

[1] An important causal factor, according to the poem of Ulsenius.

tion.[1] And the disease continued to spread over Europe until Astruc said that, from the Pope of Rome on his throne to the lowest scullion in Christendom, all were infected with syphilis.

The facts of the early life of the syphilitic pandemic are not known with an exactness sufficient to permit of anything better than hypothesis as to its source; but several ingenious theories have been advanced. The date of the return of Columbus' crew from their voyage to the Haytian Indians fell within a short span of the early years of the pandemic; and this coincidence was too tempting to be overlooked by investigators. On it the theory of the American origin of the European pandemic has been built; but, in spite of enthusiastic support, the theory has not withstood critical investigation. Certain students of the subject, particularly in England, have maintained that Continental syphilis was an evolution form of yaws, introduced from the west coast of Africa. Others still have regarded certain fugitive Jews and Moors, driven from Spain by Ferdinand and allowed to settle in Genoa, where they became notorious for their high mortality, as the sparks that caused the conflagration.

Syphilis has been the subject of two historical disputes: the first as to its identity with gonorrhœa, and the second as to its identity with chancroid. Among the ancients, venereal diseases were spoken of in a rather comprehensive way and clinical entities were not sharply separated. As long ago, however, as Rhazes (850–923) hard and soft sores were described and their differences in etiology recognized; and in the fourteenth and fifteenth centuries the distinction between lues and gonorrhœa was quite sharply drawn. During the European pandemic, however, when all three diseases probably flourished luxuriantly, things became hopelessly mixed; and then for over three hundred years the theory of the unity of the virus, the foundation of which seems to have been laid by Vella (1506) in his writings on the *phlegmon naturale* of Avicenna, held sway. It was developed by Astruc into the theory that, the virus being the same, the difference in the character of the lesion depended on whether a non-secreting or a secreting surface were affected; and this idea was elaborated by John Hunter, who probably did as much as anyone to retard the progress of the truth by his curious and notoriously unfortunate self-inoculations.[2] Bell, by inoculating the urethra with syphilis and producing a chancre on a secreting surface, laid the experimental basis for complete disproof of the Hunterian theory; but it continued to flourish, until Ricord, in 1838, on the basis of extensive inoculations (really made by Mairion in Louvain[3]) confirmed the conclusions of Balfour (1767) and Bell (1793). Ricord, although convinced of the dis-

---

[1] Was it a memory of the pandemic, possibly strengthened by things he himself had actually seen, which led Shakespeare to write (the first quarto of Hamlet belongs to 1601): "*Hamlet:* How long will a man lie i' the earth ere he rot? *First Clown:* I'faith if a' be not rotten before a' die—as we have many pocky corses now-a-days that will scarce hold the laying in—a' will last you some eight year or nine year; a tanner will last you nine year."

[2] The glans and prepuce were inoculated with gonorrhœal pus. Sores resulted, followed by buboes, tonsillar lesions, and copper-colored blotches on the skin. The experiment lasted three years and proved, writes Hunter, "first, that the matter from a gonorrhœa will produce chancres." (Hunter, *Of the Lues Venerea*, vol. ii, in J. F. Palmer's edition of his works.)

[3] Ricord, of course, made many inoculation experiments; but, curiously enough, he published no nosological conclusions from his own work.

tinction between gonorrhœa and lues, believed the secondary syphilitic lesions to be non-contagious, and the chancre and chancroid to be both luetic. It was really his scholars, Bassereau, Clerc and Fournier, who settled the question. Bassereau, in 1852, by the method of clinical confrontation, arrived at the dualistic theory as it is held to-day; in 1852, Laroyenne developed it scientifically; and in 1860, Ricord, abandoning his previous position, brought to the new view the support of his great name and authority.

The names of syphilis have been legion. During its travels about the continent of Europe the unwelcome waif, as if to emphasize its foreign origin and lay at some other door its paternity, was usually dubbed according to the country from which it came. Thus one reads of morbus neapolitanus, el mal de los Castellanos, morbus gallicus,[1] morbus burdigalensis, etc. The protective saints, too, of those afflicted with the ailment have been immortalized in the nomenclature (morbus S. Maeiri, S. Fiacrii, etc.). The name in present use dates from the celebrated poem of Fracastorius (1530), who said that the disease was first sent into the world as a punishment for blasphemy on a certain shepherd named Syphilus for his presumption in blaming the gods for a blight which had afflicted his flocks.[2] The word "chancre" is an old one and occurs in a poem of Villon.

The therapy of syphilis has passed through all the vagaries. In the pre-mercurial days great attention was paid to prophylaxis and to general hygienic measures. These were supplemented in the middle ages by invocations to the saints, pilgrimages, and the fantastic recipes of empirics; but by analogy with the treatment of other dermatoses, inunctions were soon tried for the skin lesions, and mercury recommended by the Galenists on account of its "coldness" took the first place in the therapy. Since then the luetic cloud has had a quicksilver lining. Mercury was also used internally as early as 1525 by Benedictus, who died in that year. In the sixteenth century guaiacum was highly extolled by Ulrich von Hutten and Fracastorius; and it soon took a prominent place as a therapeutic measure. Vegetable depuratives, sudorifics, and purgatives were also extensively tried. At the beginning of the nineteenth century treatment without mercury came into some vogue under the influence of Broussais. In 1836 iodide of potassium was applied by Wallace to the treatment of syphilis in general and by Ricord to the treatment of the tertiary manifestations. "After this followed the strange extravagance of syphilization, which for a time stupefied the scientific world."

Etiology.—Historical.—The story of the search for the cause of syphilis is a tale to make the judicious grieve. "One hundred and twenty-five causes of syphilis," said Lassar, speaking in 1905, "have been established during the last twenty-five years."

The idea of a living contagium as the cause of syphilis is of course an old one; but the story of its "discovery" began in the seventeenth century with the finding, by Kircher (1658) and Abercromby, of a contagium animatum (vermiculi). Seventy years later Deidier was describing "vers vénériens" as responsible for the venereal virus. In 1837, Donné, using better microscopes than his predecessors, found the *Vibrio lineola* in the pus from

[1] That this is be translated "French disease" is not beyond dispute.
[2] The etymology of the word is uncertain: σῦς, sow, and φιλέω, I love; and σιφλός, crippled or maimed, have been suggested.

chancres, buboes, and balanitis; but he regarded its presence there as accidental.[1]

In 1869 the first cause of syphilis was "established." In this year Hallier found in the blood and pus of syphilities the *Coniothecum syphiliticum*. Klotsch was soon in the field with an organism, and was shortly followed by Brunekens. Then came Salisbury with his *Krypta syphilitica*, and Lorstorfer with peculiar bodies which he had unearthed; and, in 1879, Klebs with his *Helicomonaden*. A little later Martineau and Hamonic "produced syphilis" in a pig by inoculating it with certain bacterial and micrococcal forms which they had isolated; the successful attack of Koch, however, proved their labor vain.

But in 1884 it did look as though the problem were to be solved. In that year Lustgarten described a characteristic bacillus found in both the primary sore and the internal organs. The organism was present in all of the 16 cases examined. Its morphological characteristics were, in a general way, those, as we now know, of the tubercle bacillus; and the bacterium was similar in its indifference to aniline dyes, although much less strongly acidfast than Koch's organism. It was found only in peculiarly and elaborately stained specimens, was never cultivated nor successfully inoculated, and the observations of subsequent investigators, along the lines advanced by Lustgarten, gave contradictory results. The next year, however, Alvarez and Tavel, working in Cornil's laboratory, described the smegma bacillus; and the similarity of some of its varieties[2] with the organism of Lustgarten could not but be noticed and be thought of as accounting for the observations of this author. It cannot, indeed, be said that the subject was then, or subsequently, entirely cleared up; many observers maintained that the smegma bacillus was easily distinguishable from the Lustgarten bacillus and that the readiness with which the latter gave up its stain to strong acids made confusion with Koch's organism impossible, but the Lustgarten bacillus remains to this day somewhat of a bacterial mystery. The highly probable hypothesis is that the organism seen in the internal organs was, as Baumgarten suggested, the tubercle bacillus, and that the presence of the smegma bacillus about the genitalia accounted for Lustgarten's findings in chancres.

But the story did not end here. Endless "discoveries" were made, only the more important of which can be mentioned. Disse and Taguchi were soon announcing the discovery of bacilli in syphilitic blood; Neusser and Gollasch (1894) were finding a cladothrix, and Doehle, flagellated bodies; Van Niessen was describing a pleomorphous bacillus (*Bacillus veneris*), found in the tissues and the blood, and obtained in pure culture from a number of cases. Kremer (1896) was writing of the syphilis aspergillus and Tarnowsky of mixed infections; Paulsen (1901) was describing acidfast bacilli in syphilitic blood, while Joseph and Piorkowski were claiming as specific an organism obtained from luetic sperm. Then came the announcement by Siegel of his observation of the *Cytorrhyctes luis*, an organism found not only in smears from luetic lesions, but also in the tissues and the blood

---

[1] Rille has recently shown that the organism observed by Donné was in all probability the *Spirochæte refringens*.

[2] The smegma bacillus is commonly spoken of, in connection with its similarity to Koch's organism, as though it had an unvarying morphology. As a matter of fact, its shape ranges all the way from that of a coccus to that of a streptothrix, and it is only certain forms which may be confused with the tubercle bacillus.

of rabbits and apes inoculated. The finding did not receive corroboration from other observers; it could not be substantiated by Neisser in experimental work on apes. But it must not be forgotten that the work of Siegel gave a new impulse to the study of the cause of syphilis and that it was the investigation of his findings which led Schaudinn to his own discovery.

The Spirochæte Pallida.—It was in 1905 that what seems like the final word on this subject was spoken by two German investigators.[1] On May 17th of that year the paper of Schaudinn and Hoffmann was read before the Berlin Medical Society. They had already made a preliminary report of their findings, but their Berlin paper was accompanied by microscopic demonstrations. It was a model of calmness; and despite the conviction which they must have had that they had got "to the quick of the ulcer," they presented the facts quite simply and left etiological deductions to others. They had found, they said, a characteristic organism in syphilitic lesions; it was readily told from other similar bacterial forms and had been present in the primary sore of 7 cases examined; in the anal papules of 1 case, in the genital papules of 8, in 2 closed primary lesions of the skin of the penis, in inguinal buboes in 12 cases, and once in the splenic blood. Control examinations of soft chancres, of carcinomatous, sarcomatous, and lupous tissue, and of the glans of balanitis failed to reveal the organism. Moreover, Metchnikoff had examined the primary lesion in experimentally inoculated apes, taking his specimens shortly after the appearance of the sore and before ulceration, and had found the spirochæte of the authors.

In 1903, Borrel and Gonjou had found an organism in smears from hard chancres and from mucous lesions of the throat, which appears now to have been identical with the spirochæte of Schaudinn and Hoffmann; Bordet had also made similar observations in Brussels; but these authors either did not appreciate the significance of their observations or were unable to impress its significance on others; and it was not until the appearance of the work of Schaudinn and Hoffmann that the scientific world again set seriously to work on the subject. Almost immediately corroboratory reports were coming in. By December, 1905, the *Spirochæte pallida* had been found by various observers all over the world in the following syphilitic lesions: smears from and sections of primary genital and extragenital sores, both ulcerating and intact; eroded and intact papules of the penis, anal region, and skin in various parts of the body; psoriasis palmaris; pustules; mucous patches; smears from artificial vesicles over and sections of the roseolar rash; rupia; primary and secondary lymph glands in various regions; blood, both circulating and splenic; tertiary cutaneous syphilides; gummata, both closed and open, and in the cerebrospinal fluid. In congenital cases the organism had been seen in pemphigus, in papules, in artificial vesicles over the normal skin, in secretions of the mouth and nose, in the blood, in smears from and sections of thymus, lungs, liver, spleen, kidneys, adrenals, lymph glands; in the bone-marrow, the meninges, the cerebrospinal fluid, and the placenta. Furthermore, the examination of primary sores in the experimental syphilis of

---

[1] The enormous literature on the *Spirochæte pallida* is well reviewed up to December, 1905, by Julius Glass in a Leipzig thesis (Ueber Spirochæte pallida). The complete literature is also given by Herxheimer in Lubarsch and Ostertag's *Ergebnisse der allgemeinen Pathologie*, Jahrgang xi. ab. 1. The early articles of Schaudinn and Hoffmann appeared in the *Arbeiten aus dem Kaiserl. Gesundheitsamt*, Bd. xxii, H. 2, S. 527, and in the *Deutsche med. Wochenschr.*, 1905, Nr. 18., S. 711.
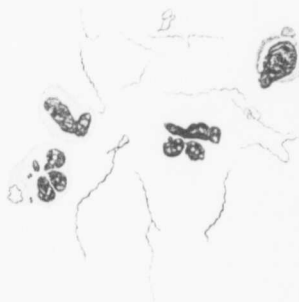
PLATE I

FIG. 1

Spirochæte Pallida. Smear from Hard Chancre.
Giemsa's stain. × 1000.

FIG 2

Spirochæte Refringens. Smear from Chancroid. × 1000.

monkeys, made by numerous competent observers, showed the presence of the *Spirochæte pallida*. On the other hand, reports of control examinations of non-luetic lesions were strikingly unanimous in asserting the absence of the organism. The vast amount of work done in the last two years has tended only to confirm these early findings both as to the presence of the *Spirochæte pallida* in luetic lesions and as to its absence elsewhere.

There have been, it is true, publications on the other side of the question. Kiolorn oglou and v. Cube claim to have found in balanitis and other non-luetic conditions a spirochæte which could only be identified with the pallida, and their claim was supported by a small number of authors. Hoffmann and Schaudinn saw their specimens, and decided that the organism observed was not the *Spirochæte pallida*. Saling, too, struck by the frequency with which smears made from the organs of congenital syphilitic cases were negative, while stained sections of the same organs showed the spirochætæ in great numbers (a phenomenon, he asserted, true of no other organism), contended and still maintains that the structures seen in stained specimens are nothing more than tissue fibrillæ, and that their presence is explained by the preceding inflammatory and degenerative processes which the disease has caused. His views have not met with much support; and a case recently seen at the Johns Hopkins Hospital suggests that the presence of the *Spirochæte pallida* in the organs of cases of congenital lues can be accounted for in no such way. A syphilitic woman presented herself to the out-patient department of the obstetrical service about the sixth month of pregnancy. She was at once put on mixed specific treatment and carried her child until the ninth month, when she was delivered. The child was alive, but died within twelve hours. The placenta was luetic and pathological examination of the organs of the child showed all the lesions of syphilis; yet continued and careful search of smears from and sections of the organs failed to reveal a single organism. The inflammatory and degenerative changes of Saling were certainly present, but the "tissue fibrillæ" were absent. Whether the spirochætæ had been actually killed off by treatment, or had been absent from the first, it is of course impossible to say, but the case offers the strongest evidence against the views of Saling.

The *Spirochæte pallida* (Plate I, Fig. 1) is a long, delicate, non-refractile, spirally curved organism. It was first studied with very high magnifications (1200 to 2800), but it may be seen quite well with the ordinary oil-immersion lens. Its average length is from 4 to 14 μ; smaller forms, 2 to 3 μ in length, are, however, also seen, and organisms 20 μ long have been observed. It is pointed at both ends. Its spirals are sharp, clear-cut, tight and corkscrew-like, and are less definite toward the ends than elsewhere. They vary in number from six to twenty-six, but shorter forms with only two or three curves are also seen. The length of each spiral measures from $\frac{4}{5}$ to $1\frac{3}{4}$ μ, and the large number of spirals in proportion to the length of the organism is a characteristic feature. The whole organism is usually somewhat curved; it may be S- or C-shaped and occasionally forms a closed circle.[1] It is circular in cross-section. In both stained and fresh specimens flagellæ have been seen, usually one at either end, although occasionally more. The flagellæ are extremely delicate and are about as long as four to six spirals of the organism. The motility

[1] This picture is probably caused by two C-shaped organisms in apposition.

of the *Spirochæte pallida* is of three kinds: rotation on the long axis, snaky, whip-like undulations of the whole body without locomotion, and forward and backward movements. The motion persists, if physiological salt solution be added, for six hours; it is stopped by glycerin, and gradually disappears on exposure to the air. Certain observers, however, have been able to see in the organism nothing more than Brownian movements. Unlike other spirilla the *Spirochæte pallida* retains its spiral form when at rest. The presence of a surrounding undulating membrane seems probable; Schaudinn claims to have observed it best in specimens stained by the Loeffler method for flagellæ.

When examined with an ultra-microscope, bodies suggestive of nuclei have been seen, but the presence of a nucleus is not beyond doubt. The organism probably multiplies, like the trypanosomes, by longitudinal fission;

Fig. 19
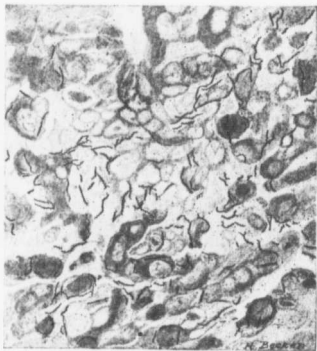
Section of lung, congenital syphilis. × 800.

no signs of transverse division have been observed. It does not bear spores. In smear specimens the *Spirochæte pallida* usually lies free and is seldom enclosed in a cell. It is, however, frequently in intimate relation with a red blood cell, often touching it with one end and not infrequently embracing it. The organisms may lie separate from one another; but often they lie in groups(agglutination of Levaditi, accolement des spirochètes of Favre and André), and occasionally they form definite tangles. Their life history is not known; what have been described as involution forms are occasionally seen. Schaudinn regarded certain of the oval and spindle-shaped forms as resting stages. One of the marked characteristics of the organism is its tinc-

torial obstinacy. No stain colors it deeply and many do not color it at all. It does not stain by Gram's method. In sections of chancres the *Spirochæte pallida* lies in the epithelial layers of the epidermis, in the lymph spaces, and in the thickened vessel walls. According to Levaditi it is first seen free within the vessels; thence it passes to the endothelium, where it causes the swelling and occlusion characteristic of the pathological picture of the disease. It is seen in greatest number in sections of organs from children dead of congenital syphilis; in these cases the tissues may literally swarm with the organism (Fig. 19). Most authors hold that the *Spirochæte pallida* is transmitted by the blood stream. Its modification and final disappearance from a lesion during specific treatment have been frequently observed; but similar observations have been made during the spontaneous healing of chancres, and it is not definitely established that the treatment (whether local or general) is responsible for the disappearance of the organism.

Method of Obtaining the Organism.—To examine a chancre for the *Spirochæte pallida* the surface should first be well cleansed with soap and water, rinsed, and dried. It is important that this be done with care, for thorough cleansing removes large numbers of the *Spirochæte refringens*, the organism usually present on the surface of sores, and, from its similarity with the *S. pallida*, offering difficulties in the microscopic diagnosis. The lesion should then be lightly curetted and the slight oozing checked by pressure with a piece of gauze. After any blood still present has been wiped away, the sore is then squeezed between the fingers until a drop of blood-tinged serum exudes. This is used for the examination, either a hanging drop or a thin smear preparation being made from it. If the chancre be covered with epithelium one can either remove the covering mechanically or obtain a drop of serum by aspiration. Enlarged lymph glands may be easily examined by withdrawing a drop of serum from them with an ordinary small aspirating syringe. Serum for smears may be obtained from lesions of the exanthemata by scraping off the covering epidermis. Certain observers have recommended the formation of artificial blisters by vesicants and examination of the serum obtained from them by aspiration. For examination of the blood the method of Noeggerath and Staehelin is best: 1 cc. of blood is removed and mixed with 10 cc. of $\frac{1}{2}$ per cent. acetic acid. The mixture is then centrifugalized and thin smears are made from the sediment.

Staining the Organism.—It is of first importance that the staining and examination be promptly done; for the organism stains badly, and sometimes not at all, in smears that are not perfectly fresh, and the color after staining gradually fades. The smear may be well fixed by simple air drying. Fixation by the vapor of osmic acid is said to give good definition and to bring out the tapering extremities particularly well; this may be readily accomplished by placing the specimens for a few seconds over the mouth of a bottle containing osmic-acid crystals.

Staining methods for the *Spirochæte pallida* are almost as numerous as the investigators who have studied it. On the whole, the modification of Giemsa's method, recommended from the first by Schaudinn and Hoffmann, is probably the best, although it is time consuming. According to the technique originally advised, the specimen is placed, after fixation, in freshly prepared Giemsa's azur-eosin[1] and allowed to stay twenty-four hours. It is then washed with water and examined. At present, a slight modification of this method is widely used. The Giemsa stain now used is known as "Giemsa-Lösung für die Romanowsky-Färbung," may be obtained from Grübler in Leipzig, and has the following formula:

Azur II-eosin	3.0 gm.
Azur II	0.8 gm.
Glycerin (Merck, c. p.)	250.0 gm.
Methyl alcohol (Kahlbaum I)	250.0 gm.

The specimen is dried in the air and hardened in absolute alcohol for one hour. The stain is then diluted with distilled water (1 drop of stain to 1 cc. of water), a fresh dilution being made for each examination. In this diluted

[1] Following is the formula:

Giemsa's eosin (2.5 cc. 1 per cent. eosin to 500 cc. water)	12 parts
Azur I (1 to 1000 water solution)	3 parts
Azur II (0.8 to 1000 water solution)	3 parts

stain the specimen is allowed to remain for twenty-four hours. Good results may be obtained if the stain stay on for only half an hour, but they are not quite so certain. In this stain the *Spirochæte pallida* is colored a delicate violet purple. The nuclei of the leukocytes should be colored a deep blackish red; if this is not the case the specimen has not been properly stained. Probably not all the organisms take up the stain; for they are not as numerous in a stained specimen as in a hanging drop from the same source.

Many other staining methods have given good results, particularly various other modifications of the Romanowsky stain. A very easy method is simple heating for two or three minutes in Victoria blue. MacNeal has also recommended a method which is quick, simple, and satisfactory. The specimen is heated on a cover-glass for forty-five seconds in the following solution:

Methylene violet (crude)		.25
Methylene blue (medically pure)		.10
Eosin (yellowish)		.20
Methyl alcohol (pure)		100.00

It is then dipped in a 1 to 20,000 sodium carbonate solution, moved about in it for one to two minutes, washed with water, and examined. The spirochæte is stained a delicate blue, or nearly black if the staining be prolonged.

For demonstrating the organism in sections the best method is that of Levaditi; it is a modification of the technique of Ramon y Cajal used for nerve fibers. Small pieces of the tissue, about 2 mm. thick, are hardened in 10 per cent. formalin for twenty-four hours. They are then left for the same length of time in 25 per cent. alcohol. After washing with water they are placed in a freshly made 1.5 per cent. watery solution of silver nitrate and left there for three days at blood temperature and protected from light, the solution being changed each day. They are then put into the following solution and left for twenty-four hours at room temperature (light excluded).

Pyrogallic acid		2.0 gm.
Formalin		5.0 cc.
Distilled water		100.0 cc.

After washing with water they are dehydrated with 85 per cent., 95 per cent., and absolute alcohol, and then enbedded. For demonstrating the flagellæ, very thin smears are necessary. Schaudinn recommends that the specimen be heated to boiling in the following solution:

Tannin 25 per cent.		10.0
Cold-saturated solution ferrous sulphate		5.0
Saturated alcoholic solution of fuchsin		1.0
Counterstain with Ziehl's fuchsin.		

Diagnosis.—The *Spirochæte pallida* is probably but one member of a large group of organisms with similar morphology, and it offers therefore some difficulties in microscopic identification. The chief trouble is caused by the *Spirochæte refringens*, for this is found just where the pallida is likely to be sought for. It occurs, for example, in the mouth, on the tonsils, in ulcerating lesions, in smegma, and on venereal warts. The *Spirochæte pallida* can, however, usually be recognized by its delicacy, its slight refractility, its tinctorial obstinacy, and by the number and tight, corkscrew configuration of its spirals. The refringens (Plate I, Fig. 2), on the other hand, is larger,

thicker, more refractile, and quite easily and deeply stained; but most characteristic of all are its spirals, which are broad and wavy or undulating, rather than corkscrew shaped. Its ends are rarely pointed and often blunt, its movements are more rapid than those of the *Spirochæte pallida*, and it occurs in great numbers in smear specimens. Not more than 2 or 3 of Schaudinn's spirochætæ, on the other hand, are usually seen in one field of a smear from a chancre; and often they are much less numerous.

Classification.—There is still dispute as to the classification of the *Spirochæte pallida*. Schaudinn regarded it as a protozoan, distinguished from the other spirochætæ, on the one hand, by its preformed spiral morphology and by its possession of flagellæ, and from the spirillæ, on the other hand, by the flexibility of its spirals, by the possession of only one flagellum at either end and by its apparent capacity for longitudinal fission. He agreed with Vuillemin's suggestion that the organism be called a Spironema.

Significance.—To attempt to speak positively about the specificity of this organism is to render a verdict on evidence which is not absolutely complete; and the unfortunate history of syphilis in this regard is a warning against premature judgment. A consideration of the present status of the question should contemplate the following facts:

1. Experts are almost unanimous in regarding the specificity of this organism as a "probability bordering on certainty." No one regards its specificity as proven, and there is everywhere an admirable caution evident in regard to opinions about the causal relation of the organism to syphilis; but it is most striking that the very extensive and careful scrutiny to which the *Spirochæte pallida* has been subjected, although it has brought out confirmatory observations in great number, has failed to reveal a single well-established fact at variance with the idea that this organism is really the cause of lues.

2. The *Spirochæte pallida* occurs almost constantly in primary and secondary luetic lesions. Failures to find it date largely from the early period of the search for it, before the technique was developed or the eyes trained; and the growing experience of clinics throughout the world is that the organism of Schaudinn and Hoffmann will be found in chancres if carefully and persistently looked for.

3. The *Spirochæte pallida* occurs unmixed with other organisms in the depths of primary and secondary luetic lesions, and in the blood.

4. It is in the most contagious syphilitic lesions (the chancre, the condyloma, and the mucous patch) that the *Spirochæte pallida* is most often found and in greatest number.

5. The *Spirochæte pallida* occurs in the internal organs, the specific exanthemata, and in the blood of congenitally syphilitic children. It is also found in the placenta and in the umbilical cord, and the absence of other organisms in these situations is a striking fact.

6. The *Spirochæte pallida* is absent from non-luetic lesions.

7. The *Spirochæte pallida* disappears, in some cases at least, under the treatment which cures the syphilis. In at least one congenital case it was entirely absent from the organs of a definitely syphilitic child, whose mother had received specific treatment for some weeks before delivery.

8. The *Spirochæte pallida* is less numerous in healing sores than in others.

9. The *Spirochæte pallida* does not pass through a Ton-filter. This fact is rendered striking by the observation of Metchnikoff and Klingmüller that the syphilitic virus behaves similarly.

10. The *Spirochæte pallida* has been a frequent, although not an absolutely constant, finding in the experimental syphilis of apes, not only after inoculation from human cases, but also in the disease transmitted from one animal to another. Its absence from the normal skin of the ape has been established by Kraus. Neisser's failure to find it in the internal organs and blood of experimentally syphilized monkeys and in the hereditary syphilis of monkeys remains unexplained.

11. Cultivation of the *Spirochæte pallida*, and therefore, obviously, experimental production of syphilis by inoculation of the pure organism, remain impossible. Koch's third and fourth laws are, therefore, still unsatisfied; but the third law is also unsatisfied in the case of the malarial plasmodium, the etiological nature of which no one doubts.

The value of the *Spirochæte pallida* from a diagnostic standpoint seems, at least, to be established. Whether we regard it as the causal agent or as a saprophyte, its almost constant presence in chancres and absence in non-luetic lesions is almost beyond dispute; and we are therefore justified, in the event of a positive microscopic finding, in making a positive diagnosis of syphilis and in instituting treatment on this evidence alone. If a single examination, however, be negative we are not justified in regarding the lesion as non-luetic, just as we would be without justification in regarding a sputum as non-tuberculous after examining one smear preparation. Recourse must be had to repeated examinations; if these continue negative, we can say, with the very highest confidence, that the sore is not luetic.

General Pathology.—Syphilis, which begins its pathological existence as a modest, inactive Hunterian chancre, soon enters upon a career that is unsurpassed for the inclusiveness and variety of its manifestations. There is no organ in the body,[1] nor any tissue in the organs, which syphilis does not invade: and it is therefore manifestly difficult to speak, at least at all concisely, of the pathology of the disease; just as it is almost impossible to describe its clinical symptoms without mentioning almost every symptom of every disease known. Certain general pathological features are, however, characteristic, and these must be here described; the other more specific changes will be treated under affections of special organs. One notices throughout the pathological changes of lues the cellular infiltration and the prominent part taken by the bloodvessels, both of which features have been seen to play such an important role in the chancre. Virchow, indeed, called attention to the fact that all the syphilitic lesions from the chancre to the gumma are granulomata so much alike that they cannot be differentiated.

1. **The Syphiloma.**—The following are the features of the general pathological anatomy of the syphiloma as outlined by Jullien:

"(a) Infiltration of the derma and the mucous layers with small cells. These cells, which closely resemble the aspect of embryonic elements encountered in fleshy granulations, are heaped up at the periphery of the vessels, between the trabeculæ of the corium, and finally involve the papillæ and Malpighian bodies to such a degree that the limitation between these two layers of the skin entirely disappears.

"(b) The inevitable destruction of those cells which are incapable of organization. At the end of a certain time the infiltrate undergoes a fatty degeneration and enters into the organism by resorption or ends in a purulent dissolu-

[1] The prostate is a possible exception.

tion. In any case the vitality of the secondary syphiloma is not sufficient to transform it into definite tissue. After its disappearance the elements of the tissues in the midst of which it was established again take on their normal disposition without any necessary loss of substance.

"(c) The centrifugal course of the neoplasm, both in its development and in its retrogression. It is always from the centre to the periphery that the infiltration takes place; the borders of the lesion are consequently more recent than the centre; hence the differences in aspect which may be presented in the two parts. When the centre becomes depressed under the influence of retrogression, the neoplasm may maintain its maximum of development at the borders; this is the reason for certain forms (cup-shaped, annular, etc.)."

The pathological changes explain the features of the various lesions. "The papule," for example, "is prominent because there is cellular infiltration; hard, because this infiltration is dense; it is brilliant, because the epidermis is tense over the summit; surrounded by a collarette, because the coloring matter of the blood furnishes an extravasation; and, finally, when resorption takes place, the epidermis wrinkles at its surface and is eliminated by an ephemeral desquamation."

2. **The Cutaneous Syphilides.**—These cannot be treated in detail on account of their multitudinous varieties. The pathology, however, of the macule, the papule, and the pustule will suffice as examples of the characteristic changes. The *macule* consists of an exudation of leukocytes and plasma cells about the small vessels, a proliferation of connective tissue, an infiltration of the hair, sweat and sebaceous follicles, with round and plasma cells. Horny pigment cells are occasionally deposited in the papillæ (Ehrmann's melanoblasts). The *papule* represents a further development of the macule, due to an advance in cell proliferation toward the surface and toward the depth. Plasma cells and leukocytes occur in groups ("Zellenwucherungen"), often about the ducts of sweat glands. Round cells are numerous and giant cells frequent. Exudation of leukocytes and transudation of serum into the epidermis may occur and the papule may, therefore, be accompanied by a pustule or vesicle. The *pustule* presents a similar picture except that suppuration is now present at the mouth of hair follicles or sebaceous glands. The walls of vessels, hair follicles, sebaceous and sweat glands show cellular proliferation and infiltration of cells, which reaches to the horny layer, obliterating the distinction between rete and cutis. Giant cells are present.

3. **The Gumma.**—This lesion belongs to the infectious granulomata and shows no specific elements or structure. The pathological changes are similar to those of the papule, but destructive changes are present and give the lesion its character. There is softening of the connective tissue, which is transformed into a thready, mucoid mass, consisting of detritus and cells which have undergone fatty degeneration. Lymphoid, pus, and epithelioid cells are present. At first there are no new bloodvessels formed, but later these become a feature. The overlying epidermis becomes inflamed and the upper layers of the corium swollen with a semiliquid infiltration. The gumma may be surrounded by dense, sclerotic, scar tissue, and present undeniable histological analogies with tubercle, both of which tend to "caseation." The gumma, however, may be absorbed and finally disappear without degeneration or ulceration; this is a remarkable characteristic and is well illustrated in gumma of the testicle, where the organ may be reduced to one-

fifth its size without signs of breaking down. The gummatous change may be diffuse, rather than confined to the limits of an infectious granuloma. The microscopic distinction between gumma and tubercle is always difficult and often impossible. In general, epithelioid cells are more frequent in tubercle, fibroblasts and connective-tissue strands in gumma; in gumma, caseation and connective-tissue proliferation are simultaneous, in tubercle the latter succeeds caseation; gummatous caseation is a much slower process than tuberculous caseation; the tubercle is often free from vessels, but new-formed vessels are a prominent feature of gumma and often persist even during necrosis. Giant cells are certainly more characteristic of tubercle than of gumma. Baumgarten goes so far as to deny their occurrence in syphilis: "The presence of a single typical giant cell of Langhans tips the scale of probability in favor of tuberculosis."

When the growth of the gumma ceases the younger peripheral cells become organized into connective-tissue cells, forming an envelope for the cheesy and gummatous nucleus. This envelope shrinks, the semifluid portions are absorbed, and finally a scar (possibly calcareous) is left behind.

4. **Lesions of the Mucous Membrane.**—When the papule occurs on mucous membranes or on moist portions of the skin it presents certain other patho-logical characteristics, but remains essentially a papule. Cell proliferation invades the cutis, necrosis of the surface occurs, and a characteristic deposit is formed. This is removed mechanically and is again replaced; or else the papillæ proliferate and mechanical stimulation leads to great hyper-trophy, immense cauliflower condylomata resulting.

5. **Inflammations.**—Syphilis may determine inflammatory changes. Arte-ritis and peri-arteritis have already been referred to; pharyngitis is frequent; acute nephritis is not rare; iritis and periostitis are common, and in the lungs a chronic fibroid change is sometimes seen (the fibrous interstitial pneumonia of Virchow). The non-specific inflammation of the viscera which occurs in tertiary syphilis commences as a congestion and runs a subacute or chronic course. It ends in new connective-tissue formation, cirrhosis of the organ affected, and atrophy of its parenchyme. Later the inflammation is gummatous in character.

6. **The Blood.**—The blood picture, which is never characteristic, may vary from that of chlorosis to that of pernicious anæmia. A normal count, although unusual, occurs. A severe chlorotic anæmia is the rule in the primary stage and is most marked in women. With the appearance of the rash there is further diminution in the hæmoglobin; the red blood count may remain about where it was or drop very rapidly. In tertiary and hereditary syphilis the picture may be that of primary pernicious anæmia with numerous megaloblasts; normoblasts, gigantoblasts, microcytes, and poikilocytes are also seen. Mercurial treatment causes the red cells to rise, although its *first* effect is often a drop, accompanied, in some cases, by hæmoglobinuria. Sometimes a hypercythæmia results from the treatment; but if it be continued too long or in too large doses, mercury itself may cause an anæmia. A large inunction or injection of mercury, given after the disease has ceased to be local and has invaded the lymph glands, causes an immediate drop of from 10 to 20 per cent. in hæmoglobin, which rises, in a few days, to normal or above normal. This is known as Justus' test; it may be obtained in any case of florid lues, is not present during the early primary stage, and, while not certainly pathognomonic, is valuable.

The leukocytes are normal in the primary stage, or slightly increased. If mercury be given, the percentage of polymorphonuclear neutrophiles increases. During the secondaries there is slight leukocytosis, with increased lymphocytes and eosinophiles. The severe anæmia of the tertiary stage is often accompanied by leukocytosis with high lymphocytosis, and myelocytes occur in severe cases.

7. **Amyloid Degeneration.**—Syphilis plays an important role in the etiology of amyloid degeneration; 21 per cent. of 80 cases of amyloid degeneration studied by Hoffmann in the Berlin Pathological Institute were due to syphilis. The intestines, liver, spleen, and kidneys are oftenest involved; and the condition is common in association with rectal lues to women. It is rare in the congenital form.

The Nature of the Syphilitic Virus.—Acquired syphilis is transmitted only by contact, either direct (venereal, buccal, mammal, corporeal) or mediate (the various contacts of domestic, social, industrial, and professional life, such as the use of common utensils, the care of children, vaccination, etc.). Hereditary transmission may be paternal, maternal (the mother actually passing on her own infection to the product of conception, or else transmitting the disease from a luetic semen without herself receiving apparent infection), or from both parents.

The virus possesses the power of remaining dormant for a long time and suddenly rousing into activity again. It circulates in the blood, and exists in the sperm, whence it may pass to posterity. The father is, indeed, most often responsible for hereditary syphilis; but he may beget a healthy child, although himself in the acute stages of the disease, and not all congenital lues is paternal in origin, for a woman with acquired syphilis is liable to bear infected children. So long as the disease is in the primary or secondary stage it is intensely contagious; in general, the virulence decreases with the duration of the illness, and at some period of its life its contagiousness ceases. Just when this occurs no one can say; there is not even agreement as to the contagiousness of the tertiary lesion,[1] but clinical evidence goes to show that on the average a well-treated case of syphilis offers no danger of direct transmission after three years have elapsed without symptoms. The danger, however, of transmission to posterity lasts much longer—how long it is impossible to say.

The virus is certainly contained in the primary and the secondary lesions, and most abundantly in those that are secreting or degenerating. Whether the normal secretions contain it is not definitely agreed. Diday, Pardova, and others, working on the tears, milk, sweat, and urine, failed to demonstrate the presence of the virus by inoculations; Fenger, however, apparently proved that the secretions possess contagious properties when inoculated in sufficient dose. The virus rapidly loses its activity outside the human body; Boeck found that when dried upon linen it soon became no longer infectious. The virus cannot apparently enter the body except through injured skin or mucosa.

The facts as to luetic immunity can perhaps be best stated in an itemized way, but one has always to bear in mind that no statement about syphilis is always and absolutely true, and that even such well-founded generaliza-

---

[1] The discovery of the spirochæte of Schaudinn in tertiary lesions probably settles this dispute. Neisser and others have recently proven, by experimental inoculation of apes, that the gumma is infectious.

tions as Colles' law contemplate only a majority, although in this case it is the vast majority, of clinical observations.

1. Syphilis is exclusively an affliction of the human race. Animals do not suffer from the disease,[1] and with the exception of monkeys, an exception which has only recently achieved the distinction of well-authenticated scientific substantiation, they cannot be inoculated with it.[2]

2. In human beings there is *no absolute* immunity to the disease.

3. Syphilis does, however, confer a certain degree of immunity, and its occurrence in an individual renders a second attack quite unlikely, although not impossible. On the basis of experimental work on apes Fenger and Landsteiner reached the following conclusion: The syphilitic at all stages of the disease can react with local specific appearances to the syphilitic virus and there exists only a very considerable, but not an absolute, immunity to the disease.

4. There is a certain degree of natural immunity to the disease. The occurrence of syphilis, for instance, in only one of several individuals exposed to exactly the same source of infection is a fairly frequent clinical observation difficult to explain in any other way. Certain authors are of opinion that prostitutes as a class enjoy a relative immunity to the disease; this may, however, be simply an acquired immunity.

5. Syphilis is essentially a disease acquired in youth, and, although no age is immune, the initial sore rarely occurs after the fiftieth year. Habits of life would, of course, account for this fact; whether immunity also plays a rôle it is impossible to say; but the proverb of Ricord should at least be kept in mind: "Let him who lusts after syphilis make use of his youth, for in old age its acquaintance cannot be first made."

6. There seems to be good ground for believing that the existence of syphilis in a community for some length of time results in a relative immunity to it, as expressed by a lessened severity of its symptoms. This observation was strikingly made after the great European pandemic; it has been repeated since, when the disease, freshly introduced into a community and taking on a virulent form, has gradually become milder; but there is no reason to suppose that this immunity will ever become absolute and that the disease will, of itself, "die out."

7. **Colles' Law.**—"One other peculiarity," wrote the Dublin surgeon, "in the history of the syphilis infantum, and one of the most singular connected with it, is this: Suppose a child shortly after birth exhibits evidence indicating intra-uterine contamination, and that the mother herself has never showed any symptom of the venereal disease, she will enjoy a perfect immunity from being infected by her own infant, which perhaps she is even suckling; while a healthy young woman employed merely to carry it about will quickly become diseased, and still more readily if she acts as wet-nurse to it." Colles was the first to propound the generalization; but the law was first formulated by Beaumès, and may be thus briefly stated: A woman who has borne a syphilitic child is immune to syphilis,

[1] The so-called syphilis of horses (Beschälenkrankheit), which affects asses as well, although clinically so similar to syphilis as to defy differentiation (Fournier and Jullien), is not generally regarded as identical with human syphilis.

[2] The inoculation experiments made upon other animals have been, at least, contradictory, and, as a rule, unsuccessful. Certain observers have claimed that the disease may be transmitted to the pig.

althoug
real, or
lightly

8. **Pr**
contagi
by its
This fa
name h
immuni
active s
a luetic
that the
and oth

9. W
most, a

10. V
is appa
placent

11. T
is not s
have be
a cured
The rep
to the t
occurre
syphilis
in the sa
still-birt

Clini
three cl
is the sta
sion of
localize
litic ph
no disea
Nor is
classific
absent;
or be al
times ol
to the tr
mind, i
clinical

The C
initial s
or hard
infectio
called t
but the
from se
and at

although she may present no signs of the disease. Whether the immunity is real, or whether the mother acquires it by being herself infected, although so lightly as to cause none of the usual symptoms, is still a moot question.

8. **Profeta's Immunity.**—When a woman suffering from syphilis in its contagious stage bears a child which shows no taint, the child may be suckled by its mother with impunity and will not contract the disease from her. This fact was first stated by Behrend, but was repeated by Profeta, whose name has since been coupled with it. It should be borne in mind that immunity of this sort is only transferred while the mother is suffering from active syphilis; the law cannot be extended to include all the offspring of a luetic mother. This immunity may be only an apparent one in the sense that the child has received a true but latent infection; this is the view Diday and others have upheld in order to explain late hereditary syphilis.

9. When syphilis is inherited it is usually the eldest child which suffers most, and often it is the firstborn child.

10. When a woman is infected with syphilis after conception, the child is apparently often immune. It may, however, be born syphilitic, and placental transmission is a well-recognized fact.

11. The question of the transmission of syphilis to the third generation is not settled beyond all dispute. Cases of pronounced congenital syphilis have been met with in the children of healthy parents; but the existence of a cured acquired syphilis in the parents can seldom be absolutely excluded. The reported cases do not bear careful scrutiny and transmission of syphilis to the third generation, if it takes place at all, is certainly not a common occurrence. Fournier is, however, strongly of the opinion that heredo-syphilis may have the same harmful effect on the fœtus as acquired syphilis; in the same way as the latter, it constitutes a predisposing cause for abortions, still-births, and the early death of infants.

Clinical Features of Syphilis.—Syphilis was divided by Ricord into three clinical stages, and to these others have added a fourth. The primary is the stage of the chancre; the secondary is the stage of the acute general invasion of the virus; the tertiary is the stage of the late, relatively non-virulent, localized manifestations, and the quaternary is the stage of the parasyphilitic phenomena. The division is, of course, more or less an academic one; no disease, syphilis least of all, follows any rule in its clinical phenomena. Nor is the evolution of the disease so constant or orderly an affair as the classification of Ricord might suggest. One of the stages may be entirely absent; the secondary and tertiary stages may be separated by long intervals or be almost simultaneous, and almost any variation of the scheme may be at times observed. On the average, however, it represents an approximation to the truth; and while its limitations must be constantly and clearly kept in mind, its value both in guiding clinical observation and in facilitating clinical description cannot be questioned.

The Chancre.—(*Synonyms:* infectious, indurated, or Hunterian chancre; initial sclerosis.) Syphilis makes its debut in the guise of the Hunterian, or hard, chancre, which appears as a rule within the first three weeks after infection, rarely earlier than the tenth day. Attention is frequently first called to the lesion, as Hunter observed, by an itching in the affected part; but the sore, both at its onset and later, is usually quite painless and free from sensitiveness on pressure. Its very early appearance varies greatly and at this time diagnosis is often quite impossible. "In the early part of

my life," wrote Colles, "I thought I could tell what was a chancre; but I am now convinced that a primary venereal ulcer may *begin* in any one possible form of an ulcer." Usually it is a small papule which is first noticed. As the sore develops, however, it takes on more or less diagnostic characteristics. It forms a brownish-red, firm, often button-like nodule with a shallow surface depression. Its size, shape, and consistency vary greatly; but characteristically it is circular or oval, measures 1 x 1.5 cm., and is quite hard. Its edges are sharply defined and the induration about it does not, as is usual in other inflammations, extend far beyond the limits of the lesion itself, but terminates abruptly. Its extreme motility is a characteristic feature. At this stage the chancre is really an exulceration resting on an indurated base. The surface of the base is regular, brilliant red (much the color of muscle), and on a level with the surrounding tissues or slightly above them. Its centre is not infrequently grayish or diphtheroid. The secretion is scanty and thin, and suppuration does not usually occur. If the lesion be on a mucous membrane, the surface remains moist and glistening; but in chancre of the skin the secretion often dries and forms crusts. It may, however, be altogether absent. The induration, which may feel like parchment, is usually more resistant and elastic, resembling cartilage. The sore is typically single, but in about one-fourth of the cases it is multiple; Fournier has reported a patient exhibiting twenty-six simultaneous initial lesions.

The chancre is usually accompanied by no general constitutional disturbances. Involvement of the neighboring lymph channels, particularly along the dorsum of the penis, is seen, but it is not associated with inflammatory redness. Soon after the appearance of the chancre the neighboring lymph glands become enlarged, forming, when the sore is a genital one, the characteristic luetic inguinal buboes, most frequently seen in both groins. They remain discrete, are hard, free from tenderness, and do not suppurate. They survive the chancre and become, later, part of the general adenopathy of the secondary stage. Enlarged inguinal glands are occasionally entirely absent.

Complications.—1. The chancre is sometimes accompanied by marked inflammatory reaction. This often takes the form of intense œdema and phimosis. A condition of elephantiasis may be present and gangrene is occasionally seen.

2. Not infrequently the chancre becomes phagedenic. This is most often seen in old men and in diabetic or otherwise diseased patients.

3. The Hunterian chancre may be accompanied by a soft chancre, and this mixed infection is frequently seen in large dispensaries. Very often, too, the evolution of a soft chancre into a hard one is observed. This is, of course, due to a mixed original inoculation; the soft sore, with a short incubation period, appears first, its base becomes gradually indurated and soon takes on the typical Hunterian characteristics (mixed chancre).

Site.—Chancres may be either genital or extragenital. About 8 of the latter are seen to 90 or 100 of the former. The characteristics of the lesion vary with its site and induration is usually less marked in chancres of the skin than of the glans, and in women than in men.

(a) *Genital Chancres.*—The primary lesion is usually situated on the genitals. In men it is most frequently seen, as Hunter observed, on the frænum and coronal sulcus; but the glans, the urethra (as far as the fossa navicularis), the dorsum of the penis, and the scrotum are occasionally the site of chancre. In women it may occur anywhere on the external genitalia, and even in the

cervical canal itself. Perigenital chancres are seen on the mons veneris, the inner surface of the thighs, and the perineum.

(b) *Extragenital Chancres.*—The contagion of syphilis, although usually spread by normal sexual intercourse, is not necessarily so transmitted; and the primary lesion is by no means always found on the genitalia. In certain regions of Russia, for example, where there are no physicians and where the most wretched hygienic conditions prevail, syphilis is, according to Tarnovsky, in 70 per cent. of the cases transmitted by extragenital contagion. In these districts there are few if any prostitutes, and " rural syphilis in Russia is first and foremost syphilis of the innocent."

Perverted intercourse for very obvious reasons may account for extragenital chancres; so, too, may certain of the contacts of every-day life (contagion from drinking cups, kissing, barbers' utensils, etc.). More frequent, however, are the extragenital sores acquired by the special contact of physicians and obstetricians and gynecologists run a particular risk in this respect. Chancres have also been transmitted by surgical instruments; the Eustachian tube has been infected by a catheter; the disease has been transferred from one patient to another on a silver-nitrate stick; vaccination and tattooing have spread it; and in the Continental countries the industry of wet-nursing is a well-recognized and somewhat dreaded source of contamination. Extragenital chancres are, therefore, often innocently acquired (syphilis insontium). They occur about the lips, on the nose, chin, brow, cheeks, eyelids, and conjunctivæ; on the gums, the tonsils, and at other sites within the buccal cavity; on the fingers, most often of nurses and physicians; on the breasts; and, rarely, on the extremities.

Varieties.— Chancres vary as to the extent and form of ulceration (simple fissures, small ulcers, giant ulcers), the depth of ulceration (erosive, ulcerative, and boring chancres), the characters of the surface (papular, squamous, diphtheroid, pustular, and papillomatous chancres), and the character of the base (foliaceous, parchment, hypertrophic, elevated, and elephantiac chancres).

Course.—With the appearance of the eruption retrogressive changes in the chancre itself usually begin; they may set in earlier or be much delayed. The induration diminishes, the central portions of the chancre undergo fatty or ulcerative degeneration, and finally the sore disappears. Absolutely no trace of the lesion whatever may be left behind, particularly if it be situated on a mucous surface. As a rule, however, an indurated scar persists and may last for years; not infrequently the scar is pigmented. If the sore becomes infected or assumes a phagedenic character its clinical course is obviously altered. Prognosis as to the severity of the syphilis is by no means to be made from the character of the sore.

Histology.—The most notable findings are the enormous cellular infiltration and the marked changes in the bloodvessels. The infiltration originates in an exudation of lymphoid cells from the capillaries, and this is accompanied by a proliferation of the cells of the cuticular connective tissue and of the elements of the walls of the bloodvessels themselves. Mast-cells also occur. In the midst of the cellular infiltration the elastic tissue disappears. The new formation of cells extends along the small arteries and veins; the tissue becomes crowded with cellular infiltration and sclerosis soon takes place.[1] Meanwhile, thickening of the media, and proliferation of the intima

[1] Unna and others hold that the chief change occurs in the *adventitia*.

have occurred in the arteries and veins; so that the vessels, crowded by cells from without and blocked by proliferating endothelium from within, become narrowed in their lumen and sometimes completely obliterated. Poor circulation results, infiltration does not advance, and retrogressive metamorphosis begins. The vascular changes are very marked in the veins and in the lymphatics, the former being represented by rings with thick and rigid walls. The arteries also have thickened walls and their lumen is much diminished; all trace of elastic tissue disappears from the vessels. The lumen and walls of the capillaries of the papillæ often remain normal. The lymph spaces remain large. Giant cells and large epithelial cells occur; and Berkley has observed alteration in the nerve fibers going to the part. The epidermis over the chancre may be nearly normal; but the epithelial stratum is usually infiltrated, and often thinned and eroded. The formation of new cells occurs also in the papillary layer, starting from the bloodvessels; the papillæ are usually long and broad; and the interpapillary ingrowth of epithelium is often interspersed with proliferating young cells. In retrograding chancres fewer cellular elements are found, but many shrunken, connective-tissue shreds. The formation of the lymphatic cord running from the initial sclerosis up the penis superficial to the dorsal vessels may have important relation to the spread of the disease from the chancre.

Diagnosis.—The sharply defined borders, the induration, the slight sensitiveness, the scanty, non-purulent secretion, and the motility are the typical clinical features of the Hunterian chancre; but no one of them is invariable and the diagnosis of the sore is usually difficult, very often impossible, and as a rule not to be made, aside from finding the *Spirochæte pallida* microscopically, until sufficient time has elapsed for the appearance of secondary symptoms. The chancroidal ulcer and the lesions of herpes progenitalis offer the greatest difficulties in diagnosis of genital chancre. Other genital lesions which may be confused with chancre are secondary syphilides exhibiting ulceration, suppurative folliculitis, erosive balanitis and vulvitis, and certain of the tertiary syphilitic lesions. The appearance of these is, however, usually not typical of Hunterian chancre; the history is often helpful; and microscopic examination of smears will eliminate the nonluetic lesions.

The diagnosis of extragenital chancres offers greater difficulties. Here the position of the lesion instead of attracting one's attention immediately to syphilis may throw one off one's guard. The characteristics of the Hunterian sore are, however, usually to be found, and one should look particularly for the accompanying adenopathy. Chancres of the skin may be mistaken for pustular ecthyma and for tuberculous ulcerations. In the pharynx one may suspect diphtheria; on the fingers, lips, tongue, and tonsil differentiation from carcinoma is often difficult. Extragenital chancres may also resemble ordinary inflammations (*e. g.*, panaritium, abscess of the tonsil, etc.).

Prognosis.—In itself the chancre is usually benign; if ulcerative or phagedenic in character, however, it may in itself be a grave affection by reason of its effect on general health and of the loss of substance which it brings about. In certain situations, too, its nature is more serious; urethral chancres for example, lead to stricture and nasal chancres to atresia of the nostrils. The supposed increased gravity of extragenital chancres is probably due,

to other factors than the intrinsic nature of the lesion itself (*e. g.*, mistaken diagnosis and insufficient treatment, accompanying secondary infection, etc.).

The Secondary Stage.—The initial lesion is the clinical expression of syphilis in its primary and localized form. We do not know that the infecting agent has actually remained at the site of original inoculation or in the lymphatic glands nearby; what we *do* know is that during the first few weeks of the disease (the so-called second incubation period), no manifestations other than the local one, are to be observed. After a lapse, however, of about four to eight weeks from the appearance of the chancre the disease changes rather suddenly from a local to a general one; constitutional signs and symptoms, in great variety, appear; and this appearance marks the onset of the secondary stage of the disease. To this stage no terminal limit can be set; sometimes it lasts a few weeks, at other times many months; its course is greatly influenced by treatment; and if the disease is not well treated it may either pass directly into the tertiary form, or disappear entirely to reappear, after the lapse of months or years, as tertiary syphilis.

The symptoms of secondary syphilis are in a general way those of a more or less grave acute infection; but a large and motley group of specific symptoms is also superadded. The most characteristic of the latter are the lesions of the skin and mucous membranes; these are also quite often the most apparent manifestations as well as the first to appear.

1. *Symptoms of an Acute General Infection.*—General constitutional *disturbances* are usually present, often marked and in striking contrast to the feeling of well-being during the primary stage. There is loss of weight and strength; the patients feel badly and this condition may be exaggerated by anxiety over the nature of their disease. The appetite becomes poor, extreme anorexia being occasionally observed. In nervous women, however, boulimia is sometimes seen. Headache is a frequent, characteristic, and troublesome symptom. Usually it is described as a deep heaviness present most of the time, but much worse in the evening. Sometimes it is violent, almost intolerable, and quite prevents participation in the activities of life. The tonsils are often swollen independently of the occurrence of mucous patches. Sore throat is frequently complained of (angina erythematosa syphilitica). When the angina spreads to the uvula and soft palate the picture is characteristic and almost pathognomonic. The inflamed area itself is dark crimson, and is abruptly separated from the healthy mucosa anteriorly by an absolutely sharp border. The lingual tonsils may be swollen and dysphagia result. The spleen is sometimes enlarged, and this fact, if fever and roseola suggest typhoid fever, may add confusion to the diagnosis. Occasionally jaundice is present. Albuminuria is not frequent, but an interesting form of true nephritis occurs, which will be fully discussed under Visceral Lesions. Anæmia is a feature of the secondary stage; it is usually of the chlorotic type and may be attended by definite clinical symptoms (cardiac palpitation, sense of oppression, etc.). The details of the blood picture are described above. In neurotic individuals syphilis often causes an extreme exaggeration of the symptoms previously present. Intense psychic depression is not at all rare; pains in the limbs and analgesias and anæsthesias (particularly of the breasts in females) are seen, and sometimes the patients suffer from definite convulsive attacks. The patella reflex may be abolished.

Enlargement of the lymphatic glands is one of the characteristic features of secondary syphilis. It is not a local affair, like the adenopathy attending genital or extragenital chancre, but is an expression of general infection. The glands are not large, are indolent, painless, hard, discrete, unaccompanied by neighboring lymphangitis, and do not suppurate. The intensity of the glandular involvement is not proportional to the severity of the disease; on the contrary, marked glandular swelling usually accompanies mild lues, and vice versa. The most frequent lymphatic glands to be involved, arranged in order of predilection, are the postcervical, the sternomastoid, the submaxillary, the epitrochlear, the axillary, and the inguinal. Enlargement of the epitrochlears is particularly suggestive, since its involvement in other conditions is not very frequent. Involvement of a small gland just under the outer border of the pectoralis major has been considered almost pathognomonic of lues; the gland is certainly rarely involved in cases of acute infectious processes (phlegmon, etc.), since it lies off the drainage tract of parts oftenest so affected. Recently, however, such an enlarged gland was removed for purposes of diagnosis and found to be tuberculous. Enlargement of the inguinal glands is of little diagnostic value; it is by no means always seen in syphilis, and is very often seen in other conditions. Palpable and even enlarged lymphatic glands in this region are, indeed, almost a constant finding in patients seen in a genito-urinary out-patient clinic, and Dietrich has found that out of 499 healthy individuals 99 per cent. showed enlarged lymph glands somewhere in the body.

Fever.—Fever is a frequent phenomenon of the secondary stage and is one of the features of its resemblance to an acute infectious disease. At the end of the fifteenth and during the early years of the sixteenth centuries, when syphilis assumed epidemic proportions, its diffusion was so rapid and widespread that it was compared with smallpox (owing probably to the intensity and persistence of the cutaneous features), and hence the name variola magna, the great pox, or *the* pox. Fever was noted by many of the writers of this period—Massa, Vigo, and others. The great reformer, Ulrich von Hutten, whose *de Guaiaci* (1519) is the most interesting personal record of syphilis in the sixteenth century, must have been much plagued by the fever of the disease, as he personified it in two of his famous dialogues, *de Febris.*

Until the introduction of the thermometer no accurate clinical studies were made upon the subject, and the statement of John Hunter, "This fever has much the appearance of rheumatic fever and after a time partakes a good deal of the nature of the hectic" (1786), expresses the extent of our knowledge. Guntz (1863), a pupil of Wunderlich, was one of the first to study this feature carefully. Important papers have been published by Yeo, Phillips, Bristowe, and Parkes Weber in England; by Musser, Janeway, Futcher, and Birt in America; and by Baümler and F. Klemperer in Germany.

The frequency of fever during the course of syphilis is variously estimated. A large majority of all cases have a slight elevation of temperature at the period of incubation. Throughout its course the disease may be afebrile, and patients with the most extensive lesions may have normal temperature.

The fever occurs at three periods—preliminary, stage of invasion, and at any time during the tertiary lesions:

1. *Preliminary Fever.*—During the period of incubation of from eight to nine weeks the patient may be without symptoms, but there may be a

feeling of weakness and loss of appetite, with pallor. In a few instances at this period fever occurs. It may be ushered in by a chill (Lang) and be accompanied by headache, nausea, and pains in the limbs.

2. *Fever of Invasion.*—As a rule, by the time we see the patient in hospital the fever has disappeared. No large statistics are available, but various estimates give the proportion of cases with fever at from 25 to 35 per cent. It is probable, if we had accurate measurements, that slight fever would be found in a much larger proportion. It may antedate the eruption by a week or two and may set in abruptly with a chill. It is commonly associated with headache, malaise, and a furred tongue. The type of fever is usually remittent. Where malaria prevails the case may be confounded with the æstivo-autumnal type of this disease.

Much less frequently the fever of invasion is frankly intermittent. No case of this type at this period of the disease has come under our observation, but Fournier refers to it. The pains in the limbs and about the joints, with the slight fever, may lead to the diagnosis of acute rheumatism. A remarkable case of this kind was seen in a young woman of good family, who had been confined to bed for three or four weeks with pains in the joints and slight fever. She had irregularity of the heart's action and it was for this that the writer was consulted. The case turned out to be one of secondary syphilis following a chancre on the lip. In a young student, fever with the unusual complication of parotitis occurred during the stage of eruption. At this stage the picture may occasionally simulate typhoid fever, which Fournier describes as "*Typhose syphilitique.*"

3. *Fever of the Tertiary Lesions.*—It is particularly at this period that the presence of fever may lead to serious errors in diagnosis. The profession scarcely realizes that protracted fever of almost any type may occur in tertiary syphilis. It is probable that many of the cases of obscure, unclassifiable fevers which are described from time to time are due to latent syphilitic lesions. A man may have quite extensive gummatous disease of the liver without pain or without great enlargement. On the other hand, there can be no question that the most extensive tertiary lesions may be present with a normal or with a very slight elevation of temperature. Among diseases for which the fever is apt to be mistaken are:

Rheumatic Fever.—Nodes growing close to joints may cause peri-articular enlargement with pain, and if fever be present the case may be regarded as one of acute rheumatism. A girl aged nineteen years was admitted to hospital supposed to have rheumatic fever. The elbows, one wrist, and both knees were involved. There was slight elevation of temperature and a day or two elapsed before the true nature of the case was recognized. The presence of nodes on the clavicles and a more careful examination of the joints led to a correct diagnosis.

Malaria.—It seems scarcely possible that the two diseases should be mistaken, and yet in the case reported by Sydney Philips there were ague-like chills and the temperature curve was most suggestive. In one of our cases, reported by Futcher, a physician, aged fifty-nine, had chills and fever which he himself regarded as malarial, but it had resisted all treatment with quinine. When stripped, the diagnosis was easy, as he had a rupia-like eruption and tender nodes on the shoulders and sternum.

Typhoid Fever.—Cases have been reported in which the syphilitic fever has been mistaken for typhoid. They are rare, however, as J. D. Rolleston

states that out of a total of 3076 cases admitted to the London Fever Hospitals wrongly certified to be typhoid fever, only 10 were subsequently found to have syphilis. For weeks the following case, reported in Futcher's paper, was suspected to be typhoid fever: The patient, aged thirty-nine years, had had irregular fever for three weeks previous to admission. The temperature chart here annexed (Fig. 20) shows an intermittent and remittent fever from August 5th until September 16th. He had a furred tongue. There were no malarial parasites. The spleen was enlarged. A continuous fever of this character in the autumn which resisted quinine was naturally regarded as typhoid. It was not until September 12th that suspicion was aroused and W. S. Thayer noted the presence of thickening of the clavicles from old nodes. There was a definite scar on the glans and the patient acknowledged infection. Potassium iodide was given at once and by September 16th the temperature was normal. It remained so and he was discharged October 3d perfectly well.

Tuberculosis.—Perhaps more important than any of these is the simulation of pulmonary tuberculosis by syphilitic fever. Many writers have called attention to these cases, and E. G. Janeway brought a series before the Association of American Physicians in 1898. The question of the relation of the two diseases has been considered in a monograph by Sergent.[1] It is more particularly in the form in which there are sweats, irregular hectic fever, and loss of weight, associated with a slight cough, that tuberculosis is suspected. The absence of well-marked physical signs and of bacilli in the sputum may suffice to call attention to the anomalous nature of a case. The liver is very often enlarged, irregular, and tender, and it is this feature that may suggest the proper treatment, which is, as a rule, followed by prompt recovery.

It is by no means easy to see why in some cases fever is present and absent in others. In many instances the liver is involved and it has been suggested that the damage to this organ is sufficient to prevent its proper action as a filter, and in consequence fever-producing substances reach the general circulation. As with other microörganisms, the spirochæte produces toxins to which the fever probably represents a natural reaction. In a few cases gummata become secondarily infected by pyogenic organisms, but this is exceedingly rare.

2. *Specific Symptoms of Secondary Syphilis.*—Syphilitic arthritis is very frequently complained of. It usually takes the form of dull pains in the joints of the extremities—much like the "growing pains" of children, or of "rheumatism," and is frequently regarded by the laity as rheumatic in character. The joints are usually not swollen, tender or red, although a small effusion may be present. The pains are as a rule not severe, but are worse at night and may be intense. They persist for a longer or shorter period, then disappear without apparent cause, and often return at irregular intervals. They resist all measures except specific treatment. More characteristic still are the osteocopic pains in the periosteum of the long bones; the clavicle, sternum, tibia, and humerus are most frequently affected. When the bones of the head are involved the dull, remittent headaches occur. These pains are usually worse at night and are out of all proportion to objective signs; the latter are as a rule absent, although there may be swelling of the periosteum

---

[1] *Syphilis et tuberculose*, Paris, 1907.

Fig. 20
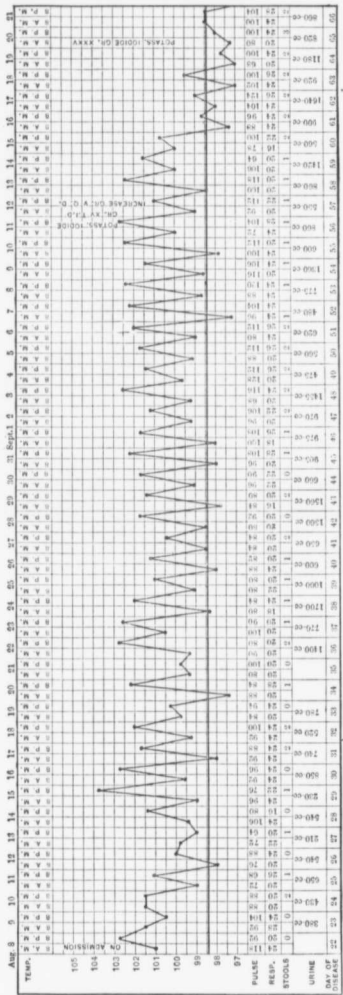
Fever curve suggesting typhoid fever.

and even a definite periostitis. The muscles and joints are often stiff and sore.

Ocular symptoms are often present. The most frequent of these is iritis. At first only one eye but finally both are involved. The iritis may be plastic, serous, or gummatous. The third form alone is peculiar to lues. It is accompanied by all the signs and symptoms of ordinary iritis. In addition one or more yellowish or yellowish-red, nodular elevations are seen, varying in size from a hemp seed to a small pea. They are situated in the pupillary margin, on the ciliary border or between the two, but they tend to coalesce. The prognosis of the condition is doubtful on account of the frequent formation of posterior synechiæ.

Disturbances of the nervous system are frequent and of the gravest import. They are sometimes responsible for death during the secondary stage. Their full treatment belongs to neurology and they will be dealt with subsequently. The most serious involvements are due to the acute arteritis so characteristic of the disease, thrombosis of the cerebral arteries with softening being a not infrequent occurrence. Actual rupture of a syphilitic artery (the frequent cause of apoplexy in the young) is usually a phenomenon of the tertiary stage, and is due to a gummatous change in the vessel wall. Acute meningomyelitis, peripheral neuritides, and compression paralysis due to periosteal lesions, are fairly common.

Functional disturbances are not uncommon. Fenger and others have shown that the skin and tendon reflexes are first increased and then depressed, sometimes finally disappearing.

Visceral lesions are so much more characteristic of tertiary lues than of secondary that they are all described together below. There are, however, sundry symptoms occurring in the secondary stage, which are undoubtedly due to some pathological change in the viscera and which may run imperceptibly into the tertiary symptoms which arise from gummatous inflammations. The bone symptoms are an example. In addition to the "rheumatic" pains already described, a periostitis with the appearance of painful and tender nodules is not uncommon; and an ostitis with the formation of exostoses is occasionally seen, particularly in the tibia. So, too, there may be arthritis with effusion, which may even be polyarticular and resemble acute articular rheumatism. Serous exudation is also seen occasionally in the tendons and bursæ. The involvement of the liver in some pathological change is probably to be inferred from the jaundice which sometimes appears early.

Cutaneous and mucous lesions are the most characteristic and constant manifestations of secondary syphilis. Nowhere is the wanton nature of the disease more obvious than in its skin lesions; for there is hardly a single cutaneous affection which lues may not simulate. The cutaneous syphilides, however, have certain common characteristics which distinguish them in part or in whole from other skin diseases. These are as follows:

(*a*) The syphilitic lesions are usually circular or approximately so.

(*b*) Their evolution is slow and the successive crops of eruption are dissimilar.

(*c*) They are more or less symmetrical in their distribution, showing a tendency to grouping, particularly in circles and semicircles.

(*d*) They have a characteristic reddish-copper color, which resembles raw ham.

(*e*) They are usually indurated and often present at the periphery a raised collarette (the collarette of Biett).

(*f*) They usually cause no itching or other subjective symptoms, although in occasional cases pain is marked.

(*g*) They tend to resolve, although often leaving behind them scars, not infrequently pigmented. (In the precocious malignant syphilide, rapid ulceration with extensive tissue destruction occurs.)

(*h*) They tend to become generalized and to involve large areas of skin. When localized, they have certain seats of predilection—the forehead (corona veneris), the extremities, the anogenital region, etc. The dorsal surfaces of hands, wrists, and feet are exempt, and the sternal and clavicular regions are rarely involved except in the late destructive lesions.

(*i*) The scales are thinner, more superficial and less abundant than those seen in non-luetic lesions; they are dirty gray and do not glisten.

(*j*) The crusts are gray, greenish brown, or black; they are made up of superimposed layers; the surfaces are rough and laminated, and they are more easily detached and thicker than in non-syphilitic lesions.

(*k*) The ulcerations tend to be kidney or horseshoe shaped.

(*l*) The lesions are altered by climate, age, sex, alcoholism, and the presence of so-called "diatheses." This is particularly marked in seborrhœic individuals, in whom the luetic eruptions often take on seborrhœic characteristics (the "interlocking of seborrhœa and lues" of Unna). This characteristic is known as syphilitic imitation.

(*m*) Finally, they are polymorphous, often manifesting themselves simultaneously in various forms.

The cutaneous syphilides may be classified as follows:[1]

1. The erythematous form	{ Macular Maculopapular
2. The papular form . . .	{ Miliary Lenticular Papulosquamous Moist papular
3. The pustular form . . .	{ Varicella or variola variety Acne variety Impetigo variety { Confluent Rodent (with deep ulceration) Ecthyma variety { Superficial Deep Rupial variety
4. The tuberculous form .	{ Tuberculous Gummatous
5. The serpiginous and vegetating forms	
6. Extravasation forms .	{ Extravasation of pigment (pigmented syphilide) Extravasation of blood (purpuric syphilide)

The names of certain of these lesions explain their nature; the other more characteristic cutaneous syphilides will be described.

(1) *Syphilitic Roseola.*—The secondary stage is oftenest inaugurated by the appearance of a measly, roseolous rash, and this event may be said to end

---

[1] Cazenave's modification of Biett's classification is followed, with a few slight changes.

the second incubation period. It takes place about the forty-fifth day after the appearance of the chancre. The rash usually appears first on the flanks and the sides of the thorax; thence it extends to the trunk and the extensor surfaces of the limbs. The face and hands are, as a rule, not involved. The rash consists of small, flat, usually round or oval macular spots. They are all of about the same size and are widely disseminated. At first they are rose-colored, later becoming darker, wine-colored, and finally fading into a pinkish yellow. Pressure makes them disappear only in the early stages. If observed through blue glass, as advised by Broca, the macules always become more apparent, and they may be recognized in this way when not otherwise visible. Occasionally the lesions are somewhat raised, like the wheals of urticaria. The rash, unlike the exanthemata of acute fevers, comes out slowly; it then persists for several weeks and finally gradually disappears. In some cases its whole course is a rapid one. Recurrences are not infrequent, and luetic patients may exhibit repeated macular eruptions at intervals even of years.

The diagnosis of syphilitic roseola from other macular cutaneous affections sometimes presents a good deal of difficulty. Measles and pityriasis rosea are the two diseases most frequently to be differentiated from syphilis. As a rule the history, the nature of the accompanying constitutional and other disturbances, and careful examination of the lesions for the specific luetic characteristics will make the diagnosis. The frequent involvement of the face in the rash of measles and its rare involvement in syphilis is an important point in the differential diagnosis. Other acute exanthemata, medicinal rashes, the eruptions of typhus and typhoid, erythema, and the roseola of gonorrhoea may also be mistaken for the macular syphilide.

(2) *The Papular Eruption.*—This represents the second stage in the evolution of the cutaneous syphilide. It usually follows the roseola by a short interval, but in some instances it comes out before the latter has disappeared; and its appearance may, on the other hand, be much delayed. The eruption consists of round, or nearly round, reddish, raised papules, varying in size from a lentil to a ten-cent piece. The lesions may be quite intact, but are often covered with a slightly squamous epidermis. They are situated most often on the trunk and face. Not infrequently they lie arranged in groups around a central element (syphilide papuleuse en corymbes of the French). The miliary or lichenoid form of papule deserves special description. When appearing early the lesions are very numerous and usually uniformly distributed; the abdomen, back, limbs, and face may be covered.

In its late form, the papular syphilide appears generally three or four months after the onset of the disease and the lesions are much less numerous. It is a polymorphous eruption, but the lesions are in general miliary and of a reddish-brown color. They are not infrequently capped by a small pustule, or covered with a crust or a scale. They are arranged in groups, often like constellations. Another more special form of papular syphilide often seen and of great interest from a diagnostic standpoint is the badly named syphilitic psoriasis. Here the lesion is a large copper- or ham-colored one, occupying a large extent of body surface (face or limbs). The edges are often indistinct, and the lesion consists of numerous concentric circles. On the surface the epidermis is partly detached in the form of dirty, dry scales, which may be easily removed without bleeding. Fissures and rhagades often accompany this syphilide, and its resemblance to ordinary psoriasis

is obvious; but the localization, the rapid evolution, the influence of specific treatment and the appearance of the scales, together with the general clinical features of the case, are usually sufficient to make the diagnosis.

The large papular or lenticular syphilide is quite commonly seen. It shows a predilection for sites about the natural orifices of the body; but is also seen on the neck, trunk, chin, and palms. It may appear at any time in the secondary stage and be the only cutaneous manifestation. Often it occurs simultaneously with the mucous patches. The lenticular papule is the most common and characteristic of the papular eruptions. The lesions are round or oval, with sharp borders and slight elevation. At first they are small and red, but later become copper-colored. The surface becomes shiny, the lesion breaks at its centre and desquamates. The desquamation is repeated until finally the lesions disappear, leaving behind them brownish or bluish-gray spots. The eruption usually starts on the forehead (corona veneris), or the nape of the neck; it then spreads to the abdomen and in two weeks is pretty well generalized. It comes out in crops and may last for ten months.

The papular rash sometimes becomes *nummular*. Here the lesions are large, with marked umbilication and a tendency to desquamation. Later they become annular, with a ring-shaped periphery of induration persisting. Intersection and interfusion of such circular, semicircular, and elliptical patches gives a dreadful and bizarre appearance.

The secondary papular syphiloderm of the palms and soles (psoriasis palmaris et plantaris syphilitica) appears as lentil-sized, non-elevated, brownish spots, which are indurated and evolve slowly. When retrogressive changes begin, a white, glistening scale forms at the centre, surmounting a smooth, reddish depression. A collar of semidetached scales forms around the papule and a brown stain is left after the disappearance of the lesion. Fissures and ulcerations are not uncommon. The syphilide is chronic in its course, obstinate to treatment, and frequently relapses. It is pathognomonic of lues, but must be distinguished from eczema and, rarely, from psoriasis.

The moist papule or broad condyloma occurs where the lesion is exposed to warmth or maceration. Neglect and uncleanliness favor its development. It appears as a flat, button-like excrescence, often much elevated above the surrounding skin; its surface may be papillary, is denuded of epithelium, and covered by a layer of dirty, grayish material, which is usually bathed in a foul, thin secretion. Condylomata are much commoner in women than in men. The lesions are most often bilateral and are extremely infectious. They hypertrophy, particularly when neglected, and may then coalesce, forming extensive, flattened, mushroom excrescences. Condylomata occur most often about the anus; but they are also frequently seen on the vulva, perineum, scrotum, thigh, etc. They are very liable to recur frequently. The diagnosis is, as a rule, easy.

(3) *The Vesicular Syphilide.*—This form is excessively rare and is ephemeral when it occurs at all, being soon replaced by crusts. Small vesicles are sometimes seen in connection with the miliary papule. It is doubtful if true bullæ ever occur.

(4) The *pustular syphilide* is, on the whole, rare in the secondary stage of the disease, and its occurrence then usually indicates a severe type of the disease. It occurs most often in cachectic or debilitated subjects. It is the latest of the secondary eruptions, is obstinate to treatment and prone to

relapse. The pustules vary in size from small, acuminated, acne-like lesions to large, pustulocrustaceous forms. Syphilitic polymorphism is well exhibited by the pustular syphilide, the lesions varying in size, number, distribution, and extent of suppuration. The lesion may resemble any of the pustular skin diseases (acne, ecthyma, varicella, impetigo, etc.); but two clinical forms, the small and the large pustular syphiloderm, should be recognized.

The small pustular syphiloderm resembles acne in many respects. The lesions, which develop from papules, are small, grow slowly, and often remain stationary for weeks, drying up finally into yellow crusts. In the early form the pustules are very numerous and are well scattered over the body. In the later forms they tend to be grouped on the scalp, elbows, knees, etc. Successive crops of small pustules often follow one another for months. In the diagnosis the distinction from acne, variola, and varicella offers the chief difficulty.

The large pustular syphiloderm begins as the large lenticular papule, which rapidly becomes pustular; the pustule soon ruptures or dries up into a crust, removal of which shows an ulceration beneath. When the ulceration heals a brown, pigmented scar is left behind. The lesion, however, usually lasts for a long while, the crusts heaping up to form the rupia syphilitica. This rupial eruption is frequent and striking. It begins as a flat papule, which becomes bullous or purulent, and is surrounded by a livid inflammatory areola. The pustule ruptures and the contents dry into brown or black crusts under which ulceration continues. The crusts, in this way, become stratified and thickened (oyster-shell appearance). The base increases in size and the lesion in height, becoming finally cone-shaped. If the crusts are removed an indolent ulcer is exposed with abrupt, undermined edges, and containing serosanguineous pus. The differential diagnosis between the large pustular syphiloderm and variola is sometimes very difficult. The syphiloderm, however, makes its appearance more slowly, begins upon the trunk and not upon the face, and shows the concomitant signs of lues.

It is not certain whether the pustular syphilide is the result of an actual secondary invasion or not. Unna has shown that such an invasion is very rarely demonstrable.

(5) The *tuberculous* and *ulcerated syphilide* merges into the papular syphiloderm on the one hand and the gumma on the other. It does not usually appear until about two years after the initial sore. When occurring early it signifies a grave form of the disease. The lesions are circumscribed, brownish-red, bean- to walnut-sized infiltrated tumors, usually relatively few in number and tending to be grouped, particularly upon the nose and forehead. The course is chronic, the lesions disappearing either by absorption or ulceration. When the lesions are few and situated on the face the similarity with lupus vulgaris may be very striking.

The ulcerated syphilide is either the subsequent stage of the tuberculous syphilide or appears as a manifestation of the rapid malignant form of syphilis. The lesions appear as red, brownish tubercles, which soon soften and ulcerate. There is an irregular loss of substance, with suppuration. This may be extensive, causing great deformity. If the lesion heals, it persists for a while as a reddish infiltration, with a protruding border and covered by a crust. It may be 3 or 4 cm. in diameter. When it disappears it leaves behind it a marked scar, often with a surrounding area of pigment.

The le
the leg
chancr
(6)
six mo
in its r
is some
in you
by Ger
conflu
among
The n
skin.
symm
the ab
It ofte
patholo
as a p
as the
(7)
known
during
circum
of alop
There
The a
the ne
fall ot
progno
to a fe
deep p
follicle
or hyp
peri-u
(8)
tant a
they a
seen o
charac
in the
raised
in the
subjec
patch
vulva,
It bec
and h
theroi
The
gades
mark

The lesion may be situated anywhere on the body, but is most often seen on the legs. It occurs most frequently in weak subjects and may follow the chancre immediately.

(6) *Pigmented Syphilide.*—This cutaneous lesion appears six to twenty-six months after the chancre; it is unique among the cutaneous syphilides in its resistance to specific treatment; it is accompanied by no symptoms and is sometimes regarded as a parasyphilitic manifestation. It is most frequent in young patients and is oftener seen in women than in men. It is called by German writers syphilitic leucoderma and consists of large, non-elevated, confluent, grayish patches, enclosing circular or oval areas of normal skin among them. The general arrangement suggests lace with large meshes. The non-colored portions of skin appear, by contrast, whiter than normal skin. The rash is almost always situated on the sides of the neck and is symmetrically disposed; it is also seen in front of the axillae, on the sides of the abdomen, and on the flanks. Occasionally it occurs on the entire body. It often occurs without having been preceded by any other eruption. Its pathology is not clear; Unna and the French consider the pigmented syphilide as a primary cutaneous manifestation of the disease; the Germans regard it as the remains of an old eruption.

(7) *Changes in the Hair and Nails.*—Alopecia is a frequent and well-known, although by no means constant, sign of secondary syphilis. It appears during the third or fourth month of the disease, and may be either general or circumscribed (alopecia alveolaris). At first single hairs fall out; later spots of alopecia, varying in size from a lentil to a silver dollar, gradually appear. There are no broken hairs in the spots—an important fact for diagnosis. The alopecia often occurs simultaneously with the pigmented syphilide of the neck. The eyebrows at the same time may be affected and sometimes fall out entirely. The hair is reproduced after syphilitic alopecia and the prognosis is, therefore almost invariably good. The fall of the hair is due to a folliculitis of the hair follicles; it is accompanied by decoloration of the deep portions of the hair and by a dilatation of the small vessels about the follicle. Changes in the nails are not infrequent. The nails may be cracked or hypertrophied; and often there is an accompanying involvement of the peri-ungual tissues (syphilitic onychia and paronychia).

(8) *Lesions of the Mucous Membranes.*—These are among the most important and constant manifestations. On account of their extreme virulence they are a grave feature as regards the spread of the disease. All the lesions seen on the skin may also occur on the mucous membranes; but the most characteristic lesion is the well-known mucous patch. This is seen oftenest in the mouth and consists of a reddish or characteristically opal, slightly raised, papular area, topped by a small erosion. It occurs at various places in the buccal cavity, quite often on the tonsils; and is seen oftenest in mouths subject to some constant irritation like that of tobacco. When the mucous patch occurs on a site subject to mechanical irritation and to neglect (on the vulva, about the anus, etc.) its character changes and it is called a condyloma. It becomes larger, protrudes, is covered by fungous, papillomatous growths, and has an abundant, foul secretion. This may ulcerate and become diphtheroid. Mucous patches often recur many times during the course.

The mucous patches may become confluent and cover large areas. Rhagades and painful fissures are often associated with them. They may cause marked subjective symptoms. Mucous patches are to be diagnosed from

mercurial stomatitis, leukoplakia buccalis, and aphthous erosions. Their frequent occurrence on the tonsils and soft palate is an important point in diagnosis.

The macular, papular, and even pustular syphilides may be situated in the mouth. The angina syphilitica, of greatest interest on account of its clinical importance as one of the early signs of constitutional syphilis, is the most frequent of these buccal syphilides. It consists in a reddening of the tonsils, the pharynx, the uvula, or the soft palate, which is sharply defined anteriorly. It gives the patient little trouble as a rule. Syphilitic laryngitis is also not infrequently seen. In these cases the voice acquires a peculiar roughness which may progress even to complete aphonia.

Fig. 21
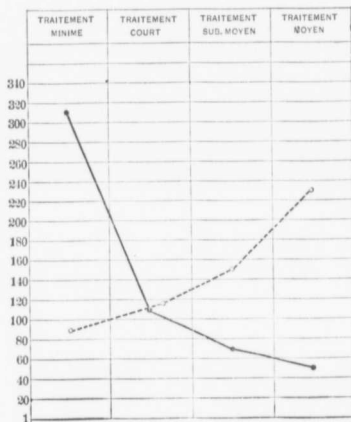
The dotted line represents the frequency curve of late secondary syphilis; the heavy line the frequency curve of tertiarism. (From Fournier.)

Late Secondary Syphilis.—This is a form of the disease to which Fournier has given special attention.[1] It consists of secondary phenomena manifested late in the disease, and of such cases Fournier found nearly 1100 examples in a series of 19,000 syphilitic patients. The symptoms may occur at any period of the disease, even so late as in the thirty-first year. What is most interesting is that the late secondary phenomena apparently occur most often in the cases which have been well treated, in direct contradistinction to the phenomena of tertiarism (Fig. 21). This of course does not contraindicate efficient treatment, for it is the tertiary phenomena which are to be feared. Any of the secondary symptoms may occur in this form of the disease, but the following are most often seen:

[1] *Syphilis secondaire tardive*, A. Fournier, Paris, 1906.

(a) *Cutaneous Syphilides.*—Any one of the secondary eruptions may occur, but when seen in this late stage the peculiar feature of them is their attenuated, abortive character. The recurrent roseola, for example, consists of circumscribed, regional, discrete, large, pale, and tender lesions. Quite frequent, too, is the tertiary erythema, which consists of a single, very superficial reddening of the skin, without infiltration, and free from scales.

(b) *Iritis,* which is essentially a secondary phenomenon, may occur in the tertiary stage and even years after the chancre.

(c) Most important are the *mucous syphilides,* particularly those of the mouth, which, in the secondary form, occur with extraordinary frequency long after the secondary stage. *Glossite dépapillante* and many scrotal and genital syphilides are among the most common secondary mucous lesions seen in the late stage.

These phenomena are not in themselves serious; but they are particularly important from the standpoint of contagion. "Late secondary syphilis has for a corollary late syphilitic contagion." In view of these facts one should watch carefully the cases of benign recurring syphilis (with recrudescences of secondary manifestations), and particularly the cases complicated by nicotine stomatitis, which seems to be a determining factor in the occurrence of the glossitis so characteristic of late secondary syphilis.

The Tertiary Stage.— The secondary stage has no sharply marked terminal limit; but as it progresses the intervals of freedom from symptoms increase in extent and the symptoms themselves diminish in severity until finally an extended period of latency supervenes. This may, indeed, continue throughout the patient's life and mark the end of the disease; on the other hand, it may mean only an abatement of symptoms which, with the advent of the tertiary stage, again appear. On the average the phenomena of tertiarism appear about three or four years after the chancre; but they may, in precocious cases of galloping syphilis, be present at the end of a few months, and in others they succeed the secondary phenomena without any interval of freedom from symptoms. They may again appear as late as fifty-five years after the initial sclerosis, and in a fair proportion of cases they are wanting altogether. They may be preceded by any one of a group of Hutchinson's so-called "intermediate symptoms:" gumma of the testicle, psoriasis palmaris, choroiditis, arterial disease expressed in convulsions, visceral engorgement, nervous symptoms (retinitis, etc.), and rupia.

Just what determines the appearance of tertiary symptoms is not known. Certainly the absence of treatment, as Fournier so strongly insists, is an important factor; out of 2396 cases of tertiarism collected by him, 78 per cent. had not been treated at all, 19 per cent. had received moderate treatment, and only 3 per cent. had been properly treated. On the other hand, the gravity of the early syphilis bears no distinct relation to the probability of the appearance of tertiary symptoms; benign cases, and even cases without secondary symptoms, often pass through a typical and even a severe tertiary stage. Alcoholism and all conditions favoring lowered resistance seem to predispose to tertiary syphilis. In general the lesions of the tertiary stage are distinguished from those of the secondary by their lack of orderly appearance and progression, by their persistence, by their asymmetrical and local arrangement, by their relative non-infectiousness, and by their tendency to ulceration. Syphilis in this stage is also less transmissible to heredity than in the secondary stage.

The Visceral Affections.—These form a most important clinical group. They are not, it is true, absolutely confined to the tertiary stage, but as they are much more frequent then than at earlier stages, it is convenient to consider them together in this place.

1. Syphilis of the Respiratory System.—1. TRACHEA AND BRONCHI.—Tracheal and bronchial catarrh may occur in the secondary stage. Later there are more serious lesions, which while relatively rare have great importance from the fact that in almost every instance life is threatened, and the mortality in the whole group of cases is very high. L. A. Connor has recently studied the subject very thoroughly.[1] In an analysis of 128 recorded cases men and women were about equally affected. In 10 cases the lesions were ascribed to inherited syphilis. The average duration of the infection was about ten years; 97 of the cases came to autopsy. The lesions were: (a) *Gummata*, 20 cases; the lesions were sometimes single, in others the tumor extended over a considerable area of the trachea or involved the whole circumference; (b) *ulcers* were present in 44 per cent. of the cases, and as a rule were large and deep. In many cases the cartilages were eroded and fragments had been coughed up. Perforation of the trachea or of a bronchus occurred in 12 cases, in 5 with fatal hemorrhage. This group is very important with reference to the acute ulcerative perforation of large bloodvessels. In 2 cases an ulcer of the right bronchus perforated a branch of the pulmonary artery. In the case of Bernays, of St. Louis, a small ulcer of the trachea perforated the arch of the aorta. In Turner's case an ulcer just above the orifice of the right bronchus perforated the superior vena cava, and in Watson's case an ulcer of the left bronchus perforated a branch of the bronchial artery. In 2 instances the œsophagus was perforated. In several cases the ulcer perforated into the peritracheal tissues, with the formation of an abscess and once with tracheocele; (c) *endotracheal scarring and contractions;* in 40 per cent. of the cases there were scars, bands, or obliterative endotracheitis, with marked stenosis. In some of these cases ulceration seems not to have been a preceding condition, but a slow, progressive proliferation of the submucous tissues has led to gradual narrowing of the lumen; (d) *fibrous peritracheitis;* of this there were 8 cases in Connor's series. The trachea and the main bronchi are encased in a dense mass of connective tissue which had involved not infrequently the recurring laryngeal nerves. It is probable that these peritracheal lesions in syphilis start as gummata of the lymph glands between the trachea and the œsophagus, and finally lead to a fibrous peritracheitis.

The associated lesions are most important. Syphilis of the lungs was present in 10 cases. Dilatation of the trachea was present 3 times, in each instance above the point of structure. It is remarkable that bronchiectasis was not more frequent, only 20 per cent., considering that in all but about 15 per cent. of the cases obstruction of some sort existed.

Symptoms.—Cough, dyspnœa (often paroxysmal), and stridor are the special features of the condition. The expectoration is often blood-stained, purulent, and fetid, sometimes with fragments of the tracheal cartilages. Profuse hemorrhage, when it occurs, is usually from a large vessel and is promptly fatal. Progressive dyspnœa, one of the most constant symptoms, is usually associated with attacks of orthopnœa and cyanosis, which may

come on with great suddenness and rapidly prove fatal. This peculiar feature of paroxysmal, intermittent dyspnœa has attracted the attention of many writers on the subject. Grossmann and others regard this type of dyspnœa as an effect rather of cardiac insufficiency than of the actual stenosis. No symptom is more striking in the disease than the stridor, which is present in about 50 per cent. of the cases. It may occur with inspiration alone or with both acts. It may be of the loud, roaring character; more commonly it is of higher pitch and sometimes it is quite sibilant. Among other symptoms are pain, which is not very frequent, and tenderness over the trachea. Aphonia was present in some cases even when the larynx was normal. Retraction of tissues at the root of the neck during inspiration is not infrequent. Gerhardt called attention to the limitation of the vertical movement of the larynx in tracheal as an important differential sign from laryngeal stenosis.

The *diagnosis* is not often made in the cases without stenosis, unless ulcers and scars are seen in the trachea by laryngoscopical examination. With tracheal or bronchial narrowing the clinical picture is very definite: "(1) A peculiar type of dyspnœic breathing in which the prolonged, labored, and relatively slight inspiration and the shorter, easy expiration follow each other without the usual pauses; (2) a stridulous sound, chiefly or altogether inspiratory; (3) in most cases an inspiratory sinking in of the tissues of the root of the neck, the epigastrium, and the lower intercostal spaces" (Connor).

The *prognosis* of the disease is grave. The mortality among 128 cases was 76 per cent. In 11 of the cases death occurred in an attack of suffocative dyspnœa, in 4 it was due to hemorrhage. The *treatment* is not very satisfactory. In a few cases antisyphilitic measures have been successful. Schroetter has treated some cases successfully with dilatation, which has been practised even in narrowing of a main bronchus. Tracheotomy was performed in 17 cases of Connor's list, in only 2 with permanent improvement.

2. LUNG.—With the discovery of the specific organism we may expect more light on the difficult problem of pulmonary syphilis. All are agreed that the lungs are rarely attacked, few are agreed as to the distinctive features of the lesions, and fewer still as to the clinical symptoms.

Many of the old writers in the sixteenth and seventeenth centuries spoke of a phthisis originating in lues, but it was not until the latter half of the nineteenth century that the attention of pathologists was particularly directed to the subject. Depaul in France, Virchow and Wagner in Germany, were the first to describe the lesions in the congenital and acquired forms. The literature is very fully given by Flockermann[1] and Herxheimer.[2] Anatomically the disease is rare. Among 2500 autopsies at the Johns Hopkins Hospital there were 12 cases in which lesions believed to be syphilitic were present. J. K. Fowler, who has given us the best study of the disease which has appeared in English,[3] was only able to find 12 specimens in the London museums, and 2 of these were of a doubtful nature.

Clinically the disease is rarely recognized. In not one of the cases seen by the senior author in which the condition was suspected was it certain, and in none of these was the diagnosis confirmed postmortem. On the other hand, there are clinicians who believe that a great many cases which we regard

[1] *Centralblatt f. allg. Path.*, Bd. x.
[2] Lubarsch und Ostertag, *Ergebnisse*, Jahrg. xi, 1907.
[3] *Diseases of the Lungs*, London, 1898.

as tuberculous have in reality a syphilitic origin. The difficulty in reaching the conclusions as to the nature of a case may be gathered from the fact that of Hiller's 84 collected cases with autopsies, Councilman regards only 28 as shown to be definitely syphilitic. It is more convenient to consider the congenital and acquired conditions separately.

Congenital Pulmonary Syphilis.—Gummata are exceedingly rare. The common lesion is the so-called *white pneumonia.* Virchow described in the lungs of stillborn children a diffuse change, sometimes involving all the lobes and causing a marked consolidation with great increase in volume, so that the pleural surface showed the impression of the ribs. The cut surface was dry, grayish or yellowish white in color, and smooth, and it has been called "pancreatization" from the similarity of appearance to a section of the pancreas. While the children, as a rule, are stillborn and premature, yet, sometimes they are born at term and they may live for several hours. In other cases or in other parts of the same lung the surface is less uniform, and presents a more grayish tint, and is firmer, indicating that sclerotic changes have occurred. This so-called interstitial pneumonia is only an advanced stage of the other process and is due to the great increase in the alveolar and interlobular connective tissue. Sections prepared by proper methods show in these lesions an extraordinary number of spirochætæ. While the majority of all cases of congenital pulmonary syphilis have only an anatomical interest, there are a few cases in which the lesions have appeared later in life; but it may be very difficult to determine the exact nature, as the co-existence of tuberculosis with syphilis in young infants is by no means uncommon.

Acquired Syphilis.—The lesions may be described as follows: (1) *Gummata* are rare and involve, as a rule, the neighborhood of the hilus and the lower lobes. They have the usual appearances of these structures and vary in size from a hazelnut to a hen's egg. They may soften and break into bronchi, or they may undergo sclerotic changes leading to extensive shrinkage of the lung tissue and to bronchiectasis. (2) *Bronchopneumonia.* Orth and others regard an exudative syphilitic pneumonia as very doubtful. New investigations should now be able to determine this point. The case recorded by Délèpine and Sisley[1] shows one way in which the lung may be involved. An enormous gumma of the right lobe of the liver, measuring five and one-half by four and one-half inches in extent, pushed up the diaphragm, to which it was firmly adherent, and extended through and involved the lower lobe of the lung. There were patches of caseous pneumonia and others looking like catarrhal pneumonia. With these there was sclerotic induration. The specimen, one of the most remarkable ever described, is well figured in Rolleston's work on the liver. In this case the involvement of the lung was by direct extension and the lesion was in no respect an ordinary bronchopneumonia. It is not yet proven that the diffuse infiltration of a lobar or lobular character recorded by Rollett, Schnitzer and Aufrecht, and others is in reality syphilitic. (3) *Sclerotic patches, chronic interstitial pneumonia.* At the root of a lung, more particularly, but scattered anywhere throughout the tissues, sometimes mapping out a large group of lobules, or radiating from the hilus of the lung, are long strands of fibrous tissue fissuring and dividing the organ, the pulmolobatus of Virchow. In advanced

---

[1] *Pathological Society Transactions*, London, xlii.

cases bronchiectasis occurs, or there may be cavity formation. When these scars occur alone, without gummata in the neighborhood and without signs of syphilis elsewhere, it is impossible to determine their exact nature. On the other hand, when such lesions co-exist with gummata, or when they actually surround or extend from them, the syphilitic character is evident.

Clinical Features of Pulmonary Syphilis.—A few well-marked cases have come under personal observation. In the following the pulmonary features were in the background and the patient died of an interstitial nephritis:[1] M. T., white, married, aged forty-three years, entered the hospital October 6th, complaining of shortness of breath and œdema of the lower extremities. The patient had usually enjoyed good health. She had had acute rheumatism several times, the first attack eight years ago, and since then several other attacks, the knees being principally affected. She has been short of breath for the last two years. Of late this has increased and she had a good deal of cough. Swelling of the legs began in July and increased very much in the two weeks before admission into hospital. On physical examination there was slight dulness in the posterior portion of the lungs and numerous moist rales at both bases posteriorly. On the face and right infraclavicular region were several nodules of ecthyma. On the 13th the patient had a chill. The examination of the urine showed a large amount of albumin and numerous casts. The patient died October 24th. At the autopsy chronic nephritis, heart hypertrophy, and a syphilitic liver were found.

Microscopic examination showed amyloid infiltration of the liver, spleen, and kidneys. This widespread amyloid degeneration, with the characteristic gummata of the liver and bands of fibrous tissue, left no doubt as to the correctness of the diagnosis of syphilis. The condition of the lungs was remarkable, a typical pulmolobatus. The surface of the right lung was very irregular. It was divided into large projecting portions with deep depressions between them. At the bottom of these depressions the pleura was thickened, and there were bands of connective tissue running from the thickened pleura toward the centre of the lung. Some projecting areas of the lung were almost cut off from their connection. The alveoli in these portions were plainly visible to the eye, and the lung substance was very atrophic. All of the projecting portions were emphysematous, some more than others. On section there were dense masses of connective tissue along the bronchi and great vessels. These bands were most dense at the hilus of the lung and radiated from it to the pleura. They were connected with the thickened pleura at the depressions. This tissue was hard and tough, was almost devoid of air, and of a grayish, slaty color. The large bronchi were slightly dilated. In the thickened tissue there were several caseous nodules surrounded by firm capsules of transparent connective tissue.

The left lung showed lesions of the same character. More than one-half of the entire lung was consolidated, both from an interstitial process along the bronchi and a mottled-red infiltration accompanying this. There were several small, hard nodules beneath the pleura. These were surrounded by zones of fibrous tissue from which bands were given off, which penetrated the lung for some distance, but were not connected with the bronchi. Pus could be squeezed from all the bronchi in the consolidated lung. Microscopic examination of the fibrous tissue along the bronchi showed a rather

[1] Reported by Councilman, *Johns Hopkins Hospital Bulletin*, 1891, vol. ii.

loose connective tissue containing few cells. The bronchi showed a growth of fibrous tissue into the lumina. Some were entirely obliterated, their place being marked by the remains of the muscular tissue. The lung adjoining these fibrous portions was in a state of acute inflammation. The alveoli were filled with fibrin and leukocytes. The walls of the alveoli were thickened and infiltrated with cells.

There can be no question, of course, that the condition in this lung was the result of syphilis, and it represents the most common form. In another case the condition was different—not a fibrous phthisis with emphysema, but an extensive gummatous caseation with softening and cavity formation—a true syphilitic phthisis. A colored man,[1] aged twenty-seven, was admitted to the Johns Hopkins Hospital with hæmoptysis. For more than a year he had had cough and shortness of breath and he was regarded at the out-patient department as tuberculous. He had weakness and wasting of the left arm. The physical signs were at the apex of the left lung with impairment of resonance and numerous rales, and there were signs of extensive disease of the right lower lobe. He died suddenly of hemorrhage from the lungs. The case was regarded as one of pulmonary tuberculosis, although no bacilli had been found in the sputum. At the postmortem the apex of the left lung felt firm and there were a few scattered nodules on its surface. On section, just below the apex, there was a caseous mass surrounded by a scar-like tissue. The right lower lobe was almost entirely solid with caseous masses, separated by strands of connective tissue. In the middle there was a cavity (not bronchiectatic) of 3.5 cm. in diameter, filled with blood, which opened directly into a bronchus, and which had eroded into a branch of the pulmonary artery. This case shows the existence of a progressive destructive disease, a true syphilitic phthisis. No tubercles or tubercle bacilli were found. An important point mentioned by Remsen is the fact that there was cavity formation due directly to the disintegration of caseated tissue. Councilman and other writers on the subject have expressed the belief that most of the cavities in syphilitic phthisis are bronchiectatic.

The *symptoms* of pulmonary syphilis are very uncertain. Practically they are those of tuberculosis, but with the physical signs more commonly at the root of the lung and toward the base. The clinical features are often those of chronic bronchiectasis or fibroid phthisis. In the cases with tracheal or bronchial stenosis dyspnœa is a special feature. Hæmoptysis may occur, as in the case here described. There may be no fever, but when softening has occurred or when there are large bronchiectatic cavities the temperature may be of the hectic type. J. K. Fowler lays down the following conditions necessary to determine the syphilitic nature of a case with progressive disease of the lung: "(1) The cases must be complete, that is, the symptoms observed during life must be considered in connection with the lesions described in postmortem examination; (2) the evidence of syphilitic infection must be undoubted; (3) repeated examination of the sputum must have been made and tubercle bacilli have been invariably absent and the absence of tubercle from the lungs (as the cause of the lesions) must be proven by postmortem examination; (4) syphilitic lesions about the nature of which there can be no doubt must be found in other organs."

[1] Reported by Remsen, *Johns Hopkins Hospital Bulletin*, vol. xix.

The relations of syphilis and tuberculosis are thus described by the same writer with admirable clearness. "(1) Tubercle usually affects the apex of the lung and subsequently the apex of the lower lobe and tends to progress in a certain route. The primary lesion of syphilis is often about the root and central part of the lung. The disease follows no definite line of march and gummata may be found in any position. (2) Both tuberculosis and gumma may undergo either necrosis and caseation of fibrous transformation, but with caseous tubercle the tendency toward softening and cavity formation is the rule, whereas a caseous gumma very rarely breaks down. (3) The progressive destruction of the lung by a process of disintegration leading to a gradual increase in size of a cavity, a change so commonly observed in tuberculous disease, is rarely if ever observed in syphilis, except as a secondary result of stenosis of one of the main bronchi. (4) In nearly all cases of advanced destruction of the lung occurring in the subjects of syphilis, stenosis either of the trachea or of one of the main bronchi is present, whereas this lesion is very rare indeed in tuberculosis. (5) The cavities found in cases of pulmonary syphilis are usually bronchiectatic, but not invariably so; whereas in tuberculosis they are commonly due to progressive destruction of the lung, but may be bronchiectatic. (6) The tendency to the formation of pulmonary aneurisms, which is so marked a feature in tuberculosis, is rarely observed in pulmonary syphilis. (7) Pulmonary lesions in tuberculosis are very common, whereas in syphilis they are extremely rare" (Fowler).

II. **Syphilis of the Alimentary Canal and Abdominal Organs.**—1. SALIVARY GLANDS AND PANCREAS.—Swelling of the salivary glands occurs in the secondary stage and it may be well developed before mercurials have been given. In two instances in students, the condition was at first thought to be ordinary mumps. Chronic bilateral parotitis with enlargement, a not very uncommon condition in hospital patients, is probably not connected with syphilis. Gummata of the salivary glands have been described, sometimes with ulceration.

The *pancreas* is rarely attacked and Herxheimer gives only three cases from the literature, all with gummata.

2. ŒSOPHAGUS.—In a few rare instances ulceration of this part has been seen, usually as an extension from the pharynx. Stenosis as a sequel of the ulceration has been described by Virchow and others.

3. STOMACH.—Great difference of opinion exists as to the frequency of syphilitic lesions of this organ. The clinical evidence is by no means trustworthy, as there are men who see a specific gastritis in every disturbance of digestion in a syphilitic patient. The best evidence of its rarity is the fact that in Chiari's 243 postmortems upon syphilitic patients there were only 2 with definite stomach lesions due to the disease.

Flexner, in describing a very characteristic example in 1898, could only find 14 trustworthy cases in the literature. Of these 9 were acquired and 5 were of the inherited form.

There are three types of lesions: (a) *Diffuse syphilitic gastritis*, which was present in a syphilitic negro (examined by Flexner) who had gummata on the frontal bone, in the liver, and in one testis. Hemmeter gives a very good picture of the diffuse gastritis present in the case in the form of a small, round-celled infiltration.

(b) *Syphilitic Ulcer.*—The majority of clinical cases reported have presented the symptoms of ulcer in connection with the history of syphilis. Fenwick

very correctly concludes that in fully one-half of the cases in which the two diseases co-exist in the same patient there is no direct relationship between them. The chief evidence of the specific character of the lesions is the ready response to antisyphilitic treatment, perhaps after prolonged trial of other measures. As there seem to be no distinctive features of the syphilitic ulcer, this point has been especially insisted upon, particularly by Stockton and by Einhorn, who have reported interesting cases. Fenwick concludes that "these cases chiefly differ from the simple variety of the disease in three particulars, the first of which is the extreme severity of the pain and vomiting, the second the infrequency of hemorrhage, and the third their obstinacy to ordinary treatment and their great tendency to relapse." We do not, however, think it possible to draw a clear distinction between simple and syphilitic ulcer, although it is well to bear in mind the undoubted existence and the possible frequency of the latter condition.

Naturally, the experience of anyone with syphilitic ulcer is very limited. Of one or two instances with well-marked symptoms of ulcer of the stomach in connection with other syphilitic lesions, it was impossible to be certain of the specific character of the stomach trouble. Perhaps the most definite case was one which was referred from Montreal and which was subsequently reported by Lafleur.[1] The patient, aged thirty-seven, had had syphilis ten years before. For about six months he had had very severe stomach symptoms, frequent vomiting with very little actual pain. He had lost thirty pounds in weight. There was no hydrochloric acid in the gastric juice. Although his color was good he had become very thin and weak. The stomach was moderately dilated, with visible peristalsis after inflation, and there was a great difference in the consistency of the stomach wall as the waves of peristalsis passed. An exploratory operation by Dr. Armstrong, of Montreal, showed perigastric adhesions and an extensive area of ulceration fully four inches in extent along the anterior wall. The edges were undermined, the surface smooth and almost bloodless. Dr. Lafleur suggested the specific nature of the ulcer and the patient was given antisyphilitic treatment. He gained rapidly in weight, there was no recurrence of the vomiting, and he has remained well ever since. This seems to have been a very characteristic case. While, of course, it is possible that it was only a simple ulcer of unusual dimensions, there were special features about the lesion. The soft, overhanging edges and the dry and bloodless base, and the long, tag-like adhesions on the external surface presented a picture almost identical with that described and figured by Flexner. A point of some moment is the histological character, which was very similar to that found in Flexner's case.

This case, which has been reported fully by Dr. Flexner,[2] was in the Johns Hopkins Hospital on several occasions. He was first admitted February 14, 1893, when he was forty-eight years of age. He had had a primary sore ten years before. In January, 1890, he had irregular fever, with pains in the abdomen. His evening temperature was sometimes as high as 103.5°. He gradually improved. In July, 1902, he had diarrhœa and the legs and abdomen became swollen. The dropsy did not disappear until November. He had lost nearly eighty pounds in the past two years. There was no jaundice. The liver could not be felt. The spleen was enlarged. We

[1] *Transactions of the Association of American Physicians*, vol. xviii.
[2] *Ibid.*, vol. xiii.

regarded the case as one of ordinary cirrhosis of the liver. He returned on March 4, 1894; in the interval the abdomen had been tapped forty times. The spleen was greatly enlarged. On November 30, 1894, he returned again. He had been tapped up to date sixty-five times. He had been using potassium iodide freely and had been gaining in weight. Then one day he had a sudden pain in the abdomen, signs of acute perforation, and he died of peritonitis. The liver was reduced in size, particularly the left lobe, which was represented by a shrunken mass formed by the confluence of several gummata. The mass formed a fibrous tumor 11 by 5 cm. It extended into the right lobe. The spleen was enlarged and hard, measuring 12 by 17 cm. In the greater curvature of the stomach was an open ulcer 5 by 5 cm., with puckered, overhanging margins, and in the centre a perforation.

(c) *Gumma* of the stomach is exceedingly rare. Of the 14 cases collected by Flexner 5 or 6 had positive nodular gummata, the largest formed a flat tumor 8 cm. in extent, with slight ulceration on the surface. In no instance has the diagnosis of a gumma during life been confirmed at autopsy.

In connection with syphilis of the stomach there are two conditions in which tumor may be present. At the pylorus, or in its neighborhood, there may be nodular thickening and it is quite possible that in certain of the cases in which gastric tumors have disappeared entirely, the lesion has been specific. Several of the suggestive cases recorded by Einhorn are of this nature. Following the scar of the syphilitic ulcer near the pylorus, the orifice may be narrowed, with the result of great dilatation of the stomach. In a more important group of cases the tumor believed to be in the stomach, is in reality a gumma of the left lobe of the liver adherent to the anterior wall. We have seen two or three patients with suspected carcinoma of the stomach with epigastric tumor in whom the condition has apparently been caused by a gumma on the left lobe of the liver, simulating very closely carcinoma. Mayo Robson and Moynihan, in Plate XXX of the second edition of *Diseases of the Stomach* show a stomach the cardiac orifice of which was obstructed by a gumma, which also involved the adjoining portion of the liver.

(4) INTESTINE.—In the small bowel, which is less frequently involved, there may be enteritis, gummata, ulceration with consecutive cicatrization and narrowing. The so-called syphilitic *enteritis* offers nothing peculiar. There is swelling of the lymphatic follicles, sometimes with small ulcers. In long-standing cases of tertiary syphilis with chronic diarrhœa, amyloid degeneration of the mucous membrane is not uncommon, sometimes with definite ulceration.

Ulcers.—Apart from the follicular ulcers in the enteritis of syphilis there may be quite extensive loss of substance due to the breaking down of gummata. The ulcers involve the lower part of the jejunum and the ileum. In a few cases perforation has taken place. Healing of the ulcers may lead to cicatricial contraction with stenosis, and there are cases on record in which in several places the calibre of the jejunum and ileum was narrowed. Appendicitis has been attributed to syphilis, but there is no evidence that persons with this disease are more frequently attacked than others.

5. RECTUM.—The special liability of this part to the disease is doubtless the result of a direct infection by the secretion, either from the vulva or from condylomata. In a few instances the ulceration follows the breaking down of gummata. The loss of substance, often very extensive, is usually circular, and in healing leads to marked stenosis. The condition is very much more

frequent in women than in men. The stage of ulceration may be quite latent, and the patient is not infrequently first seen when narrowing has already taken place. The wall of the bowel is greatly thickened, the muscular coat much hypertrophied, the mucosa roughened, or actually ulcerated, and the lumen narrowed so as to admit the little finger with difficulty. Periproctitis is a common sequence, and in women the pelvic peritoneum may be greatly thickened. The ulcers may perforate with the formation of a pelvic abscess or a rectovaginal fistula. The diagnosis rarely offers any difficulty, although the syphilitic rectum has been excised for cancer. The greater frequency in women, the marked thickening of the walls with narrowing of the lumen, and the absence of definite marginal growths about the ulcers are important points. The presence of other lesions, the fact of recurring miscarriages in a woman or the presence of syphilitic lesions in the husband may help in the diagnosis. A remarkable form of syphilitic tumor of the pelvis has been described in which the connective tissue is chiefly involved, forming a dense mass in which the organs are embedded. Herxheimer cites 4 cases from the literature and reports 1 of his own. In one instance the pelvis was occupied by a tumor the size of two fists, situated between the bladder and the rectum, and which very naturally during life was thought to be cancer. The mucosa of the rectum may be intact.

6. SPLEEN.—In the early stages of the disease enlargement of the organ may usually be determined, and Moxon has described an acute syphilitic splenitis.

Gummata are common, particularly in cases where the liver is involved. The substance of the organ may be thickly set with growths varying in size from a walnut to a large orange. Wilks'[1] description and figures are excellent, and he was one of the first to recognize the true nature of these bodies. They are very rare in the congenital form (Still).

Gummous Cicatrices.—More frequently the organ is enlarged, the capsule thickened, the surface indented and scarred and fissured, even divided into four or five sections; the liver and spleen may look very much alike. The greatly enlarged and irregular organ may present a remarkable degree of mobility.

Amyloid Spleen.—In long-standing cases, particularly those with disease of the bone and of the rectum, amyloid change is common either as a diffuse process with enlargement of the organ or limited to the Malpighian bodies, the so-called sago spleen. And, lastly, in certain cases of syphilis with enlargement of the liver and spleen the degree of leukocytosis is such that leukæmia is suspected. In a case of congenital syphilis with an extraordinarily fissured liver, the spleen weighed more than 1500 grams. It was the most prominent feature in the distended abdomen. There was great increase of the leukocytes and the case was regarded as one of leukæmia until the postmortem showed the existence of congenital syphilis.

7. LIVER.—Whether the liver was attacked by syphilis was much disputed by the older writers, some of whom maintained that it was, while others particularly Morgagni, thought that this organ was exempt. Our accurate knowledge dates from the studies of Ricord, Rayer, Dittrich, Wilks, and Virchow. The recent literature is very fully given by Herxheimer in Lubarsch and Ostertag's *Ergebnisse*, Jahrg. xi, and the whole subject is dis-

---

[1] *Transactions of the Pathological Society of London*, 1871.

cussed at great length in a masterly way in Rolleston's work on *Diseases of the Liver.*

Incidence.—It is difficult to determine the frequency with which the liver is involved. Once attention has been called to the subject and the special features have been recognized the cases are found to be not so very uncommon; in the records at the Johns Hopkins Hospital during a period of eighteen years there were 30 cases diagnosed as such, while in the postmortem room among 2500 autopsies there were 40 cases showing gummata or syphilitic cicatrices (20 of each) and 15 additional cases regarded as syphilitic cirrhosis. Among 5088 postmortems analyzed by Flexner, interstitial changes were found in 42, gummata in 22, perihepatitis in 16, amyloid degeneration in 70, and syphilitic scars in 38. In the postmortem records of St. George's Hospital for a period of forty-two years, in 11,629 autopsies, there were only 37 cases of gummata and in 27 other cases cicatrices alone were found (J. L. Allen). These figures give no idea of the actual frequency of the lesions. Statistics of this sort are not of much value unless the postmortems have been made with special attention to their collection. The story of the incidence of tuberculous lesions has impressed this truth upon us. The incidence in congenital syphilis is very much higher and has been given at from 40 to 70 per cent. of cases of infants born prematurely or dying shortly after birth.

Morbid Anatomy.—The lesions may best be described in four groups: (1) *Diffuse interstitial hepatitis.* This is common in the congenital form, in which the liver is usually enlarged, very firm, with a peculiar color, described as grayish-yellow or having more the appearance of flint—the *foie silex* (Gubler). The cut surface may be uniform, and frequently miliary gummata are to be seen. The process may be much more advanced in some parts of the liver than in others, and there may be large areas of fibrosis. Microscopically in the early stages there is diffuse small-celled infiltration and the gradual production of a cirrhosis which may be monolobular or multilobular; and in nearly all instances there is extensive fibrosis within the lobules themselves. (2) *Gummata.* These characteristic structures consist of large, opaque, white tumors, usually firm and solid, the cut surface resembling a section of potato and much denser and harder than the ordinary cheesy matter of tuberculosis. It is not surprising that the older writers thought these tumors to be cancerous. Surrounding the gumma is a definite zone or capsule of connective tissue, and outside that a zone of translucent tissue representing the small-celled infiltration of the advancing syphilitic process. In fresh gummata of all sizes the three zones may be recognized. In old ones the translucent zone is absent. The tumors vary in size from small nodules of from 2 to 4 mm. in diameter to huge tumors the size of two fists. They may be solitary, more frequently there are from 3 to 4, or in some instances 12 or more. Gummata undergo retrogressive changes. Just as the massive subcutaneous, muscular, or periosteal tumors, those of the liver may disappear completely, leaving only a fibrous scar. It would seem scarcely possible that a tumor on the surface of the liver feeling as big as the two fists could disappear, yet we see large gummata of a testis or multiple subcutaneous tumors, even of maximum size, melt away under appropriate treatment. Softening may occur in the centre of a large gumma, either from the breaking down of the necrotic tissue or occasionally from septic infection. No change may occur in the consistency of a large gumma

while it is undergoing even rapid absorbtion. Calcification may occur, and the rare instances of diffuse calcification in wide areas in the liver have probably been of this character. (3) *The scarred and the botryoid liver.* There may be (*a*) small, puckered depressions on the surface, with perihepatitis, but with very little actual deformity of the organ. These small scars may be central as well as peripheral. There may be nothing in the liver itself to show that these are the remains of healed gummata, but in other cases specific lesions may be present elsewhere or in the other parts of the organ itself. (*b*) One or both lobes may be divided by bands of fibrous tissue, radiating irregularly from the hilus or following the portal canals. The bands may be from 5 to 10 mm. or more in diameter and the lobes may be greatly puckered and deformed. Sometimes there are gummata associated with these cicatrices. In extreme cases the whole surface of the organ is lobulated, and to this condition the term "botryoid" has been given. In a still more extreme form large sections of the liver may be completely isolated, or the organ may be made up of three or four sections united by flat bands of connective tissue. The liver substance itself may look natural, or it may show slight cirrhotic changes. Occasionally it is amyloid. (*c*) Amyloid change may co-exist with gummata, or it may occur independently in long-standing tertiary lesions.

Symptoms.—Congenital.—In the majority of cases the infants do not live. In children under two years the luetic appearance, together with an enlarged abdomen due to an increased size of the liver and the spleen, are the most usual manifestations. The enlargement of the liver is uniform and may be very great, reaching below the level of the navel. Tumors are very rarely felt, but the organ is firm; very often the edge may be pressed readily with the finger, or through a thin-walled abdomen the shadow of the edge of the organ may be seen to descend with inspiration. As Gee pointed out years ago, enlargement of the spleen is almost constant in syphilitic children. Jaundice is not very common and when it occurs is early. Ascites is rare.

In general practice a much more important group of cases is the syphilitic hepatitis which occurs as a late manifestation. The attention of the senior author was called to this form by a very remarkable case in the practice of Palmer Howard, of Montreal: A boy aged ten years had for several months obscure abdominal trouble with enlargement of the liver, slight jaundice, ascites, enlargement of the spleen. Finally, definite, irregular nodules were felt on the liver, whether tuberculous or malignant we were in doubt. One day his father was discovered to have a very characteristic palmar psoriasis. He confessed to having had a syphilitic infection as a young man. This gave us the diagnosis, and after months of serious illness the boy recovered promptly and is still alive, now some thirty years after the attack. Since that date a number of very interesting cases have been seen, several of which have been reported.[1]

J. G. Forbes[2] has analyzed 132 cases of late congenital syphilis and in 34 per cent. the liver was involved, coming next to the bones (39 per cent.), as the seat of disease. The age incidence is worth noting—the first decade 26.5 per cent., second decade 57.5 per cent., third decade 12.3 per cent., fourth decade 3.7 per cent. The clinical features are often very characteristic.

[1] *Lectures on Abdominal Tumors,* 1895.
[2] *St. Bartholomew's Hospital Reports,* vol. xxxviii. p. 37.

The facies, the interstitial keratitis, the rhagades, the Hutchinsonian teeth, the dwarfed stature, sometimes infantilism, or the clubbed fingers—one or other of these points may clinch the diagnosis in an obscure abdominal case with symptoms pointing toward the liver. The symptoms do not differ materially from those of adult syphilis of the liver and there may be the three groups of cases: the enlarged, irregular liver, with pain due to the perihepatitis; fever, and an obscure abdominal condition the nature of which is entirely overlooked unless some clue is furnished. A boy at present in attendance at the Radcliffe Infirmary has a small, irregular liver, a big spleen, infantilism, and an increased pigmentation of his skin. Three or four years previously he was in the Westminster Hospital for a very obscure disease characterized by enlargement of the liver, and slight jaundice, with fever. The second group of cases, those with tumor on the surface of the right or left lobe, present no special features, and lastly there may be a final stage of the syphilitic hepatitis in which there is portal constriction, enlarged spleen, and ascites. Under the section on syphilis of the spleen the fact is noted that in certain of those cases there may be marked leukocytosis and a clinical picture resembling leukæmia.

Clinical Features in the Adult.—The manifestations are most protean and the cases may be grouped, as Rolleston suggests, into (1) those with *features of hypertrophic cirrhosis.* A man with a history of a primary sore has pains in the region of the liver, slight jaundice, and on examination the organ is found to be enlarged, reaching to the navel or even a hand breadth below it. It is usually tender and possibly a little irregular, but in some cases it may be quite smooth. One of Stockton's cases, seen with him, was of this character, and it was remarkable how the really enormous liver gradually reduced in size and the patient recovered. (2) The cases resembling ordinary *atrophic cirrhosis with recurring ascites,* enlarged spleen, and all the ordinary features of hepatic dropsy. The portal obstruction may be due to direct pressure of large gummata on the main branches, or the stenosis may follow cicatrization. Such a case as the one the abstract of which is given under syphilitic ulcer of the stomach had a very characteristic picture: there was recurring ascites for two or more years, with great loss in weight, and the postmortem showed a contracted, gummatous tumor which had almost obliterated the left lobe and compressed the portal vein at the hilus. In the *Lectures on Abdominal Tumors* the report of another case of similar character is given; this was a woman who had been very frequently tapped before admission, and in whom the diagnosis of syphilitic hepatitis was made by the accidental examination of her shins. She recovered promptly and some years afterward died suddenly just prior to her confinement. The liver showed the old healed gummata. Undoubtedly many of the cases of cured alcoholic cirrhosis are of this nature. It is sometimes impossible to get positive evidence of syphilis, but in a patient who has been going from bad to worse and has had to be tapped repeatedly, if recovery occurs promptly under syphilitic treatment, it is fairly good evidence as to the nature of the disease. (3) *Hepatic Tumors.* The syphiloma on the surface of the right or left lobe may form a visible or palpable tumor, or there may be multiple nodules on the surface of the organ. Such cases are not very common, and personal experience coincides very closely with that of Einhorn. Several very characteristic cases are reported in the *Lectures on Abdominal Tumors.* There may be a small, solid nodule easily felt attached to the

right or to the left lobe. It is painless, and may remain unchanged for months. The nature of the case may only be determined by the development of a gumma elsewhere, or a tumor may arise in the epigastrium in a patient with slight fever, anæmia, loss in weight, and the diagnosis of gastric carcinoma is made; or there may be a huge tumor the size of the two fists upon the surface of a greatly enlarged liver and the volume of the tumor may throw the practitioner off the scent. In 1896 we had a remarkable illustration in a soldier who had a large, prominent tumor between the ensiform cartilage and the navel. It had grown gradually since September, 1893. Much discussion had taken place as to its nature. He had been in many hospitals and the tumor had been tapped several times. He had a well-defined history of syphilis, and giving him the benefit of the doubt, he was placed upon large doses of iodide. It is scarcely possible to believe the change which occurred. He was shown repeatedly at the out-patient clinic, the pains lessened, the tumor slowly disappeared, and finally on November 11th, which was ten months from the date of his first visit, the tumor had almost entirely disappeared. The liver was reduced in volume. The edge could be felt 4 inches below the ensiform cartilage, irregular and rounded. On February 25th, a little more than a year from his first appearance, he returned, having gained fifty pounds in weight. He was so stout that it was impossible to make an examination of his liver. In several of the cases the diagnosis of malignant disease had been made. An important point in the diagnosis of these cases is the almost invariable association of enlargement of the spleen. Of course, there is nothing in the tumor itself which is of help in the differentiation from malignant disease. The syphilitic liver may be just as large and irregular as the cancerous, but there is rarely the rapidity of growth or the cachexia. (4) *Amyloid Liver*. In long-standing cases with necrosis of bones and in extensive gummatous disease the liver may be greatly enlarged with amyloid degeneration. The organ may be smooth and uniform, or there may be nodular irregularities due to gummata or other cicatrices. The spleen is usually greatly enlarged. Albuminuria is usually present with dropsy, and the general features of the cases are renal. Rolleston gives a case in which the liver weighed eight pounds and ten ounces. (5) *Cases Resembling Abscess.* The enlargement, the tenderness, the fever, and the slight jaundice, not unnaturally lead to the suspicion of suppuration, and if in addition to these there is a prominent tumor the suspicion becomes almost a certainty. The liver has been aspirated. Sometimes a gumma becomes secondarily infected and softens and forms an abscess; (6) and lastly, there are instances in which the great enlargement of the spleen and the diminished area of the liver suggest a primary blood disease, a *splenic anæmia*, or, if the liver is reduced in size, Banti's disease. Coupland has reported a case in which the large spleen was removed, but the woman died from hæmatemesis. The liver was found to be syphilitic.

III. **Renal Syphilis.**—Morgagni was the first to recognize that the kidneys were involved in the disease. Our modern knowledge dates from the studies of Rayer. The literature is very fully given by Herxheimer.

The most important renal complication is acute nephritis, a not at all uncommon event, but one to which comparatively little attention has been paid. The French writers have for long recognized its importance, and Lafleur, of Montreal, brought the subject before the Association of American Physicians in 1896. Early in the nineteenth century the presence of albumin

in the urine of syphilitics was noted by Weils, Blackall, and others, but it was attributed to the use of mercurials. Rayer pointed out that it occurred as a result of the disease itself, and this view has been amply sustained. There may be simply slight and transient albuminuria, just such as occurs in the initial stages of any acute infection. In other instances the symptoms of nephritis become manifest within from two to four months of the initial lesion. In the majority of the cases it occurs with the cutaneous outbreak. The nephritis of the later period of the disease is of a different character, and depends upon amyloid change. The pathological changes described by Cornil resemble very closely those of scarlatinal nephritis.

The symptoms are those of acute or subacute nephritis. There is rarely any fever. The onset is insidious, usually without any pain in the back, and œdema is the first symptom noticed. It may be confined to the face and legs, or it may become general. The urine is diminished in quantity, smoky, contains blood, tube casts, and much albumin. After persisting for five or six weeks the albuminuria lessens, the dropsy disappears, and the patient makes a good recovery. A few cases have been reported in which a fatal event has followed in from fourteen to twenty-one days. Chronic nephritis is an occasional sequence. The nephritis may also occur in hereditary syphilis. Chronic interstitial nephritis is met with in old syphilitics, and is, as a rule, the sequence of arterial changes. It is more commonly a patchy atrophy of areas of the cortex than a uniform general involvement of the organ.

Amyloid disease, which is so common as a late manifestation of syphilis, presents no special features and requires here no detailed description.

Gummata.—The kidney is not often affected; when present the tumors are small, multiple, and rarely cause symptoms; even when a dozen or more pea-sized tumors are present there may be nothing to indicate their existence. In a few cases the kidney is the seat of enormous gummous tumors. Boldby[1] has reported the case of a woman, aged forty, with swelling in the right renal region. The kidney was enlarged, hard, and easily movable, and evidently the seat of a tumor of considerable size. A new-growth was diagnosed and the organ was excised. It weighed seventeen ounces and the surface was nodular on section. It cut like fibrous tissue and the surface presented an appearance exactly like that of a gummatous testis. All trace of renal tissue had disappeared. The microscopic examination showed typical, small-celled infiltration and caseous degeneration. The patient recovered rapidly, but, as Boldby remarked, for the future it must be borne in mind that a renal tumor of considerable size may be caused by syphilis, and it is probable that antisyphilitic treatment would have obviated the necessity for operation. Here may be mentioned the remarkable association of diabetes insipidus and cerebral syphilis which is present in a considerable proportion of all cases. Of the 9 cases reported by Futcher, 5 had this association.

IV. **Syphilis of the Circulatory System.**—BLOODVESSELS.—Upon no system does the virus of the disease fall with greater intensity in all stages than upon the bloodvessels. It is safe to say that through the arteries syphilis kills more than through any other channel. Cerebrospinal lues is largely a matter of arterial disease. The gummata often originate in or about the bloodvessels. The late arteriosclerotic changes leading to fibrosis are very

[1] *Pathological Society Transactions,* vol. xlviii, p. 128.

often due to the toxins of the disease; but, above all, the association of aneurism with syphilis gives a place of first importance to its vascular aspects. Those acute old writers, Ambrose Paré and Morgagni, appreciated very clearly the frequency of arterial disease in syphilitic patients. In his classical chapter on aneurism there is scarcely a case in which Morgagni does not refer to the presence of syphilis. The recent very extensive literature is given in the papers of Benda and Chiari.[1]

Gummata of Arteries.—The larger vessels are rarely the seat of distinct gummous tumors. Three changes are met with in the smaller bloodvessels:

1. *The Nodular Periarteritis.*—In this form many of the branches of the circle of Willis present nodular tumors, which may be from 3 to 5 mm. in diameter, oval in shape, firm and hard, often associated with gummous meningitis, or with numerous large gummata. The tumors are larger and firmer than in the nodular arteritis of tuberculosis. On section the nodular process seems to be almost entirely in the adventitia, sometimes with subintimal proliferation and with great narrowing of the lumen.

2. *Acute Gummatous Endarteritis.*—This, too, is most frequently seen in the cerebral arteries, but it has been described in the larger branches, and it is quite possible that the acute perforating ulcer of the aorta is of this nature. The lesion consists of a localized gummatous infiltration of the subintimal tissue, with softening and erosion leading to the production of aneurism or to perforation. This may occur quite early in the disease.

3. *Obliterative Endarteritis.*—This is seen most commonly in arteries of medium or small caliber. It may be limited to one or two vessels, as to one of the coronaries in which it is not at all infrequent, or to a posterior tibial. The endarteritis leads to a gradual narrowing and a final obliteration of the lumen. There is nothing specific in the process itself. So far as known, the spirochæte have not been found, but it is a lesion met with in comparatively young persons with syphilis, which may be associated with gummatous lesions. An identical endarteritis may occur as a senile change or as a result of toxic agents. For the histological changes the reader is referred to text-books on pathology.

Syphilitic Arteritis.—This is seen chiefly in the large branches, particularly the aorta, and is one of the most important of all the lesions of syphilis. It has nothing to do with the ordinary atheroma. While it may occur in persons above the middle period of life, it is most commonly seen in those under forty who have been the subjects of syphilis. It presents several special features: (a) The process may be limited to a small section of the aorta, an inch or so, for example, at the root, or a patch extending for a couple of inches in extent anywhere in its course. The intima in the rest of the extent may be quite smooth. The parts of the aorta most frequently involved are the root, and the lower part of the thoracic and lower part of the abdominal aorta. The appearance differs very markedly from that seen in ordinary atheroma, particularly in the absence of calcification and of fatty degeneration and of areas of atheromatous softening. While in the early stage the intima may be smooth and the mesarteritis entirely microscopic, in the later stages the intima presents the appearance of what Marchand has called the scarring sclerosis. The intima looks wrinkled with linear depressions or little

---

[1] *Verhandlung, der Deutsch. Path. Gesellschaft,* 1903, and Lubarsch und Ostertag, *Ergebnisse,* 1904 and 1906.

pockets, or there may be puckerings or scar-like fissures, sometimes arranged in a radial manner. The bottom of some of these depressions has a bluish tint, and held up to the light the vessel here looks translucent. (*b*) Microscopically the changes are very remarkable and consist in (1) extensive degeneration of the elastic fibers of the media, which is shown very well with the Weigert stain; (2) areas of small-celled infiltration, sometimes focal, sometimes linear. These two features of destruction of the elastic and of the muscular elements, with the widespread, small-celled infiltration often localized sharply in a media otherwise healthy, is the most characteristic microscopic change. (3) The changes in the adventitia are often even more marked than in the media and consist of areas of round-celled infiltration which may be quite extensive and look like microscopic gummata. They frequently surround the arteries and they extend in linear form between the boundaries of the media and adventitia, or they may be traced in direct continuity with similar linear collections in the media. With this there is a marked obliterative endarteritis and endophlebitis of the vasa vasorum: (4) In the larger areas of small-celled infiltration giant cells are found and even patches of necrosis; and lastly, and this is an all-important point, Schmoll, Reuter, and others have found the spirochæte in these lesions.

It is quite possible, of course, that other acute infections may lead to similar changes in the bloodvessels, and much discussion has taken place as to the specificity of those here described, but the evidence points strongly to the fact that syphilis is, at any rate, one of the most potent factors in the production of this form of arteritis, and the discovery of the spirochæte seems to clinch the view which has been so well maintained by Chiari and others.

The Relation of Syphilis and Aneurism.—Morgagni seemed to be fully aware of an important relation between these two diseases. Welch, in 1876, called attention to the frequency of aneurism in soldiers and thought that at least 50 per cent. of the cases were associated with syphilis. Since then in the collections of statistics the percentage has ranged from 20 to 80. The same difficulty has occurred here as with locomotor ataxia. The more carefully the cases are looked into, the more accurately they are studied, the larger will be found to be the percentage of cases with the history of lues. One feature which has impressed the writers on the subject is that the age incidence of aneurism and of ordinary atheroma is different. In a large proportion the patients are in the third and fourth decade. The studies of Chiari, Benda, and others show that the type of mesaortitis here described is almost constantly present in cases of aortic aneurism. The recent experimental production of aneurism by the administration of adrenalin lends support to the view. The necrosis and degeneration is produced in the media, over which there may be a perfectly smooth intima; in places this may crack, and through the narrow fissure the blood passes and gradually a small aneurismal sac is produced. This is probably the sequence of events in the majority of cases of aneurism in man. The aortic wall is weakened in its most important coat by the destruction of elastic and muscular fibers, and during a sudden exertion, or spontaneously, the intima is split, with the formation of, first, a small aneurism which gradually increases in size. Of course, this does not exclude the origin of aneurism in a small proportion of cases from ordinary atheroma.

SYPHILIS OF THE HEART.—The cardiac lesions of syphilis may be considered under the headings of endocarditis, fibrous myocarditis, and gummata.

Endocarditis.—Whether there is an acute endocarditis caused directly by the spirochæte is not yet settled. Taneff recognized a verrucose syphilitic endocarditis as a very rare form. Much more commonly it is a sclerotic form which may be either mural or valvular. The former is met with as thickened patches of the endocardium, chiefly of the ventricles, sometimes in direct connection with gummata in the myocardium. It is impossible to determine the specific character of an ordinary sclerotic valvulitis in a syphilitic subject. The cases most likely to be of this nature are those in which the valves are implicated directly in scarring of the mural endocarditis or in a patch of fibrous myocarditis. There is a very important group of cases in young syphilitic subjects who come under observation with angina pectoris, and who present signs of aortic insufficiency. The semilunar valves are involved with the root of the aorta in a specific mesarteritis and peri-arteritis. A strong evidence in favor of the luetic nature is the complete relief afforded by antisyphilitic treatment, the aortic insufficiency, of course, remaining.

Fibrous Myocarditis.—This is seen most frequently in the left ventricle and near the apex. In many cases it follows directly upon endarteritis of the descending branch of the anterior coronary artery. Unless gummata are present, or there have been well-marked signs of syphilis, it may not be possible to determine the specific character of the lesion. When extensive, it may lead to aneurism of the heart. In other instances the scarring in the myocardium is due to healing of small gummata. Widespread areas of fibrous myocarditis in syphilitic patients are most frequently the result of arterial disease.

Gumma of the Heart.—Stockmann, who has written a monograph on the subject (Bergmann, 1904), was able to collect 76 cases from the literature. The gummata may be small and multiple, or there may be a tumor as large as a walnut. The appearances are those of gummata in other parts.

The *symptoms* of syphilis of the heart are indefinite. Sudden death is not uncommon. Of the 6 cases reported by Herringham all but 1 were brought into the hospital either dead or dying. Symptoms of dilatation are perhaps the most common. Attention has been directed particularly to two forms—the syphilitic variety of Stokes-Adams disease, in which there is either a gumma at the top of the septum, as reported in one of Keith's cases, or it may follow a syphilitic endo-arteritis. Two of our patients were syphilitic. One of the cases reported by Erlanger had bradycardia and epileptiform seizure for a year or more and recovered completely under specific treatment. The other group is the aortic insufficiency in young subjects, which may come on with attacks of angina pectoris. They also may be greatly relieved by appropriate treatment.

Syphilis of the central nervous system, one of the most interesting and important forms of the disease both on the clinical and pathological sides, will be discussed under Diseases of the Nervous System.

The Tertiary Cutaneous Syphilides.—The tertiary syphilodermata are rarer than those of the secondary stage and vary less in type. They tend to become grouped or localized.

(a) The *tuberculous syphiloderm* is one of the earliest of the tertiary manifestations. The lesions appear first as small, brownish-red nodules, which gradually reach a considerable size and then undergo central disintegration. At the same time the lesion advances at the periphery by infiltration, and since this takes place more or less irregularly the ordinary picture is that of disintegrated tubercles with advancing crescentic walls of infiltration inter-

spersed with superficial scars. The coalescence of adjacent nodules gives rise to the serpiginous and circinate syphiloderm. The eruption is usually confined to one part of the body, the forehead, the nape of the neck, the upper part of the back, and the scrotum being the favorite sites. The differentiation from lupus vulgaris and lupus erythematosus may be difficult. On the palms and soles the tuberculous syphilide is a common manifestation of the disease. The lesions are often circinate and are accompanied by great thickening of the horny layer of the skin.

(b) The *gummatous syphiloderm* is the most characteristic tertiary cutaneous manifestation. It appears either in the skin or subcutaneous tissue, as a pea- to walnut-sized, rounded, painless nodule—fixed to the skin when cutaneous, movable under it when subcutaneous. The gummata occur most frequently in the lower limbs and at the points where bone is directly covered by skin. The nodules increase in size; and, after a while, softening begins at the centre. The skin becomes reddened and finally may break, a sticky, tenacious, glairy fluid being discharged and a gummatous ulceration being formed. Gummata may, however, disappear without rupture, leaving slight traces behind them. They are usually few in number, although Lisfranc reported a patient having 150 at the same time upon the hands and legs. They occur late in the disease, but have been seen contemporaneous with the initial sore (Mauriac). Rhinoscleroma, carcinoma, and sarcoma have to be considered in the diagnosis of cutaneous gumma.

(c) The *ulcerative syphiloderm* is a later development either of the tuberculous or the gummatous eruption. The shape of the ulceration is at first that of the preceding lesion; but the marginal extension is usually irregular, and ulcerations of the most varied sizes and shapes are thus produced. The base of the ulcer is irregular and covered by secretion which dries into crusts, forming the pustulo-crustaceous, the ulcero-crustaceous, or the rupial eruption. The ulcerations always result in scarring. They vary greatly in extent and number.

In the mucous membranes either the tuberculous syphiloderm or gummata may be seen. Softening and ulceration occur early, the lesion being most often seen in this stage. Its commonest site is the hard and soft palate; but it may also affect the tongue, pharynx, nose, vagina, etc. Tubercles and gummata also occur in the submucous tissue, where they form irregular, ragged ulcerations. The glossitis gummosa is a typical example.

The Quarternary Stage.[1]—Certain pathological changes, neither exclusively nor necessarily caused by syphilis, bear to the disease a relation long unrecognized, but now undeniable. They are not, as Fournier (who was one of the first to call attention to their relation to syphilis) puts it, strictly speaking of syphilitic nature, but they are none the less of syphilitic origin; and to them he has given the name metasyphilis or parasyphilis. Many, although not all, of them occur long after the initial lesion; and the syphilis in its early stages may have been quite benign and have run its course without incident. The two most striking characteristics of parasyphilis as distinct from syphilis itself are its total failure to respond to specific treatment and the fact that the clinical phenomena of affections parasyphilitic in nature differ in no way from these same affections when they are the result of

---

[1] The two following are the most useful works on this subject: (a) *Les affections parasyphilitiques*, by A. Fournier, Paris, 1894. (b) *Les affections parasyphilitiques*, by S. R. Hermanides, Haarlem, 1903.

some other cause. Tabes, for example, may be either syphilitic or non-syphilitic; but it is the same clinical entity in either case. Notable also are the proneness of parasyphilis to affect the central nervous system and the gravity of its prognosis. The pathology of the condition is not, strictly speaking, a part of the pathology of syphilis as such; nor is the syphilitic origin of all of the "parasyphilitic phenomena" beyond dispute. The more syphilis is studied, however, the more convinced one becomes that it is not the self-limited disease it was once thought to be; and the more prone one is to consider as an etiological factor the remote luetic infection of which there is a history in so many cases of the affections which have come to be known as parasyphilitic.

(*a*) **Tabes.**—Tabes is the type, par excellence, of parasyphilitic affection. It was in 1875 that Fournier first taught that tabes originated in the majority of cases from syphilis. He was vigorously opposed by Charcot and the Salpêtrière school, as well as by Leyden and Westphal; and the question as to the etiological relation of the two diseases has been discussed ever since, the opponents of the Fournier doctrine holding the occurrence of syphilis and tabes in the same patient to be a pure coincidence. There is no doubt about the fact that in the large majority of tabetic patients there is a history of syphilis, and that the percentage of tabetics who have had syphilis is much greater than the percentage of the healthy population who have had it. Erb found 89 per cent. of a series of 600 cases of tabes to be syphilitic; Fournier about 90 per cent. of 750 personal cases; and Marie says, "For all practical purposes tabes is always syphilitic in origin." At the same time Erb has found that tabes develops much more often in syphilitics in whom some of the other predisposing causes have been at work (exposure to cold, sexual excess, overwork, neuropathic tendency, etc.); and he regards syphilis not only as the most important, but as the necessary, etiological factor without which the "predisposing causes" cannot produce the disease.

Neither the clinical phenomena nor the anatomical findings throw any light on the question; for there is nothing about either that makes either for or against the luetic nature of the disease. The argument of Charcot and Leyden that tabes could not be luetic since it did not yield to specific treatment is not pertinent, and *absolute* proof of one or the other claim is still wanting; meanwhile, conclusions must be drawn from clinical data; and these, if not absolutely decisive, point so strongly to the etiological relation of the two diseases that the question may be regarded as settled. Certain of the cases of juvenile tabes have been shown by Strümpell and others to be the manifestation of hereditary syphilis.

(*b*) **General Paralysis.**—What has just been said in regard to tabes applies also to dementia paralytica. The etiological relation between syphilis and general paralysis of the insane was first suggested by Esmarch and Jessen in 1857; but the idea has since been staunchly supported by others. The line of argument is much the same as that used in the case of tabes and it is almost equally convincing; so that dementia paralytica must be considered among the parasyphilitic affections. Here again clinical facts seem to point also to a causal connection between juvenile general paralysis and hereditary syphilis. The very striking recent observations on the deviation of the complement in the study of the cerebrospinal fluid of patients with general paralysis (referred to below) apparently confirm completely the views of the Fournier school.

(c) **Nervous Affections.**—There is a whole host of other nervous affections which have been described as parasyphilitic, but their discussion belongs rather to neurology and they can only be mentioned here. Quite important is the syphilitic neurasthenia, more particularly the syphilophobia, which inspires the afflicted patients with a colossal dread of the disease, interprets every trivial subjective sensation as a luetic manifestation, and assures its victims that all the most horrid events of syphilis are to be their portion and their offspring's. Parasyphilitic epilepsy is also a fairly well-established clinical entity; and besides these are to be mentioned hysteria, Little's disease, and hydrocephalus among others.

(d) **Tongue.**—Parasyphilis frequently affects the tongue. It may take the form of fissures in persistent mucous patches or of recurrent herpes on the borders or dorsum of the tongue. But the common and serious lesion is buccal leukoplasia, which often degenerates into carcinoma, and is supposed to be most frequent in patients whose mouths have been subjected to the irritation of tobacco. In this condition the epithelial layers are thickened and hornified, the intercellular spaces roomy and filled with round cells. Keratohyaline drops (stained an intense red with picrocarmine and the sure sign of hornification) are present. The onion bodies, seen in epitheliomata, are often found in buccal leukoplasia. The adventitia of the vessels is thickened, there is proliferation of the connective tissue of the corium, and round-celled infiltration. The lymph and mucous follicles are also the seat of cell proliferation.

(e) **The Pigmented Syphilide** (syphilitic vitiligo or leucoderma), already described, may be regarded as parasyphilitic because it is not peculiar to syphilis (homologous eruptions being the chloasma of pregnancy, cachectic melanoderma, etc.) and because it resists specific treatment.

(f) The list of parasyphilitic affections may be almost indefinitely extended if one includes all the diseases in which syphilis is often an etiological factor, but against which antiluetic treatment is useless. The importance of syphilis in the production of amyloid degeneration, of arteriosclerosis, and of aneurism has already been referred to; diabetes insipidus is often associated with cerebral lues, and there are many more instances of suspicious association of this sort which might be mentioned.

Congenital Lues.—**Effect of Syphilis on Pregnancy.**—The first and most marked effect of syphilis on the fœtus is the interruption of pregnancy. In 330 syphilitic gravidities studied by Kassowitz, abortion or premature delivery occurred in 40 per cent. and only 60 per cent. reached term. The nearer conception is to infection, the greater the danger of interruption of pregnancy. Where many conceptions occur, however, in a syphilitic woman, the specific influence apparently "wears off;" the earliest pregnancies end in abortion, then dead children are born, then living children are prematurely delivered, then full-term syphilitic children, and finally full-term healthy children.

In pregnant women who are syphilitic, hydramnios is also frequent. The fœtus of a syphilitic woman either has macerated skin or, if born at term, presents the cutaneous lesions seen in adults. There are marked visceral lesions, particularly in the liver and spleen, which are much enlarged. The bones show the osteochondritis of Wegner, and the child has the pathognomonic "little old-man" facies and the other characteristics of hereditary lues to be described below. Placental changes are most marked when the

disease is contracted by the mother early in her conception. The placenta is large, weighing sometimes one-quarter as much as the fœtus. It is pale, œdematous, and either friable or firm. Microscopic examination shows placental cirrhosis with endo- and peri-arteritis and phlebitis of the chorionic villi. The umbilical cord also shows infiltration and vascular lesions.

The ill effects of syphilis on the children born of syphilitic parents may manifest themselves in three ways: (1) By faulty nutrition and various dystrophies; (2) by the actual signs of syphilis in the child at birth; (3) by the signs of the disease appearing some time after birth in a child born healthy.

1. **Dystrophies Syphilitic in Origin.**—The inaptitude for life transmitted by luetic parents to offspring, even when no actual syphilitic lesion is demonstrable in the child, may show itself in the intra-uterine death of the fœtus. When, however, the child reaches term, even in absence of definite signs of syphilis, the luetic dystrophies are often seen. Some of the children are born small, have no resistance to gastro-intestinal and other infections, and die early. Others survive; but they remain small, atrophic, and infantile, both in physique and intellect, have very slight resistance to tuberculosis and other infections, and are particularly subject to rickets. Faulty development and diminished resistance are the prominent characteristics of such children. Numerous malformations may, however, be added; but, although these are often seen in the children of luetic parents and seem to be syphilitic in origin, if not syphilitic in nature, it must be remembered that most of them may be and frequently are due entirely to other causes. These malformations usually affect the cranium. Asymmetry of the skull is often seen; large frontal bosses are not uncommon; and microcephaly and other variations of the head, both in size and shape, are observed.

Other characteristic deformities are seen in the face and mouth; for example, the flattened nose and the vaulted palate. Scoliosis and spina bifida are not infrequent. Polydactylism, syndactylism, congenital luxation of the hip, and flat-foot are some of the deformities of the limbs seen in the children of luetic parents. The heart valves are often faulty; congenital hernia is not rare; malposition of the viscera is occasionally observed, and incomplete development of testicles, breasts, and ovaries is sometimes seen. Retardation of intellectual development may be very slight, but quite often the children are slow in their mental grasp and lack attentiveness and memory; in some cases the children are congenital idiots. Deaf-mutism, deafness, strabismus, keratitis, malformation of the iris and other ocular structures are some of the deformities affecting the organs of special sense. One of the most characteristic malformations is seen in the teeth; this deformity was studied chiefly by Jonathan Hutchinson, and the "Hutchinsonian teeth" are still regarded as one of the very important stigmata. The change affects the median upper incisors of the permanent set of teeth. The teeth themselves are stunted and peg-shaped, their lateral borders being curved, and their axes usually converging from base to edge. At the free cutting border there is a single, broad, shallow, crescentic notch, or semilunar excavation. It persists for some years; but is finally obliterated by wearing down of the teeth. These changes described by Hutchinson are quite definite, and it is improper to call any malformed syphilitic teeth "Hutchinsonian teeth." The typical changes may, however, be absent and other malformations (not themselves peculiar, as the Hutchinsonian teeth are, to syphilis) may be seen. Transverse grooves and depressions are among the commoner changes,

the latter sometimes taking the form of the cupuliform atrophy of Parrot. Simple microdontism is sometimes seen.

With the exception of the Hutchinsonian teeth none of the dystrophies above described can be considered peculiar to syphilis.

2. **Early Congenital Syphilis** (*Syphilis héréditaire précoce*).—This is the most frequent form. The signs and symptoms are characteristic and the diagnosis is usually easy. Sometimes the disease is manifest at birth, but usually the child is born healthy and thrives until about the sixth week; occasionally the symptoms appear first about the sixth month. The typical facies described by Trousseau presents the following features: The skin is yellowish, the expression wretched, the eyelashes are wanting, the hair of the head scanty, and patches of alopecia are present; later, the appearance becomes the well-known one of a "little old man." The facies of Trousseau may be absent. The appearance of actual symptoms may be preceded by a period of restlessness and wakefulness. One of the first symptoms observed is the characteristic rhinitis known as "the snuffles;" this is a coryza with serous discharge, the formation of crusts, and resulting respiratory obstruction. The child usually at this time begins to nurse badly and nutritional disturbance supervenes. Ulceration and necrosis of the nose, with the formation of the saddle-shaped deformity, may occur. Fissures or rhagades appear at the corners or the free borders of the lips, increasing the wretched appearance of the child and greatly adding to the danger of contagion on the part of the nurse. Anæmia is present. The child goes from bad to worse; it suffers from malnutrition and often succumbs to cachexia. Many of the children are carried off by intervening acute infections, particularly bronchopneumonia and enteritis. Among good hygienic surroundings the prognosis is fair; otherwise it is grave, and in foundling hospitals the children practically all die. The glands are usually not enlarged; but a whole host of cutaneous lesions, including most of those seen in syphilis of adults and certain others peculiar to the congenital form, appear. Their severity is a clinical characteristic.

The roseola is usually wanting; but a yellowish-red, maculopapular erythema, beginning on the buttocks and thighs and extending to trunk and face, is sometimes seen.

The psoriaform syphilide is very characteristic. It consists of bright-red or copper-colored, infiltrated areas on the palms of the hand and soles of the feet, covered by white, dry scales, which are easily detached, leaving a collarette at the periphery. It corresponds to the psoriasis palmaris and plantaris syphilitica of adults.

The erythema, when situated about the body orifices is usually accompanied by *rhagades*. These are true ulcerations which may leave indelible scars, particularly characteristic being the ray arrangement about the lips and chin.

Mucous patches occur in the mouth and about the lips; but they show a predilection for the intergluteal groove, the perineal, genital, and genito-crural regions. This may be due in part to the constant irritation by urine and fæces in these sites. There is, however, very little tendency to condylomatous overgrowth, as in adults. Patches are also seen back of the ears and near the nose, where they are often covered by crusts.

Pemphigus neonatorum is the most characteristic of the cutaneous lesions. This syphilide is most often situated on the palms of the hands and soles of the feet. It may be present at birth, or, if appearing later, it begins as a

bluish-red infiltration; the epidermis is soon raised and vesicles and bullæ are formed. Sometimes, however, there is no liquid present. The lesions are 2 mm. to 1 cm. in diameter. The epidermis is white, as if macerated, and lies in folds; below, the skin is reddish, wine-colored. The serous exudate soon becomes purulent, by the invasion of fusiform and round cells and leukocytes; the vesicles become tense and are either absorbed or burst, leading to purulent ulcers, which are often serious. In malignant cases there is extensive destruction of the skin, with gangrene, necrosis, and, not infrequently, death.

Hemorrhagic Exanthemata.—Syphilis is a well-recognized cause of hemorrhage in the newborn and not infrequently this occurs subcutaneously (syphilis hæmorrhagica neonatorum). The hemorrhages may be subcutaneous or submucosal; sometimes they occur about the umbilicus. Of 3364 children studied by Wilson[1] at the Philadelphia Lying-in Charity, 10 died of hemorrhage attributable to syphilis. Reduced coagulability of the blood and increased arterial tension in the newborn are the causes assigned by him. Jaundice was practically always present in some degree.

Acne syphilitica, impetigo syphilitica, and *ecthyma syphilitica* are three self-descriptive exanthemata more or less characteristic of the congenital form of lues. The *poorly nourished skin* of children afflicted with hereditary lues is also subject to many skin affections not themselves specific. Eczema intertrigo is, for example, quite common; and suppuration and destruction of the nails is not infrequent.

Bony changes are frequent and characteristic. The dystrophies of the cranium, particularly the frontal protuberances, have already been mentioned. In the limbs they often manifest themselves in the syndrome of Parrot (syphilitic pseudoparalysis of the newborn). This is characterized by immobility, pain, bony swelling, and sometimes crepitation at the epiphyseal line. There is no true paralysis, the muscles reacting to faradism and galvanism. It usually affects only one limb, but sometimes two. It may be the first sign of congenital lues; but more often appears in the third or fourth month.

Osteochondritis syphilitica, first described by Wegner, is highly characteristic of congenital lues. Its site is the boundary between diaphysis and epiphysis of the long bones (upper end of the tibia and both ends of the femur particularly) and between bone and cartilage in the ribs. Three stages are recognized. In the first there is marked proliferation of cartilage cells at the boundary of the diaphysis, forming a zone recognizable macroscopically between diaphysis and epiphysis. Within this zone ossification is irregular and retarded. In the second stage proliferation of cartilage cells advances and there is further irregular ossification at the epiphysis. In the third stage one finds bulgings of the cartilage, with thickening of perichondrium and periosteum. The cartilage forms a broad, irregularly limited zone; the portions next the spongiosa consist of a pus-like, semifluid mass. Epiphyseal separation may occur.

Rickets was regarded by Parrot as merely an expression of hereditary lues. This view cannot be maintained; each is an independent disease; yet there is little doubt that congenital syphilis predisposes to rickets and that the two conditions are frequently combined.

[1] *Archives of Pediatrics,* vol. xxii, p. 43.

Visceral lesions are observed in practically all the organs of congenitally syphilitic children. Many of them are without characteristic symptoms; diarrhœa and vomiting occur, but they are not pathognomonic. Involvement of the testicle is, however, particularly characteristic; and orchitis with exudative vaginitis in an infant is always suggestive of lues. It usually ends in sclerotic atrophy. The enlargement of liver and spleen are also of clinical importance from the aid they give to diagnosis. The former is regular, smooth, and very large, reaching sometimes to the iliac fossa. It is cirrhotic, but the cirrhosis is usually unaccompanied by circulatory changes or icterus. The large, palpable spleen is also of diagnostic import. Affections of the eye are seen in the early form of hereditary syphilis, but interstitial keratitis is much less frequent than in the late form.

3. **Late Congenital Syphilis** (*Syphilis héréditaire tardive*).—This form, especially studied by Hutchinson and others, has been clinically well recognized only in comparatively recent years. Its manifestations were formerly either regarded as those of acquired syphilis or dismissed as "scrofulous." It appears usually about the time of the second dentition or at puberty, and is most frequent in those who have shown signs of the early form in infancy. It occurs also, however, in patients whose childhood has been free from disease. Its manifestations are not often seen after the twenty-eighth year; but a terminal time limit is, of course, difficult to set. Any organ in the body may show syphilitic manifestations of a gummatous, sclerous, or sclerogummatous type; but the following are those most often affected: the eyes, the bones, the skin, the throat, the pharynx, the brain, and the ear. One of the most important changes is the almost pathognomonic interstitial keratitis. This usually occurs between the eighth and fifteenth year, and begins as a diffuse haziness near the centre of the cornea of one eye. It is accompanied by some irritability of the eye and by dimness of vision. When looked at more closely the corneal haziness is seen to consist of discrete, punctate deposits within the cornea itself and not on its surfaces. In a few weeks the whole cornea becomes involved, takes on the appearance of ground-glass, and is surrounded by a zone of ciliary injection. Photophobia becomes a symptom and involvement of the opposite cornea takes place. The vision is quite dimmed; but soon the condition begins to improve and the cornea clears slowly. If the case is treated early, the prognosis is fair and is inversely proportional to the degree of photophobia. Recovery is, however, always slow and, at best, imperfect.

The cutaneous and mucous lesions of late congenital syphilis in general resemble those of acquired lues. Fissures and rhagades occur about the mouth. Changes in the bones are a marked feature of the disease. Bosses are seen on the skull, and hyperostoses on the long bones. The sabre-shaped tibia is particularly characteristic; here the bone is much bowed and is increased in volume by a chronic osteoperiostitis accompanied by gummata. The latter often break down and ulcerate. Arthropathies are occasionally seen, particularly a form of synovitis which resembles white swelling; and a special form of symmetrical synovitis of the knee has been described by Clutton.

In typical cases the whole clinical picture is characteristic. The patients are small and poorly developed; the skin is of an earthy paleness; the forehead is prominent, the frontal eminences marked, and the skull asymmetrical; the bridge of the nose is depressed and its tip *retroussé;* there are cicatricial

stigmata of the skin and mucosæ, and striæ about the mouth; there is the presence of the Hutchinsonian triad (pathognomonic alterations of the teeth, interstitial keratitis, and disturbances of hearing); there are signs of infantilism (slender physique, undeveloped testicles, rudimentary beard, and pubic hair); there is glandular enlargement, often mistaken for tuberculosis; and finally there is arrested intellectual development. Further confirmation of the diagnosis may be obtained by inquiry into the family history, which will often show a high mortality or a high percentage of abortions; and, by confrontation, revealing the source of the disease in one parent or both. The general clinical picture has been well drawn by Augagneur: "Had I in a few words to present the ideal, clinical type of late hereditary syphilis, I should select a young girl, eighteen or twenty years old, whose eyes should present traces of parenchymatous keratitis; the teeth should be eroded and crescentically notched; at the same time they should be small and irregular; the hearing should be partially or totally lost in consequence of frequent attacks of otorrhœa; the genitals, possessing all the attributes of virginity, should be small, the mons veneris and the axillæ should be smooth; the mammæ without prominence, and menstruation should scarcely be established. Add to these all the tertiary lesions you please and you will have before you a complete picture of late hereditary syphilis. . . . To the triad of Hutchinson—interstitial keratitis, defective incisors, and deafness—I propose to add two other signs: general congenital atrophy and general arrest of development."

Prognosis.—Syphilis is a curable disease. It is not, however, *always* cured even by the most efficient treatment; and there is unfortunately no way of determining with exactness whether treatment in a given case has been sufficient to warrant us in a dogmatically favorable prognosis. We have only empirical results to go upon; but the clinical records of large series of cases carefully studied over long periods of years justify the following conclusions as to the outlook for a luetic patient:

1. In general, the prognosis for the average case is good with prolonged treatment and bad without it. This holds for the secondary phenomena, for tertiarism, and for the transmission to progeny.

2. No deduction as to the virulence of the disease is to be drawn from the character of the chancre; phagedenic sores may introduce a mild syphilis and herpetic chancres a malignant one. Nor do the secondary symptoms *per se* give us any indication of the future.

3. The prognosis improves with the promptness of the institution of treatment and seems to depend pretty directly on the vigor and intensity of the early mercurialization. The secondary period, if the sore has been positively diagnosed and treatment promptly begun, is as a rule only manifested by a few benign symptoms; on the other hand, cases first treated in the tertiary stage are difficult and often impossible to cure.

4. The frequency of tertiary symptoms, other things being equal, is inversely proportional to the adequacy of treatment received.

5. A patient who has received the thorough treatment outlined below is entitled to consider his disease cured and himself a safe husband and father. We cannot, however, *guarantee* that no syphilitic or parasyphilitic phenomenon will manifest itself. We can only say that such an occurrence is extremely improbable. "Neither the dose," said Ricord, "nor the pharmaceutical preparation, nor the duration of treatment, confer immunity

with certainty or guarantee the complete and radical extinction of syphilis." For this reason a patient who has had syphilis should never be dismissed from observation; and he should be advised of the importance, in case of future disturbance of health, of informing his physician of his syphilitic antecedents.

6. Three types of syphilis may be recognized, according to course and prognosis. *Benign syphilis*, which is even occasionally seen in untreated cases, occurs most commonly in women. Here the initial lesion, a mild sore throat, a moderate roseola, and an adenopathy, perhaps with headache, make up the entire symptom-complex. *Normal syphilis* shows well-marked but not severe symptoms throughout, and the manifestations are quite amenable to treatment. After a certain time, during which a number of relapses and exacerbations occur, the disease ends, although parasyphilitic phenomena may later appear. *Malignant* or *galloping syphilis*, less frequent now than formerly, presents either the normal manifestations in severe, frequently recurring, and obstinate form, or else violent, often rapidly fatal tertiary manifestations early in the disease. The skin eruptions are ulcerative and pustular; cachexia is marked; gummatous lesions are extensive and occur early, and the internal organs are rapidly involved.

7. Hereditary syphilis offers in general a very bad prognosis. The average mortality is probably about 75 per cent. Kassowitz states that one-third of all syphilitic infants die *in utero*, and of the remainder 34 per cent. succumb during the first six months of life. Here, again, treatment affects the prognosis wonderfully; according to Etienne 95.5 per cent. of living syphilitic children die if untreated and only 10 per cent. if properly cared for.

Syphilis and Marriage.—Syphilitics may marry with safety after they have undergone three years of thorough treatment and have been without symptoms at least one year after treatment has ceased. Hutchinson thinks that in women who have suffered from acquired syphilis the liability to transmit to offspring lasts much longer than it does in men.

Syphilis and Insurance.—The relation of syphilis to the problems of longevity gives this disease great importance from the standpoint of life insurance. It is very difficult to estimate the percentage of deaths actually due to syphilis; but the vital statistics published by the *United States Census Bureau* make it seem probable that the fatality is about 2 per cent. (Hyde). Runeberg, of Helsingfors, on the other hand, found that 11 per cent. of 734 deaths of insured persons were due to diseases resulting from syphilis; and that if certain apoplexies, probably syphilitic, were included the syphilitic mortality was 15 per cent. of the total, being second only to tuberculosis which caused 21 per cent. of the deaths. These figures assume added importance when it is remembered that they represent the facts existing among the insured—that is to say, the most vigorous portion of the population. Chronic alcoholism, long-continued tobacco narcosis, extreme fatigue, severe affliction, poverty, and the stress of anxiety are well-known contributing factors to the serious effects of syphilis. The diseases most commonly causing death after syphilis are affections of the heart, general paralysis, diseases of the central nervous system, chronic nephritis, and aneurism.

The damage wrought by syphilis consists, however, chiefly in its lowering the standard of average health, paving the way for other diseases and possibly laying the foundation for mental degeneration and alienation. The expectation of life after acquired syphilis is in large measure affected by the inherited

tendencies, the habits of life, and the environment of the individual. The longevity prospects are undoubtedly better for women than for men. The ideal applicant for life insurance who has suffered from syphilis should have had active and unmistakable symptoms early in life; he should have had, after efficient treatment, several years' exemption from all evidences of infection; he should have an excellent family history, particularly as regards nervous diseases; and he should lead a life relatively free from strain, excess, indulgence in alcohol and tobacco. Most insurance companies require that four or five years shall have elapsed since the disappearance of the last symptoms of the disease; and no applicant who has had syphilis is given a policy which will keep him on the company's books after his fifty-fifth year. The frequent occurrence of arteriosclerosis in middle life among those who have had syphilis suggests the possible practical value of studying the blood pressure of these applicants for insurance with regard to increased arterial tension at the time of application (Hyde).

Prophylaxis.—There are many striking things about syphilis, but none is more striking than its persistence in spite of knowledge complete enough to stamp it out. It is a disease almost unparalleled in the extent and intensity of its ravages; it is the subject of popular dread; yet it is both preventable and, within limits, curable. Metchnikoff has called attention to the strange fact that medicine has been able to restrain, in some cases almost completely, infectious diseases transmitted by flies and mosquitoes, but that in tuberculosis, lues, and other diseases carried about by man and transmitted without intermediary, prophylactic measures have been attended with great, almost insuperable difficulties. In these instances both receiver and transmitter of the disease are reasonable beings; and if, as is the case in syphilis, an absolutely sure prophylaxis were known (congenital and innocent syphilis are for the moment left out of consideration) one might expect that the disease would be as easily and completely eliminated as typhus, for example, has been. It is true that syphilis, where it exists at all, is less prevalent among civilized than among uncivilized peoples; in Siam, for instance, uninfected individuals are said to be considered rarities. Yet even civilization has not done for syphilis what it did for smallpox. In Paris, out of every 100 men at least 13 to 16 infected individuals may be counted; and Paris is only mentioned as an example. The number of days on which soldiers of the English army were incapacitated from duty on account of syphilis has become nearly trebled during the years from 1880 to 1897, while the number of men has only been doubled in that period. The reason for this persistence of misery in the face of information complete enough to prevent it is of course not far to seek; it lies in the Social Problem, with which the problem of syphilis is so intimately allied. And it is therefore essential to an understanding of the hygiene of syphilis that practising physicians, since it is they who must face the problem which belongs equally to the State, become familiar with the facts of the case and with the various solutions suggested.

The problem of syphilis is essentially the problem of prostitution. More exactly, it is the problem of clandestine prostitution. This is the source of the disease; and inasmuch as elimination of this source is beyond the dream of all, the question which the physician has to answer is a double one. First, How can clandestine prostitution be best kept within limits and made least harmful to the common weal? Second, How can the public best be kept advised of the danger to itself of prostitution and be made to escape

that danger? The prophylaxis of syphilis includes, therefore, public and private hygiene. Public hygiene has concerned itself with efforts aimed directly at prostitution, with efforts aimed at syphilis itself, and with efforts aimed at society itself, by way of education, institutional reforms, etc.

1. **Public Prophylaxis Dealing Directly with Prostitution.**—One hesitates to approach this subject because of the very varied opinions which have existed and still exist about it. Relentless abolitionism on the one hand and equally relentless State control on the other have been enthusiastically supported. The whole question, indeed, of the relation of the State to the industry of prostitution is beset with difficult problems at every step; yet men impressed with the injury to the commonwealth which prostitution involves have always been tempted to turn, as they are tempted to turn in other similar dilemmas, to a State fiat for the panacea sought. State interference with prostitution is no new procedure. In Athens prostitutes were denied the right of citizens, the Areopagus oversaw and punished them; they were given a certain part of the city for their dwelling and made to wear a particular costume. Similar laws prevailed in Rome, where the "licentia stupri" was a State permission of the industry. This seemed to these enlightened governments the best solution of the problem, and since those ancient days many students of the question have thought similarly; others, however, have maintained that recognition of an institution well known to be detrimental to public health was no business of the State; and between these two sides a lively battle still rages. Statistics unfortunately have given little assistance in deciding the dispute. The presence of venereal diseases may be exceedingly difficult to demonstrate in women, so that the exact extent of syphilis is impossible to know at any given time. The extent of prostitution, a large part of which is always clandestine, is equally impossible to determine, and its prevalence is so influenced by other factors (state of public opinion, character of population, etc.) as to make it difficult to reason from its diminution or increase to State interference as the cause.

There have been three parties as to the attitude the State should assume toward prostitution. The first has maintained that prostitution should be under State control; the second, that prostitution should be prohibited by the State; and the third that no State regulation should exist. Each one of these views has been put in practice. State control was given an early trial in Belgium; prohibition was attempted in Bavaria in 1861; and in various European countries all theories of the State's attitude toward prostitution have been tested.

(a) *State Control of Prostitution.*—Where this obtains, the industry is recognized by the government as a necessary one; it is, however, also recognized as a dangerous one, and its practice is permitted only under governmental supervision. Essentially, it consists of (1) inscription of prostitution, either voluntary or forced; (2) permission to ply the trade under certain regulations; and (3) governmental medical inspection, with obligatory treatment. Control of this sort, on the part of the State, has been attempted in many forms. Simple State regulation (*Kasernirung*) and the establishment of brothel streets (as in Bremen) are the three forms at present in vogue, and each has its staunch adherents and equally staunch opponents. Fournier in his latest book argued strongly for State control. He recognizes its limitations and states that "it is definitely proven, from long experience, that the administrative and police measures which constitute the present

system are insufficient to defend us against syphilis." Nevertheless, he concludes, from a thorough-going analysis of the question, that regulation is necessary in the public interest. It should include medical examination of all women convicted of professional prostitution and internment of these women in case of contagious disease. The supervision should, however, be carried out in a legal way; it should aim also to be humanitarian and charitable.

(b) *Abolition of State Regulation.*—Von Düring, on the other hand, an exceptionally well-informed, enthusiastic, and logical writer on the subject, relentlessly opposes State regulation of prostitution for the following reasons: (1) The medical supervision is necessarily incomplete and therefore gives a false sense of security. (2) The industry is one which leads to much misery and the State should have no hand in it. (3) The number of prostitutes in a given community cannot possibly be even estimated approximately; the greater part of prostitution is clandestine; and for these reasons it is absurd to talk of regulating it. (4) State regulation is contrary to the Constitutions of the Governments which forbid pandering. (5) There is no need for brothels; this is proven by the fact that they are actually diminishing in number in most of the Continental cities; and that at best the inmates of them represent a very small fraction of the total prostitution of a community. (6) Brothels are a danger to the State. They are morally unsound, as enticing to youth and teaching them that illegitimate intercourse is safe. They offer allurements particularly to unripe youths and to the intoxicated. They mean slavery and a most dreadful existence for the inmates; and they are the breeding places of sexual perversions. They do not clear the streets, as is proven by the small percentage of the total prostitution of a community living in them. (7) Examination of prostitutes for venereal diseases is no function of the police; and it is unjust, because it includes only women. (8) Almost everyone who is well informed on the subject is against regulation. (9) State regulation, after a fair trial, has done nothing in diminishing the occurrence of venereal disease; it has been a practical failure. (10) To these arguments may be added that of Josephine Butler, the famous English abolitionist: morality comes before every other consideration; hygiene only comes in the second place; "if the safeguard were as real as it is fallacious it would in no way render regulation legitimate" (P. W. Bunting).

It is obviously difficult to come to a conclusion in a question where experts are at such disagreement. Certain facts are, however, to be taken as settled. State regulation has been a very small factor in the fight against venereal disease, even granting its exponents' claim that it has been a factor at all. And it is supported by very few of those venereologists whose opinion is entitled to consideration; in France, the home of regulation, a recent Commission by a majority of 60 to 5 adopted, among others, the following motion: "The regulation of prostitutes is to be condemned."

The question of State regulation of prostitution, it must, however, be insisted, is really one of the minor problems connected with the problem of the prophylaxis of syphilis. Governmental supervision deals, as has already been said, even under the most ideal conditions, with an almost negligible fraction of the total prostitution, and from the very nature of the case leaves untouched the clandestine prostitution which is spreading disease. It is, furthermore, absurd to ask much of it, when it is remembered that law is only effectual as an expression of the predominating opinion of the common-

wealth; and to expect, as has been expected, that State regulation subdue prostitution in countries where the mistress is not simply a tolerated but a well-recognized and accepted personage, where promiscuous intercourse not only thrives, but has actually created for itself a literature, where the marital tie is regarded in the loosest way, is like sowing weeds and then asking for a law that no weeds shall grow.

We have then to consider those aspects of the public hygiene of syphilis not directly concerned with the attitude of the State toward prostitution.

2. **Public Prophylaxis Concerned with Syphilis Itself.**—(*a*) It has been suggested, first of all, that the disease be made a reportable one and that treatment be obligatory. Aside from the very large problems which this procedure would create as to a physician's right to reveal a professional secret of this nature, it seems quite certain that a regulation of this kind would rather hinder than promote proper treatment of the disease. Enforced publicity would certainly lead to the concealment of syphilis, and many cases now well treated would go untreated.

(*b*) The establishment and maintenance of proper institutions for the study and treatment of venereal diseases is a crying need everywhere; and the commonwealth can do nothing better for the common weal in the matter of syphilis than by making this necessary hygienic provision. This is a part of the fight against the disease which has been wofully neglected; it is a part which should receive the support of every well-informed physician, as offering a well-grounded hope of accomplishing much in the attempt to eliminate the sources of infection and to diminish the miseries of the already contracted disease. The cure for syphilis is known; if it is not applied, the fault lies with the community which chooses to make no use of its knowledge; and of this blame the medical profession must accept a large share. "Before having recourse," wrote Mireur in 1874, "to extreme procedures, before extolling Utopian projects, it would be rational to demand that those most elementary measures be carried out without which every effort is vain." The "elementary measure" of hospitalization and efficient treatment was then in a sorry enough plight. In England and on the Continent the provision made for the treatment of venereal disease was ridiculously inadequate and patients were actually "abandoned to be devoured by the disease like fodder."

The progress of the last thirty years has not made anything like adequate provision for syphilis. "The number of beds," said a Commission of the French Academy of Medicine, "provided for cases of venereal disease is notoriously insufficient;" and this puts the case only mildly for other countries than France. Yet the prophylactic value of adequate therapeutic provision in the case of syphilis can hardly be exaggerated. "Let us suppose," wrote Acton, "that a syphilitic woman has no money for treatment and cannot be admitted to a hospital; does anyone believe that she will die of hunger in order to avoid the risk of infecting the drunken laborer with money in his pocket? What happens? Her disease grows worse. . . . The drunkard, whom she has infected, is a husband, who gives the disease to his wife and by her the suckling is infected. The father does not dare to confide to his wife the nature of the disease; and the wife, ignorant of its consequences, leaves it to work out its ravages. Soon the whole family, unable to supply its needs by work, becomes a parasite, for months at a time, on public charity. Every year death harvests a large number of children infected in this way;

and he who has closed the hospital doors to the disease has done nothing else than send away the pestilence which hastens, with rapid steps, into the shadows."

It is not, however, by real hospitalization that the disease is best treated and cured. Hospital wards, where selected cases can be sent, are badly needed, and the present deplorable inadequacy of hospital provision for syphilis cannot be too heartily condemned. But the crying need is for efficient venereological dispensaries. These should be numerous; they should be systematically distributed, so as to save patients loss of time; the consultations should be at convenient times and every effort should be made to render the dispensaries easy of access; they should furnish instructions as to prophylaxis against the disease and the necessary measures to prevent its spread; they should be conducted humanely and with due regard to the feelings of patients in this matter; and they should, of course, be manned by well-trained venereologists. This is a part of the public prophylaxis against syphilis which physicians should insist on; it is a rational, promising, and feasible procedure.

(*c*) *Antisyphilitic Vaccination.*—Experiments with this method of prophylaxis have not been very satisfactory and the procedure must develop greatly before any State interference of this sort promises to accomplish what compulsory vaccination against smallpox has brought about. Various sera have been used: blood serum from syphilitic subjects in the secondary or tertiary stage, serum from heredosyphilitic subjects, serum from the secretions or pathological liquids of syphilitic subjects, serum of animals inoculated with various syphilitic products. The discovery of the spirochæte of Schaudinn may throw some light on the subject; but unfortunately this protozoan belongs to a group difficult or impossible to cultivate on media hitherto employed, and much progress must be made before a practicable method of cultivating the syphilis spirochæte on a scale large enough for these purposes is obtained. Levaditi has, however, succeeded in cultivating two analogous spirilla, those of fowl septicæmia and of relapsing fever; so that the cultivation of the spirochæte of Schaudinn does not seem entirely out of the question.

The outlook as to the prophylaxis of syphilis by the serotherapeutic method is not, for several reasons, very good. The early endeavors of Richet and Héricourt with defibrinated blood were failures; nor were the experiments of Roux and Metchnikoff with subcutaneous and intravenous injections of serum from syphilitic patients encouraging. A mode of prevention by means of true vaccines might have a better chance of success; but here again one meets the same practical difficulty, inability to obtain the pure virus in sufficiently large quantities. Certain experiments of Metchnikoff and Roux made in 1903 seemed to show that the syphilitic virus, if passed through macaci, became much attenuated both for the macacus and for man; and it is not at all out of the question that inoculation with an attenuated virus may in the future be an important feature of the prophylaxis of syphilis. Even at best, however, the prophylactic use of antisyphilitic vaccine seems destined to be limited. The use of a living syphilitic virus on a large scale might bring about awkward complications, tabes and general paralysis, for instance, being frequently seen after very mild syphilitic lesions; and the great frequency of exposure to infection would offer a practical difficulty in the use of virus not experienced, for example, in the case of

diphtheria. Vaccination might be applicable to the uninfected children of luetic parents, and this mode of transmission might be thus prevented. On the whole the method of prophylactic vaccination, although it is no Utopian scheme, offers at present little beyond the hope that the discovery of the causative organism of syphilis and the increasing knowledge of experimental syphilis in animals may lead to useful development in serotherapeutics.

Already the study of experimental syphilis along the lines of immunization has led to what is apparently an important discovery from the standpoint of diagnosis, and on it the following diagnostic test for syphilis is based:[1] Syphilitic material from monkeys which have received treatment is mixed with the material to be tested and complement (fresh guinea-pig serum) added. To this mixture one adds specific hemolytic serum and red blood corpuscles. If the material to be tested is luetic, hemolysis ceases or, at least, is diminished; if it is not luetic, hemolysis proceeds. In the former case the amboceptor in the luetic material to be tested unites with the receptor in the known immune syphilitic material; the two together cause diversion (Ablenkung) of the guinea-pig complement, and the reaction results. If, however, the material is *not* luetic, no combination of amboceptor and receptor occurs, there is no diversion of the complement, and the reaction is absent. The cerebrospinal fluid of 8 cases of general paralysis has been recently examined in this way, and the luetic antibodies were always found. Other non-luetic cases similarly examined were negative.[2]

The vaccination of persons suffering from hard chancre against the occurrence of secondary symptoms has been experimentally studied by Kraus and Spitzer. Their first results were encouraging, but Brandwenier and others finally proved that secondary symptoms could not be prevented in this way.

3. **Public Prophylactic Efforts Concerned with Society and its Institutions.**— Procedures of every sort have been suggested according to which the prophylaxis of syphilis was to be strengthened by some change in the legal attitude of the State toward the disease or by an alteration in the institutions of Society.

(a) Penalty for the transmission of syphilis has been proposed by some as a necessary and important step in the attempt to destroy it. The infection with the disease, it has been urged, is a distinct bodily injury knowingly inflicted, and it should be subject to legal punishment just as assault and battery is. Quite aside from the constitutional question involved as to what constitutes a bodily injury, the practical difficulties in the way of ascertaining with certainty the source of infection, and proving that the disease was maliciously transmitted, render this suggestion wholly futile except in rare instances.

(b) Should the transmission of syphilis from husband to wife or from wife to husband constitute grounds for divorce? And should its existence in either party be prima facie evidence of adultery. These are difficult questions which belong rather to law than to medicine; yet they are questions which cannot be disregarded in considering the prophylaxis of syphilis. The hideous injustice to which a husband or a wife submits when he or she

---

[1] Wassermann, Neisser, Brucke: *Deutsche med. Wochenschr.*, 1906, Nr. 19, 10.
[2] Morgenroth u. Stertz: Nachweis der syphilitisch. Antikörper u. s. w. *Virchow's Archiv*, Band clxxxviii, Nr. 1.

is knowingly and voluntarily infected, by the other party, with the disease tempts one to provide legal redress for the predicament. Yet the procedure is a dangerous one; its application would present great practical difficulties, and it is doubtful if it would often be taken advantage of by the injured party.

(c) It has also been urged that a certificate of health as regards venereal disease be required before marriage permits are issued. Once more, practical difficulties loom large. The right of the State to invade this domain is not generally conceded, and the right of the physician to reveal professional secrets of this sort is pretty generally questioned. Furthermore, this sort of an alliance between medicine and the police, aside from its being an infringement on the dignity of the medical profession, would offer opportunity for all sorts of abuse. Upon one point, however, there can be no doubt. It is the bounden duty of every physician to use every means in his power to prevent marriage between people with venereal infections. He should absolutely forbid his syphilitic patients to think of this step until they have undergone proper treatment, and he should enforce this command with complete information as to the dire misery sure to result from such a marriage.

(d) Sanitary examination of men. (1) Such an examination, together with obligatory treatment, already obtains among certain government employees, as, for instance, in some armies and navies. Diday maintained that it should apply to all government servants, and the method of attacking syphilis by requiring all civil service employees to undergo examination has been strongly urged. It has also been suggested that all public wards (tramps, beggars, and prisoners) should be submitted to examination for syphilis. Over the army and navy the government can, of course, exercise a legitimate control; and strict hygienic provision should be made for restricting the occurrence of the disease and limiting its bad effects in every way. This is all the more necessary when one remembers how important a factor soldiers and sailors are in the transmission of syphilis; and hygienic regulation of this sort would accomplish much more if strengthened by international agreements as to the hygienic care of sailors and soldiers in foreign parts. The extension, however, of such a governmental oversight to the civil service and even, as has been urged, to private assemblies of workmen in factories and elsewhere, besides presenting great practical difficulties, represents a paternalistic attitude that would receive scant support from the community. (2) The examination of customers on their entrance to brothels has been seriously urged by certain writers as a promising procedure in preventing syphilis. The idea is no new one. As early as 1430 there was a regulation requiring such an examination in London, and Diday was a strong supporter of the idea. It was tried for a while in Hamburg. The scheme is, of course, quite out of the question; for it would be perfectly impossible to find reputable physicians who would give their time to such business; and in the hands of any but such physicians it would lead to all sorts of graft and abuse. Furthermore, as Ricord showed, it would simply result in an increase of free prostitution: "Aside from the difficulties of such an arrangement, the dangers which one wished to prevent by it would be increased; for instead of falling into a sewer which the police could cleanse, the filth would go elsewhere."

(e) It is notorious that venereal diseases furnish a large percentage of the material of charlatanism. In the case of syphilis the insufficient and unintelligent, if not actually dangerous, treatment which results is a definite menace to public health, and war on charlatanism is therefore a distinct

part of the prophylaxis of syphilis. Nowhere can neglect or ignorance bring greater misery, and most often to the innocent, than in the case of this disease; that its care should be in competent medical hands is therefore essential to the public health. Provision for its treatment in adequate venereological dispensaries is one phase of this prophylactic measure; but legal provision against the industry of quacks, a provision to which the public, with strange neglect of its welfare, is indifferent or even hostile, is an equally important feature in guarding against it.

(*f*) There are certain industries (glass blowing is one of them) notoriously dangerous in the transmission of syphilis; and it seems to be well within the power and duty of the State to see to it that proper hygienic supervision is exercised. That vaccination should be under rigid oversight in this respect goes without saying; and the possibility of infection by surgical or dental instruments is one that has but to be mentioned in these days of careful technique. One should insist, however, on the very great care necessary in venereological dispensaries where chancres are being constantly handled and circumcisions frequently done, for this operation has more than once been responsible for the transmission of the disease.

(*g*) Education, the sovereign balm in so many other instances, offers the greatest hope. Here is a disease bringing untold misery to a large proportion of the community, rendering great numbers of citizens inefficient, and transmitting its calamities to wholly innocent parties. It is a disease the phenomena and far-reaching miseries of which are known with certainty; it is a disease which can be perfectly well avoided; it is a disease which, when contracted, can be greatly limited both in its early manifestations and its late effects. Yet it is a disease about which even the educated classes are wholly uninformed or wofully misinformed; while the masses depend for their information on the unintelligent mouthings of alarmist quacks.

1. *Education of the Medical Profession.*—Students are rarely well instructed in syphilis; they are almost never thoroughly instructed. "This explains," writes Fournier, "why medical men mistake chancres and mucous patches for something else; why they give syphilitic infants to the care of a healthy nurse, or inversely; why they regard syphilis as cured after a few months or even weeks of treatment, and why they permit marriage to uncured syphilitics." In no way, indeed, does the public health suffer more than when medical errors are made than it suffers if the errors be made in regard to syphilis; and these are errors which might be avoided by adequate attention to the subject in medical curricula.

In England there is not a single chair of syphilography; only recently has attendance on a clinic for syphilis been required in Germany, where many universities are without chairs of syphilography and where not a single full professor of dermato-syphilology exists; in America, in Austria, in Italy, even in France there are similar complaints; while only rarely do the departments of skin and venereal diseases possess the equipments deemed necessary for the treatment of other diseases. The establishment of adequate venereological dispensaries is, therefore, an educational need of the greatest importance; and attention to the public health demands that the instruction in regard to syphilis should be improved in the universities. Every candidate for a degree in medicine should be required to have attended at least a three months' special course in venereal diseases and to have passed a rigorous examination on this subject. Furthermore, the clinical material

of venereal wards and dispensaries should be utilized for the instruction of students and for the investigation of the disease. "If the sexual diseases are to be subdued," writes von Düring, "every single practising physician must be sufficiently instructed along these lines."

2. *Education of the Laity.*—This procedure is a delicate and difficult one. Certain suggestions may, however, be made as to possibly valuable educational undertakings.

(a) The first need is that the dangers of syphilis, about which the laity has the vaguest ideas, become matters of public knowledge. It is, of course, idle to expect that such knowledge would entirely protect the public from contagion; for those who are to be deterred from debauch by no consideration of public or private hygiene would continue to contract and to spread the disease. There are, on the other hand, certain people who are absolutely protected from danger by a thorough knowledge of it; and it is the duty of the medical profession to see that such persons, however small a part of the community they form, do not have to purchase their knowledge at the price of experience. Just how this knowledge is to be spread is a matter for consideration on account of the unique delicacy of the task. No doubt one of the functions of a venereological dispensary is that of instruction; and it would probably be useful to have printed guides distributed from these centres in somewhat the same way as is now done for tuberculosis. Much work is being done along these lines, and there seems no good reason why the public should not be given this information in popular magazines and similar ways. For it must again be emphasized that the problem of syphilis is one which each nation will have, sooner or later, to meet. The dangers of syphilis are essentially dangers to the commonwealth; and the commonwealth should be instructed about the disease itself, about the value of adequate treatment, and about the great risk of neglect.

(b) It is also in the interest of public health that the community should understand the dangers of prostitution. Instruction in this matter, by reason of its difficulty and delicacy, offers hope of doing good only when given with the utmost wisdom. Yet the opinions of students of the question and the success of modest efforts already made are united in encouraging us to hope that something may be accomplished by this form of education in the future. The conventional objection, of course, is that the industry of prostitution is regulated by the law of supply and demand and that it cannot, therefore, be influenced by an educational campaign similar to that being made against other diseases. But it is common experience that demand may be contracted or expanded almost at will; it is daily increased by advertisement and frequently diminished by boycott. In the case of prostitution there seems to be no reason for doubting that the more reasonable portion of the youth of a land could be, to a degree at least, protected against its dangers by a thorough understanding of those dangers. For it must be remembered that syphilis is most frequently contracted during the years of inexperience. By an examination of 11,000 cases Edmond Fournier has shown that the maximum incidence is attained at the twenty-third year in men and the twentieth year in women. There is no question that the medical profession should stand behind any wisely considered attempts to give to the youth of the land the instruction which they fail to get at home; and in this movement no one can accomplish more than the general practitioner. For if the source of syphilis is ever to be rendered relatively innocuous it

will only be done by making the public understand what a menace to health prostitution really is.

(c) It is immediately incumbent on the medical profession to keep itself informed and to instruct the public as to the danger of innocent syphilitic contagion. Nothing can be more tragic than the disease acquired in this way, and in a large number of instances information and reasonable care would have entirely prevented it. The danger of transmission by wet-nurses and by many of the contacts of every-day life should be known to all men.

(d) The close association between alcoholic abuse and the contraction of venereal disease being an absolutely established fact should, in the interest of public health, be more widely appreciated. "Sine Baccho friget Venus;" "Der schlimmste Kuppler ist eben der Alkohol;" "Aus der zwei V, Vinum und Venus, entsteht ein grosses W (Weh)." The simple fact behind these popular statements gives the physician sufficient warrant for regarding the alcohol problem as a distinctly hygienic problem quite from the standpoint of the syphilographer.

(e) Lastly must be mentioned the close association between the prophylaxis of syphilis and many social reforms. This is not the place to go into these matters in any great detail; but there can be no doubt that public hygiene demands attention to them on the part of medical men. Prostitution, the great source of the disease, is at present a part of the social fabric; and it exists, partly at least, because of the injustices of society. No movement therefore which makes for improved industrial and hygienic conditions can fail to be of service in the fight against syphilis. Neither bathos on the one hand nor smug Pharisaism on the other is the attitude to take toward the source of this plague. And the questions of female pauperism, of improved tenement quarters, of proper female education, of wholesome amusements for the poor—these are problems which, although properly sociological, have a distinct medical interest and importance.

4. **The Private Hygiene of Syphilis.**—There can be little doubt that the physician has a distinct duty to fulfil to his patients in explaining to them certain elementary hygienic details which cannot well be publicly considered, and which do not enter into the prophylactic campaign of the State. There is first the question of continence, and here the physician dare teach his patients but one thing, namely, that continence, no matter how difficult, is the relation of greatest safety for the individual and for society and is not detrimental to health.

As to the more immediate measures of private hygiene, the physician has little to do that has not already been mentioned. It certainly is not part of his function to sacrifice his professional dignity to the extent of advising certain protective measures for rendering illicit intercourse safe. For the health of the commonwealth must be one of his considerations as well as the health of a single patient; and quite aside from the value of this or that measure, or the fact, for instance, that the famous mot of Ricord about the most common form of protection is as false as it is sententious, this is a business in which the physician with any sense at all of his moral obligations can have no hand, provided he has, as he *should* have, a proper sense of the danger to public health of illicit intercourse.

The Prophylaxis of Hereditary Syphilis.—This is the most tragic form of the disease; and it is therefore unusually satisfying to know that much can be done toward preventing it. The most certain prophylaxis consists, of

course, in proper treatment of the parents before marriage. In statistics compiled by Fournier, it has been shown that the infantile mortality of the issue of subjects whose syphilis has been properly treated is only about 3 per cent. In 45 pregnancies, however, occurring after the marriage of untreated syphilitics, the mortality was 82 per cent.

We are here concerned rather with the question as to whether there is any hope of protecting the fœtus by treating a healthy mother who has conceived by a syphilitic man. It has been shown that mercury and potassium iodide pass from mother to child through the placenta. Porak demonstrated iodide in the urine of a fœtus forty minutes after its administration to the mother; Cathelineau and Stef found mercury in the bodies of fœtuses whose mothers had received it. This sort of prophylactic treatment is therefore rational, and, as a matter of fact, it has produced excellent results. Women, for instance, whose previous pregnancies had been disastrous, have frequently had normal pregnancies when specific treatment was instituted; and the following rule may be formulated: "When a woman is pregnant with a child threatened, by paternal antecedents, with syphilitic heredity, syphilitic treatment of the mother, although healthy, constitutes for this child a real and powerful safeguard for which there is a precise and formal indication."

Treatment to be effective must be begun in time. "After the fifth month it is too late," says Pinard. Mercury is the drug to be given, and is best administered in the form of the proto-iodide pills. The fœtal dose cannot, of course, be accurately guaged, but about gr. $\frac{1}{2}$ is usually a sufficient dose. The treatment should be continued during the whole pregnancy. Pinard advises continuous treatment, but others prefer the intermittent method—twenty days' treatment and ten days' rest every month.

Treatment.—I. **Initial Stage.**[1]—It is usually the appearance of the chancre which brings syphilitic patients for treatment. In many instances, it is true, the chancre is entirely overlooked or neglected and the patients are first seen with secondary or tertiary symptoms; but as a rule the physician's therapeutic problems begin with the chancre itself. And the questions with which he must concern himself are the two following: (a) How should the chancre itself be treated? (b) When should constitutional treatment be started? The idea that the primary sore is a local affection, and that syphilis might therefore be extinguished *ab ovo* by treatment directed at its primary manifestation has always been an attractive one. In 1514, Jean de Vigo advised it and Hunter believed in it thoroughly. Several methods of accomplishing the purpose have been suggested.

(a) *Blockading the Chancre.*—Mercurial injections about the lesion, injection or excision of the neighboring glands, and even division of all the lymphatics (!) have been proposed.

Cauterization of the chancre has, however, been a more feasible and a more widely used procedure. Chemical caustics (Ricord's carbosulphuric paste, Vienna paste, etc.), the actual cautery, and specific caustics (a substance being used which is both caustic and an antidote to the syphilitic virus) have all had clinical application.

Excision of the chancre was a popular therapeutic procedure in the early history of syphilis, but fell into disrepute on account of its failures. In 1877,

[1] Fournier's incomparable *Treatment of Syphilis and Prophylaxis of Syphilis* are now published in English translation (Rebman Co., 1906). Nothing better exists on these subjects.

however, Auspitz again drew attention to it and since that time it has received a good deal of notice. The procedure is simple, provided the lesion be situated on a part which can be resected without damage; chancres of the meatus, however (for example), could hardly be treated in this way. It is essential that a margin of healthy tissue about the lesion be removed with it, and to avoid contamination of the wound the chancre itself should first be destroyed with the thermocautery. The wound usually heals quickly, with a small scar. In excision of chancre of the penis, hemorrhage is sometimes severe. Recurrence of the lesion *in situ* is not uncommon, and a third induration may even occur after excision of a second one.

In spite of the attractiveness of these various methods of attacking the primary sore the procedure has led to doubtful if not wholly disappointing results. It is irrational because the chancre, so far from being the source of the disease, is but an early expression of it; and to expect that its ablation will cure the disease would be like treating typhoid fever by excising a rose spot. It is further irrational because experimental work has shown its uselessness. In the experiments of Neisser carried out in Java, injections of sublimate begun immediately after the inoculation of the syphilitic virus prevented neither the development of a chancre nor the general distribution of the virus throughout the body. But it is the clinical failure of the method that is most important. Cauterization of a chancre, even in its earliest stage, is absolutely powerless to prevent constitutional infection. Langston Parker cauterized a chancre of two hours' duration without preventing constitutional symptoms; Berkeley Hill cauterized a ruptured frænum with fuming nitric acid eleven hours after a suspicious intercourse, but the wound became indurated and secondary symptoms followed. Many other similar experiences are recorded. Specific cauterization, widely used by Hallopeau, has given no better results.

Excision has had, and still has, enthusiastic advocates; but there is no question that its failures far exceed its successes. Furthermore, even its successes are of a doubtful nature; for in view of the great difficulty in the diagnosis of an early chancre there is always the suspicion that the sore excised was chancroidal and not luetic. In a certain number of instances there is little doubt that this was the case. In nearly all cases where the attempt has been made to establish the probability of syphilis by confrontation, excision has failed. It has even failed when done during the first few hours of the chancre; cases in which excision was practised twelve hours after the appearance of the chancre are reported by Rasori and by Taylor, and one in which the chancre was ten hours old by Brandes. In all, constitutional syphilis developed. Ricord went so far as to say: "Even if we amputated the penis as soon as the chancre appeared, syphilis would none the less certainly follow." Ablation of skin of the penis where a chancre *would be likely to appear* has even been practised after suspicious intercourse and before any signs of a chancre were present; but infection was not prevented and general syphilis occurred without a chancre. Furthermore, excision of the primary lesion has not succeeded in even attenuating the subsequent constitutional syphilis.

The treatment of the chancre, therefore, consists in doing nothing. This is particularly important if there is any doubt about the diagnosis; for cauterization of the sore will destroy its normal appearance, prevent its normal evolution, and thus make the diagnosis further impossible before the appearance of constitutional symptoms. In these cases simple cleanliness and

dusting with calomel powder suffice. When the diagnosis of the sore is quite certain, excision may be practised to get rid of a none too pleasant lesion and to ease the patient's mind. No other results should be expected of it, although it is still within the realms of possibility that it may do good. Now that Schaudinn's discovery has made early diagnosis of the sore possible, the whole subject needs further experimental study. Extensive cauterization cannot be too heartily condemned; tampering with powerful caustics may turn relatively benign chancres into deforming phagedenic lesions which promptly heal when kept clean and let alone.

(b) When should constitutional treatment be begun? Briefly, it should be begun the moment a positive diagnosis of syphilis can be made. The disease should be attacked too soon rather than too late; for when treated from its commencement it generally shows itself amenable to treatment, benign in its symptoms, and relatively less severe as regards later manifestations. On the whole, syphilis is more dangerous and less curable when treatment is begun late; early treatment often prevents many of the distressing and compromising secondary symptoms, and, if the diagnosis be made, "it is impossible," in the words of Hutchinson, "to commence too soon." But *only, if the diagnosis be made;* for in cases where careful and minute examination of the lesion leave one in doubt as to its nature it is better to wait until the appearance of confirmatory constitutional symptoms before prescribing mercury. Unfortunately, a large proportion of the cases are of this kind; for anyone who has seen many venereal lesions will appreciate the very great difficulty of making a positive diagnosis on the appearance of the sore alone. It is just here that examination for the presence of the organism of Schaudinn is of the greatest value; for if the spirochæte be found, we are justified in regarding the lesion as luetic and in immediately instituting treatment. In cases, however, where doubt still exists as to the nature of the sore, we must wait for secondary symptoms, and for the following reasons:

(1) We lose little by this procedure. We need wait, at longest, only a few weeks; and as the disease is already constitutional when the chancre appears, we are not permitting a local infection to become a general one, but a general infection to express itself constitutionally.

(2) The efficient treatment of syphilis is no light matter. It is never agreeable, often disturbs the general health, and must last over a period of two years at the very least. For these reasons the best results are only obtained with intelligent patients; they are *never easily* obtained; and the absolute conviction of both patient and physician that a serious affection is present is essential. But if early treatment be instituted before a positive diagnosis is made, the secondary symptoms may be obscured, no certainty will ever exist, and treatment will surely be lax.

(3) It is of the highest importance for a man to know whether he has syphilis or not. "A disease," said Ricord, "which grips forever the body of its victim, a diathesis which pursues its victim all his life, and beyond it to posterity, a constitutional taint, transmissible and hereditary—these are not vain and frivolous considerations." They are considerations, indeed, which a man should face in the most intelligent manner possible; but they cannot be intelligently faced if treatment "at all hazards," mercury "prescribed for the sake of prudence," have obscured the diagnosis from the start. For a diagnosis thus obscured may remain obscure; and a patient may suffer from late effects of the disease which properly continued treatment would

have prevented. The situation is particularly embarrassing when the question of marriage comes up. "If the patient has had syphilis," writes Fournier, "a few months' treatment will not prevent his being dangerous for his wife and future children. But if he has not had syphilis, why should be he condemned to celibacy? There is no escape from this situation; it is a blind alley."

II. **The Secondary Stage.**—With the onset of constitutional symptoms and the establishment of the diagnosis, treatment becomes as active as it had been inactive during the primary stage. The physician now has a patient whose general health must be watched and provided for, and whose specific disease must be vigorously attacked.

1. *The Auxiliary Treatment.*—Syphilis is not completely treated by the simple prescription of mercury or potassium iodide. It is true that in many cases this suffices; but in certain patients, more particularly in nervous women, auxiliary treatment is of very great importance.

(a) *Diet.*—Many idle words have been written as to the syphilitic diet; and although the matter is by no means unimportant, it is quite simple and to be summed up in a few words. The keynote is the avoidance of excess. Irregularities of diet are to be forbidden and food and drink which cause diarrhœa or are prejudicial to the gastro-intestinal functions are to be avoided. Alcoholic excess is particularly dangerous. With these exceptions the diet should be interfered with as little as possible.

(b) *Hygiene.*—Here again avoidance of excess is the keynote. Overstimulation of an organ directs the syphilitic virus to that organ. Cerebral syphilis, for example, is especially common after nervous and intellectual overwork, after excitement, dissipation, and venereal or other excesses. Again, buccal syphilides are most frequent and more serious in tobacco users. For these reasons one should insist on the very great danger of overstrain to a syphilitic under treatment, and forbid tobacco.

Not an unimportant part of the physician's hygienic duty to his patient consists in attention to his state of mind. "Avoid sad passions" was the old advice to syphilitics; but, as Diday said, "Of all the anguishes, it is often the syphilitic anguish which lies heaviest on the syphilitic." This is the sad passion which the physician should correct. He can, fortunately, tell his patient, with truth, that the disease is curable, that safe marriage is possible, and that the prospect for healthy posterity is good. This wholly warranted assurance may be a very vital part of the treatment of the disease.

(c) Special attention must be paid to patients with *nervous predispositions.* It is the nervous system which is most often attacked by tertiary syphilis, and to these dangers nervous patients are more liable than others. It is the hereditarily neuropathic patients and the patients subject to nervous overwork who are especially subject to these calamities. Neurasthenia may be called one of the "localizing causes" of syphilis, and neurasthenic patients should be particularly careful in the avoidance of excess of every kind. Hydrotherapy and other more specifically neurasthenic treatment should also be used.

2. *The Specific Treatment.*—For all practical purposes the specific treatment consists in the administration of mercury and iodide, either separately or in combination. A whole host of other drugs have been used, and some of them have been championed with enthusiasm. None has shown, however, any true antiluetic property; and except for more or less important adjuvant value, none possesses more than historic interest.

(a) *Mercury.*—This drug has now been shown by extensive clinical application to possess a power over syphilis, at least in its secondary stage, that has almost no parallel in medicine. This power is in direct proportion to the amount of the drug taken up by the economy. The drug is, at the same time, not without its injurious effects, and cannot be recklessly given. In the effort therefore to combine the maximum of therapeutic effect with the minimum of untoward symptoms, several methods of mercurial administration have come into use.

(1) *Ingestion.*—This is the method most widely used, not because it is free from disadvantages, but because it is practical, in the sense that it is easy, convenient, and efficient. Nearly all the preparations of mercury known to chemistry have been administered by the mouth. Metallic mercury, calomel, the biniodide, the binoxide, the black sulphide, the acetate, the cyanide, the so-called peptonate and tannate, and the salicylate of mercury have been tried; but it is the proto-iodide and the bichloride which have, after long experience, proven themselves most valuable.

Proto-iodide is insoluble and can therefore only be administered in the form of pills. The dose varies from gr. ½ to gr. j (0.01 to 0.06 gm.). A small dose of opium, gr. ⅓ (gm. 0.02), is often prescribed with the mercury to prevent gastric irritation, the most famous combination of this sort being Ricord's pill.[1]

Bichloride of mercury may be given either in pills or in solution. The usual dose for an adult is gr. 1/16 (gm. 0.004) three times a day. This, too, is often combined with opium, to assure gastric tolerance for the sublimate, as in the well-known Dupuytren's pills, but the drug is preferably given without opium in pill form or in solution with a small amount of gum acacia. Sublimate solution is irritating to the stomach and should be given in a dilute form. On account of its objectionable taste and also to diminish gastric symptoms, syrup of sarsaparilla or peppermint may be prescribed with it. If taken in milk the drug is also found better tolerated by the stomach.

Gray powder (mercury with chalk) is a form of mercury particularly lauded by certain authors. It may be given in gr. ½ (0.03 gm.) doses, and is Hutchinson's favorite form of treatment. In cases of visceral disease with ascites the well-known Addison's pill (containing calomel, digitalis, and squills) is useful; but in general the visceral lesions (more particularly syphilitic hepatitis) require in addition the administration of iodides. Bichloride of mercury is also frequently prescribed in combination with potassium iodide.

The mercurials administered by the mouth may also be given per rectum in the form of suppositories. This method of administration is mentioned for the sake of completeness, rather than because it possesses any unique advantages.

(2) *Inunction.*—This is the oldest of all the methods of administration of mercury. It consists in anointing the skin with salves containing the drug in a suitable form and in the olden days included, among other things, as

---

[1] The original formula of Ricord was as follows:

Proto-iodide of mercury	3 grams.
Extract of thebaine	1 gram.
Thridace	3 grams.
Confection of roses	6 grams.

For sixty pills

an important part of the treatment, depuration by purgatives and by bleeding. The ointment most often used is the well-known blue ointment, composed of equal parts of mercury and lard (double mercurial ointment, Neapolitan ointment). Lanolin may be substituted for the lard and is said to penetrate the skin better. Mercurial soaps have also been used, but, in spite of certain advantages, have not replaced the blue ointment. Mercury-vasogen (which may be had in 33 per cent., 50 per cent., and 75 per cent. mixtures, and should be ordered put up in gelatin capsules containing the required dose) is a very clean and efficient form of ointment for this purpose, and in private practice should always be prescribed. Its expense is its only disadvantage. The average dose of mercurial ointment is 1 dram. For women, who are more subject to salivation from inunctions than men, $\frac{1}{2}$ dram is, as a rule, a sufficient dose. Infants tolerate inunctions well and proportionally larger doses may be prescribed for them; in quite young infants 15 to 30 grains may be safely used. The inunctions should be carried out to the point of dryness; for a dose of 1 dram this requires at least 30 minutes. One inunction is usually prescribed per day for six days of the week; it is omitted on the seventh day, when a hot bath, preferably a Turkish bath, or a sweat bath is taken. The hairy regions of the body should be avoided in applying the ointment, as inunctions in these regions lead frequently and rapidly to stomatitis and often cause dermatitis. To avoid mechanical irritation, the seat of the inunctions should be varied, the sides of the thorax and the inner surfaces of the thighs and arms being chosen.

The inunctions are best given at night before retiring, the site of the application being covered with cotton, after rubbing, to prevent soiling and to keep the ointment from being wiped away. The inunction treatment is quite efficacious even when simply carried out; but a regular sweating bath[1] is beyond doubt of advantage, and life at a mineral spring, where hydrotherapy is assiduously practised, large amounts of water drunk, and frequent Turkish baths taken, makes it possible for the patient to absorb larger amounts of mercury than can be taken up without such auxiliary treatment. The inunction treatment should be interrupted from time to time and a recess of a few days taken to avoid stomatitis, and the mouth, in all cases, should be very carefully watched during the treatment.

(3) *Injection.*—The introduction of mercurials under the skin was originated by Hebra and Hunter, but it was first widely used after the publications of Lewin in 1867. The technique of the procedure is quite simple. The injections are best made into the buttocks, well above the ischial tuberosities, the two buttocks being used for alternating doses. An all-glass syringe is the best to use; the needle should be of sufficiently large caliber, and it is essential that it should be long enough to reach well through the skin and subcutaneous fat. For the injections, although often spoken of as hypodermic, are, or should be, intramuscular. The skin is washed with green soap and water and swabbed with ether. The needle is then plunged straight into the muscles, and watched for a moment to see that no blood escapes. If blood *does* escape, the needle should be re-inserted. The syringe is then attached and the injection made. When the needle is withdrawn, a small collodion and cotton dressing over the puncture wound is sufficient.

---

[1] Vapor baths may now be purchased quite cheaply and these may be used by patients in their homes.

Both soluble and insoluble forms of mercury have been used for this purpose. Of the former, bichloride and biniodide; of the latter, metallic mercury, calomel, and salicylate of mercury have been the ones most frequently employed. The following are the formulæ:

Bichloride.—

Hydrarg. chlor. corros.	gr. j.
Glycerini	ℨij.
Aquæ destillat	ℨij.

Sig.—Injections of ♏v to xv every one, two, or three days.

Biniodide.—This may be given in a 0.4 per cent. solution in olive oil. The injections may be given every day, the dose at the start being ♏x, which is rapidly increased to ♏xxx or even ♏l.

Metallic Mercury.—This is given as the gray oil, introduced by Lang, of Vienna. Half an ounce of mercury is rubbed up with 2 ounces of anhydrous lanolin, and the mixture then increased to 5 ounces by the addition of paraffin oil. Enough carbolic acid should then be added to make a 2 per cent. solution for antiseptic purposes.[1] This mixture should not be warmed, in which case the mercury separates out; nor cooled, in which case the solution stiffens. The dose is ♏x and the injections may be given once a week or once every five days.

Calomel	gr. xxiv.
Glycerin	ℨij.
Distilled water	ℨij.

This may be sterilized by placing the bottle in which it is kept in boiling water and keeping it there for an hour. The dose is ♏v to xv (gr. ½ to 1½) injected every five to fifteen days. Olive oil, oil of vaselin, oil of almonds, and distilled water may also be used for making the suspension.

Salicylate of Mercury.—This is best given as a 10 per cent. solution in liquid albolene, which may be sterilized by heating. The dose is ♏x once or twice a week. The injections usually cause no local disturbances, but indolent nodosities have been seen after the use of salicylate.

Certain authors have also advised the use of massive doses of soluble salts of mercury. This is dangerous; for the rapid absorption, which is quite beyond one's control, may lead to alarming symptoms. Moreover, although intense mercurialization may be thus produced it does not appear that the influence of such injections on the disease is a persistent one.

Intravenous injection of mercurials, introduced by Bacelli, of Rome, has, in spite of its dangers, found certain staunch supporters. Bacelli used bichloride in 0.1 to 0.2 per cent. solutions, 1 cc. (representing gr. 1/64 to gr. 1/32), being injected. The therapeutic effects have not, however, been superior to those of other methods. Lang has suggested paravenous injections for the purpose of having the mercury reach the blood promptly, but not too directly.

(4) *Fumigation.*—This, too, is quite an old method of treatment. Like inunction, it formerly included sweating and depuration. Previous to the invention of the fumigation box by Lalouette in 1776, the patient was entirely enclosed in a chamber in which mercurial vapors circulated; and inhalation of these vapors caused dangerous symptoms and even fatalities.

---

[1] This is the principle, although not the exact formula, of Lang. The formula is the one recommended by Lambkin, of the British army.

Nowadays the patient, seated, is covered up to the neck by a sheet which reaches to the floor. Under the chair is placed a voporizing apparatus containing 15 to 60 grains of calomel. The calomel is volatilized and the patient is bathed by the vapors. Volatilization is usually complete in fifteen minutes, after which the patient is left for another ten minutes in the vapor. He is then put to bed for forty-five minutes, wrapped in the same coverings. The treatment may be repeated every day or used only twice a week.

(5) *Mercurial Baths.*— This method of treatment, formerly much in vogue, particularly in infantile syphilis, is now little used. A series of baths is given to which the following solution of mercury is added:

Bichloride of mercury
Hydrochlorate of ammonia . . . . āā ℥v.
Water . . . . ℥vj.

(6) *Mercurial Plasters.*—These, formerly much lauded, have fallen into disuse. The famous *emplastrum* of Vigo, contained besides mercury twenty-three other drugs, each possessing marvellous qualities; but the plaster now used is the sparadrop of Quinquad, who has studied the subject scientifically:

Diachylon plaster . . . . 30 parts.
Calomel . . . . 10 parts.
Castor oil . . . . 3 parts.

This is applied to the skin for a week and then renewed until the desired effect is produced.

Merits of the Various Methods of Mercurial Administration.— Fumigation, treatment by mercurial baths, and treatment by plasters have, except in rare instances, little that can be said for them. Of the other three methods— inunction, ingestion, and injection—it is difficult to say dogmatically that any one is always and everywhere the best. "There should be nothing absolute in the choice of a therapeutic method," says Fournier; "this choice should always be subordinated to individual indications; indications concerning the patient and the disease; indications which are naturally of the most varied nature." The advantages and disadvantages which inhere in each must, however, be known in order that intelligent choice of method may be made.

Ingestion is particularly appealing by reason of its ideal simplicity. It is less liable than inunction to cause stomatitis, and the stomatitis which it causes is of a less rapid and severe type. It avoids the pain and occasional accidents of injection. The method is, on the average, best suited to the occupations, convenience, and social and professional obligations of the average patient; and the probability that convenience of form of treatment will make for prolonged and efficient treatment is not to be lost sight of. Patients who will not submit to inunctions or return for injections will swallow pills almost indefinitely; and for these, and other reasons, the method of ingestion remains the method of choice for the average patient. It must not be forgotten, however, that the method has the disadvantage of leaving the treatment largely in the hands of the patient. It is contra-indicated when the digestion is poor, or when experience shows the stomach to be intolerant for the drug; when the patient is cachectic and must have his digestive powers respected; when the digestive organs must be left free for other remedies which may be required; and when a pressing and urgent danger renders rapid mercurialization necessary. Ingestion can, however,

as will be shown later, be quite well combined with inunction or injection. The chief advantage of inunction is its active therapeutic effect. This may be an absolute indication for the choice of this method where urgent symptoms are present. But the absence of gastric complications is an additional advantage. Again, inunction leaves the stomach free for other medication; either the exhibition of iodides, when mixed treatment is carried out or the administration of auxiliary medication (potassium bromide, tonics, etc.). On the other hand, it is a dirty, inconvenient, and repulsive method, involves a certain amount of publicity, and often discourages patients, leading them to abandon treatment altogether. It is occasionally accompanied by diarrhœa and by dermatitis; and quite commonly by stomatitis which occurs more frequently with this method than with any other. Moreover, the stomatitis which it causes is more rapid in its onset, more general and more intense in its manifestations, than that seen after ingestion. Inunctions are also somewhat uncertain in their effects; one patient responds well to them, another badly. This is no doubt due to the way in which the rubbing is done, and for this reason the method is not always applicable. It cannot be too strongly insisted that patients who are receiving inunctions should be carefully watched, particularly as to the development of stomatitis; and that care should be taken that the rubbing is well done. The method is indicated in severe cases (cerebral and spinal syphilis), in cases refractory to other methods, in dyspeptics and those subject to diarrhœa, and in cachectic patients. It is of particular value in the treatment of syphilis in young infants, whose lives may depend on the integrity of the digestive system.

The method of hypodermic injection is a relatively accurate one. The drug must be administered by the physician, and deceit as to the amount of the drug taken is therefore avoided. The chief advantage of the method is its therapeutic intensity; it induces mercurialization rapidly and intensely, and is of particular value in the presence of urgent symptoms. It also leaves the stomach free for other medication, and does not, as a rule, cause intestinal symptoms. It is claimed that the hypodermic method ensures the most exact dosage of mercury; but this accuracy is an apparent rather than a real one; for the sufficient dose of a drug is to be estimated not alone by the amount given, but by the physiological effects obtained, and these can be estimated quite as well when inunctions or ingestion are used. Pain and local irritation are strong objections to the method; for, aside from the inconvenience caused, these are often sufficient to drive the patients away and make them neglect treatment altogether. The formation of nodosities and sloughs is occasionally seen, although only occasionally with present-day technique. The method is, on the whole, not practicable because it requires an amount of attention on the part of the patient which the patient does not, as a rule, feel willing to give. It is not wholly free from danger. Several cases of pulmonary embolism have been reported following the subcutaneous injection of calomel; and hemorrhage and nervous accidents (partial paralysis, trophic disorders, etc.), although rare, have occurred. The method is one of "special indications."

Intravenous injections may be given quite without pain. Local accidents are, as a rule, absent; the dose given is mathematically controlled; and much has been claimed, by enthusiasts, for the therapeutic results. As a rule, however, it has been pretty generally abandoned, and is now recommended only when very rapid action is required. The technique is not altogether

simple, as the vein may be missed; and local accidents, although not frequent, do occur. Moreover, the therapeutic effects of the method have not been encouraging, and most authorities hesitate to advise such sudden introduction of a toxic substance directly into the blood stream.

The Disadvantages of Mercury.—Aside from the question of method of administration, the dangers of the drug itself must be considered. Stomatitis is the complication most frequently seen. This was formerly regarded as an essential part of the cure; in the days of Astruc "a good cure required a good salivation of 4 or 5 pounds a day." The stomatitis now observed, however, is usually of a milder type and begins as a gingivitis. The saliva becomes stringy and superabundant; there is a metallic taste in the mouth; the gums (especially of the lower jaw) become reddened and swollen and bleed easily; the teeth become tender and appear to the patient to be elongated. There is a metallic and fœtid odor to the breath. In bad cases, now not often seen, the entire mucous membrane of the mouth is swollen, ulcerated, and bleeding; ropy saliva wells from the lips; the teeth are exceedingly tender, become loose, and may even fall out. The ulcerations of the buccal mucosa may resemble mucous patches quite closely. Stomatitis may often be prevented by prophylactic measures, including: (a) Choice of remedy and method of administration; ingestion is less frequently accompanied by stomatitis than injection or inunction, and proto-iodide more frequently than sublimate. (b) Hygiene of the mouth. Neglected mouths are particularly subject to stomatitis, and mercury should never be given without inspection of the mouth. Where this is in bad condition, attention should be paid to it. But in any case the teeth should be carefully and regularly brushed and the mouth frequently washed with a solution of chlorate of potash or some astringent wash. The gums may be occasionally painted with tincture of iodine. Patients should also be informed of the buccal accidents of mercury and told to report immediately if any symptoms are noticed. On the least sign of buccal irritation, mercurial treatment should be discontinued.

Salivation, when present, is treated, as follows: Stop mercurial treatment and order immediate and repeated Turkish or vapor baths. See that the bowels are kept open and that large amounts of water are taken to stimulate the kidneys. Order a potassium chlorate or potassium permanganate mouth wash to be used every hour, and internal doses of potassium chlorate (5 grains three times a day) for three or four days. Atropine in doses of gr. $\frac{1}{32}$ (0.002 gm.) may be given. The gums may be painted with the following solution:

> Tinct. krameriæ,
> Tinct. iodi . . . . āā ℥v.
> Tinct. myrrh. . . . . ℥iiss.

In ulcerous stomatitis hydrobromic acid or silver nitrate should be used to cauterize the ulcers.

Gastro-intestinal complications are not infrequent during mercurial treatment. These may take the form of pains in the stomach, colic, diarrhœa, loss of appetite, or even persisting dyspepsia. Some corrective (such as opium) will often suffice to prevent or attenuate these complications. But even the strongest stomach may become fatigued by the remedy, and treatment should therefore be now and then suspended, to give the digestion a respite.

Disturbances of nutrition, in the form of languor, anæmia, want of appetite, fatigue, and emaciation, occasionally occur, particularly when mercury has been too strenuously prescribed. The nutritional dangers of mercury have, however, been exaggerated; their occasional occurrence is but one more argument for the careful and intermittent administration of the drug.

Cutaneous Complications.—Irritative dermatitis from inunctions is a local affair and may, by varying the site of inunction, be avoided. The absorption of mercury also causes eruptions. They are due to a personal idiosyncrasy and occur with even very small doses. The most common form is that of desquamative polymorphous erythema. In the milder cases, the symptoms consist only in local heat and itching, with slight fever. Occasional cases are severe, the clinical picture being that of a severe, extensive burn.

Other manifestations of hydrargyrosis are albuminuria, cylindruria, and changes in the nervous system (particularly polyneuritis).

(*b*) *Potassium Iodide.*—This drug, introduced into the treatment of lues by Wallace and popularized by Ricord, takes the place in the therapeutics of the tertiary stage which mercury holds in that of the secondary. It is very soluble in water, rapidly absorbed, and appears in the urine twenty minutes after ingestion. The economy soon becomes impregnated by it and it may be found in all the secretions. Its antisyphilitic power is quite miraculous and its power to dissolve luetic tumors is the most dramatic thing in therapeutics. The drug may be administered by the mouth, by the rectum, or hypodermically; but inasmuch as it is usually well tolerated by the stomach, the second two methods have little more than theoretical interest. In certain rare cases the administration by enemata might be indicated, as in unconscious patients in whom it was not desirable to pass a stomach tube; but for all practical purposes the drug should always be administered by the mouth. It should be given in weak solution, as strong solutions have a disagreeable taste and irritate the stomach. The taste may be masked by giving the drug in milk or wine or by adding peppermint or one of the syrups (the best is syrup of bitter orange). In cases where the taste of iodide is persistently nauseating, one has to experiment until some pleasant drink is found which successfully masks it. The drug should be taken after or during meals. In some patients it causes constipation, in others diarrhœa; and a mild purgative or astringent should in these cases be prescribed with it. It may be ordered in the saturated solution, the required number of drops being put into the milk or other drink which is to be used.

As to the dosage, there is divergence of opinion. Some advocate small, others extremely large, doses. Fournier thinks that the method of beginning with small doses is bad, for it is the small doses which appear to be particularly harmful. On the other hand, he is strongly against what he calls "iodide debauches." He begins, for an adult man, with 30 grains daily (given in three doses); for a woman, with 15 to 20 grains. The dose is gradually increased until it reaches 45 to 60 grains daily, and here it remains. When the indications are very urgent larger doses (beginning with 70 to 90 grains and rapidly increasing to 150 to 180) are given; but doses of 500 grains he considers useless "intemperance." When tolerance for the drug is established, the curative value apparently diminishes, and the dose must therefore be increased. Other authors, however, advise larger doses, beginning with

30 to 40 grains daily and increasing a grain a day until about 250 grains daily are given. Gottheil reports a case of gumma of the meninges which only showed improvement when 900 grains were administered daily; half of this was introduced into the stomach through a tube and the rest into the rectum in enemata. Whether parasyphilitic affections would be prevented by routine employment of massive doses, as claimed by some authors, is a point still unsettled.

Iodide of sodium, ammonium, and rubidium, iodine, iodoform, and other iodine compounds have been used instead of iodide of potassium; but none of these has yet proven itself a satisfactory substitute.

Iodism.—Potassium iodide, like mercury, joins with its remarkable therapeutic value certain untoward effects. The cause of these symptoms seems to be an idiosyncrasy in the patient. They appear after small doses and often early in the treatment. The most common are the iodic taste, coryza, and acne. The taste is a slightly salty or metallic one, is especially noticed in the morning, and is most frequent in women. The coryza is much like that of an ordinary cold in the head; it is characterized by snuffling, a sense of nasal obstruction, running from the nose, frontal headache, etc. The discharge from the nose is usually serous. The coryza may disappear in a few hours or last, in a subacute stage, throughout the treatment. The acne eruption generally appears on the face in the form of recurring crops of acneform pustules, seldom more than four or five at a time. Both the coryza and the acne may appear in severe form, the former resembling influenza (iodic grippe) and the latter appearing as a large, furunculoid, deforming eruption. Other rarer symptoms of iodism are neuralgic pains, especially of the jaws, and most often seen in women; a mild sialorrhœa, never so intense as in mercurial salivation; conjunctivitis; iodic purpura; gastro-intestinal symptoms (nausea, vomiting, diarrhœa); swelling of salivary and parotid glands (iodic mumps); and localized œdema, especially of the eyelids.

The eruptions of iodism, which are sometimes severe and occasionally fatal, appear in three general types: the bullous type (iodic pemphigus), the furunculo-carbuncular type, and the pustulo-crustaceous type. The latter may be impossible to distinguish from tertiary syphilides; the rapidity of invasion, the initial form of the eruption, the inflammatory character of the areola, the soft base, and the disappearance of the eruption on suppression of the drug make the diagnosis. Purpura may occur. Iodic œdema of the respiratory passages, sometimes requiring tracheotomy and occasionally ending in death, is another rare symptom of iodism which must be mentioned.

The accidents of iodism are not as a rule severe; the symptoms often disappear as tolerance is established, and suppression of the drug is not necessary. When they do not disappear, it may be discontinued for a short period. For patients who are subject to localized œdema and to prevent the nasopharyngeal accidents, belladonna may be exhibited, 1 grain of the extract being given daily.

Mixed Treatment.—It is true that mercury is the drug, *par excellence*, which is indicated, roughly, in the early stages of syphilis; and that the iodides produce their most remarkable effects in the later stages of the disease. Syphilis, however, may be entirely cured without the use of iodides, the administration of which in lues is only a matter of relatively recent years. Furthermore, iodides have, as a rule, only a slight influence on the secondary phenomena. They are not, therefore, in any sense of the word a substitute

for mercury. To say these things, however, is by no means to warrant us in dividing syphilis into two halves, for one of which mercury and for the other iodide is indicated; for iodide may be of use in the secondary stage and mercury is an antisyphilitic at every period of the disease.

In the secondary period iodide has a marked influence on the headaches and should be prescribed in 15 grain (1 gm.) daily doses. It is also of value for the vague neuralgic pains which are especially common in women. In early malignant syphilis—which is really tertiary syphilis succeeding the chancre without a secondary stage—iodides are of benefit; and they are indicated whenever mercury cannot be tolerated by the patient in any form. Mercury, on the other hand, seems to be always useful as an auxiliary agent in the tertiary stage; it may, indeed, even replace iodides, certain of the lesions (notably sarcocele), which had failed to yield to iodides, having been cured by mercury. Moreover, it must be remembered that it is mercury which cures syphilis; iodide "erases the symptoms." "As a preventive medication," therefore, "there is much more confidence to be placed in mercury than in iodide."

For these reasons the method of mixed treatment is the one that should be followed. The drugs may be administered separately or together. The best plan is to order a solution of iodide in syrup to be taken at the same time as the mercury; or to prescribe mercury by inunctions and potassium iodide by the mouth. A very satisfactory plan is to combine the exhibition of potassium iodide with mercurial injections.

Treatment of the Local Manifestations.—1. *The Chancre.*—The treatment of the chancre has been discussed above.

2. *The Syphiloderms.*—These, as a rule, require no attention. When on the face or hands they may be made to disappear more rapidly by the use of white precipitate ointment. The tuberculous and pustular syphilides require more energetic treatment; white precipitate ointment may be used, or a 10 to 20 per cent. solution of the oleate of mercury in oleic acid. For the alopecia, local inunctions of blue ointment are advised.

3. *Mucous Patches.*—Cleanliness is very essential, and a mouth wash of bichloride (1 grain to 6 ounces of water) should be prescribed. The use of tobacco should be forbidden. The individual lesions should be touched occasionally with the nitrate of silver stick.

4. *Condylomata* and *moist papules* are, as a rule, best treated by cleanliness and the use of a bland dusting powder. Large growths may be cauterized with silver nitrate. Painting with the following mixture is said to remove condylomata:

> Salicylic acid,
> Tinct. cannabis indica . . . . āā ℥j.
> Flexible collodion . . . .   ℥j.

Condylomata may also be excised if they present a suitable pedicle. Simple clipping with the scissors usually suffices; the hemorrhage is slight, a small dressing is all that is needed, and the wound heals well.

5. *The Eye.*—When syphilitic iritis is present, it is necessary to administer constitutional treatment in the most energetic manner possible—best, by the method of injection. In addition, the pupil should be kept dilated by the use of atropine.

The General Management.—The patient is generally first seen after the appearance of a suspicious genital sore; and the physician's first duty is to use every possible means, microscopic examination for Schaudinn's organism being one of them, to make a positive diagnosis. If this cannot be made, no treatment should be used; the patient should return for frequent examination so that the evolution of the sore may be followed and constitutional phenomena seen as early as possible. The moment the diagnosis is made, treatment should be instituted. One may begin with proto-iodide pills, gr. $\frac{1}{4}$ three times a day. This is, however, a *small dose*, and must be increased very soon until the patient is receiving at least $1\frac{1}{2}$ to 2 grains a day. The usual error is to prescribe proto-iodide in too small rather than too large amounts. Inunctions may also be ordered, particularly if compromising lesions are present on the face. The patient should be carefully watched at first in order to determine how the mercury is being borne, and the dose should, if possible, be pushed to the point of toleration. This will require experimentation. If the method of ingestion is badly borne, injections may be tried; some patients take one form well and others another, and the method of choice must depend on the reaction of the patient. The general health of the patient must be cared for; the mouth and teeth scrupulously watched. Regular Turkish baths should be ordered; and if the patient can afford it, frequent trips to mineral baths, both for change of scene and for specific therapeutic effect, may be of value. Early in the secondary stage iodides should be ordered in addition to the mercurial treatment. Often the case will run along smoothly, but many patients will tolerate mercury poorly or will neglect their treatment; and these cases will require all the therapeutic resources which have already been mentioned.

Whether mercurial treatment should be continuous or symptomatic is a point which has been disputed. Continuous treatment is the plan advocated by Hutchinson, Keyes, and others. The drug is pushed just short of salivation in order to determine the toxic dose; and then is continued at a slightly lessened dose until active symptoms subside. It is then given in smaller amounts (the so-called tonic dose) throughout the disease, the appearance of symptoms being the indication for increase of the dose. The patient is thus kept steadily under the influence of the drug until the end of the second year.

Others advise what is known as the symptomatic or opportunist method. This is based on the theory that specific treatment acts on luetic lesions, but not on syphilis itself, and that the results of treatment limited to the periods when the disease is actually manifesting itself are satisfactory. Each successive outbreak is regarded as a recrudescence of the disease and is vigorously treated; between "relapses" specific treatment is stopped and the administration of tonics substituted. In this way, it is claimed, the establishment of a tolerance to mercury does not occur. It is, however, quite untrue that mercury acts only on the symptoms of syphilis; and the opportunist method of treatment, besides being unsound in principle, is to be heartily condemned on account of its failures and disasters in practice.

The most rational plan, as well as the one which has given the best clinical results, both as regards the cure of secondary symptoms and the prevention of tertiarism, is the one advocated by Fournier. This is known as the method of chronic intermittent treatment. Syphilis is a specific infection continuously present, symptoms or no symptoms; but the stomach will not

stand mercury indefinitely, and the body, before long, renders mercurial treatment less and less effective by establishing a tolerance to it. For these reasons prolonged treatment, combined with regular periods of rest, is the most rational plan to pursue. The syphilitic patient, when first seen, is put on vigorous mercurial treatment for about two months. If no symptoms are present a rest of about four weeks is then given, when treatment is resumed whether symptoms are present or not. The second course lasts about six weeks and is followed by a second rest of two months. Medication is then resumed for six weeks and again suspended for several months, this plan being followed for three years. In this way four mercurial courses are given during the first year, three in the second, and two or three in the third. When the iodides are begun they should also be given intermittently, each course lasting about five weeks and being followed by at least a month's rest. This program is not, of course, absolute; in most instances the courses of mercury should be longer and the rest shorter than here advised; the details must be modified for the contingencies of particular cases; but the principle of chronic, prolonged, intermittent treatment must be adhered to.

Hallopeau has suggested that the scheme be modified by giving alternate courses of mercury and iodide; it is not necessary, he says, to abstain from all treatment during the required interruptions of mercurial treatment, and during these periods of rest the evolution of the disease should be attacked by iodides. It is particularly important that the treatment during the first mercurial course be vigorous, for there is evidence that energetic mercurialization at this time exerts a powerful modifying action on the future of the disease. It should also be emphasized that the method of Fournier makes it not only possible but essential that the mercury, when given, should be administered in strong therapeutic doses.

That the treatment should be prolonged is beyond all dispute; just how long it should be continued is matter for some disagreement. Of one thing there is no doubt: the closer acquaintance with the disease becomes, the more the time limit of treatment judged necessary for its cure is extended. Ricord, for instance, thought that six months' mercurial treatment followed by three months of iodides were enough; Fournier in 1873 advised two years of mercury, but later three or four years and, in some cases, even five or six; and this extension of time for treatment represents a general trend among those well informed on the subject. It seems safe to say that mercurial treatment should be continued (intermittently) at least three years; continuance for four years is not unwise, and is perhaps the safest plan. The iodides may be continued, in courses, a year or so longer, and there seems, indeed, no good reason why regular bi-yearly courses of iodides should not be taken indefinitely.

Serum Treatment.—This has been discussed above. The method, although promising, offers the physician at present no help in treatment.

Hereditary Syphilis.—The mercurialization of the mother during pregnancy has already been dwelt upon; it remains to consider the treatment of an hereditarily syphilitic infant. The child should, in the first place, be nursed by its mother whenever possible, both to avoid infecting other women and because the mortality among artificially fed luetic infants is enormous. The treatment of the mother, which is a fairly efficient treatment of the nursing infant, should be continued throughout lactation. If symptoms appear (coryza, marasmus, eruption) the child itself must be given mercury,

which is best administered in inunctions. About 10 grains of the mercurial ointment (for an infant a few weeks old) are smeared daily on the abdomen, under the binder. It is absorbed rapidly. Gray powder may also be used in doses of $\frac{1}{2}$ to 2 grains (0.003 to 0.12 gm.) thrice daily, given with sugar or milk. Mercurial baths (10 to 30 grains of corrosive sublimate to an ordinary baby's tub of water) may be employed, the child being "soaked" for ten to twenty minutes every other day. The local lesions may be treated with mild ointments; blue ointment mixed with 8 parts of vaselin is appropriate. It is particularly important to keep the child under observation during dentition and puberty.

CHAPTER XIII.

INFECTIOUS DISEASES OF DOUBTFUL NATURE.

By THOMAS R. BOGGS, M.D.

FEBRICULA.

Synonyms.—Ephemeral fever; febris herpetica; Leichteserkältungsfieber; simple continued fever; ardent fever.

Definition.—Under the above and many other titles is included a group of acute fevers characterized by a brief course of from one to several days and the absence of the diagnostic features of the specific infectious group.

Historical.—With the steadily increasing refinement of diagnostic methods and consequent sharper definition of diseases on an etiological basis this somewhat anomalous and indefinite group has undergone a constant and gradual contraction. The older writers devoted much space to its consideration under such names as synochus simplex, febris sanguinea, febris continua simplex and the like, including in it many cases of mild atypical typhus and typhoid fevers and others which we are no longer able to recognize. And it was only in the nineteenth century, following the work of Louis and his pupils and crystallized in the classic descriptions of Murchison, that this group was reduced to something like its present proportions. When all allowance has been made, however, for errors in diagnosis and aberration from type in specific fevers, there yet remains a number of cases which must be classified under one or another of the above titles.

Etiology.—The causative factors are varied and indefinite. It is, in fact, our ignorance of the relation of specific microörganisms or toxins to these cases which compels us to accept such a classification as the above.

In general it may be said that the young are particularly affected, the overwhelming majority of cases falling in the first two decades. The changeable seasons of the year show the greatest number of cases, while sudden exposure to great heat or excessive cold is frequently the determining factor. Vigorous persons of full habit more often suffer than those less robust.

Individual susceptibility plays undoubtedly an important role. There are many persons whose heat-regulating mechanism seems particularly unstable and in whom slight dietary indiscretions, emotional and intellectual excitement, or bodily fatigue, may be followed by a marked rise in temperature of greater or less duration, and, so far as we can determine, entirely unassociated with any localized infection or inflammation. It is this class perhaps which furnishes the best examples of the ephemeral fever in the stricter sense, that is, of only twenty-four to thirty-six hours' duration.

Abortive types of the acute infectious disorders are often necessarily classed as febricula in the absence of the characteristic features. Such

INTRODUCTION.

THE EVOLUTION OF INTERNAL MEDICINE.

By WILLIAM OSLER, M.D.

I.

SCARCELY twenty years have passed since the completion of Pepper's *System of Medicine.* The distinguished ability of its Editor and the important group of contributors with whom he was associated combined to produce a treatise which profoundly influenced medicine in America. Twenty years are a very brief space of time, but science has been progressing with extraordinary rapidity, sufficient to make even that important work out-of-date, though not in all particulars. As in Reynolds' *System*, in Virchow's *Handbuch*, and in von Ziemssen's *Encyclopedia*, so in that *System* there are articles which still retain their freshness, and must for many years be valuable for reference. Meanwhile in England Allbutt's *System*, now in a second edition, has proved a worthy successor to *Reynolds*. In Germany, where such publications are planned on a vast scale in comparison with the American and English works, the great *Handbuch* of Nothnagel, in twenty-four volumes, has just been completed; and a selection from the volumes is appearing in English dress. The days of the Encyclopedias in France appear to have passed, at any rate years have gone since the issue of the last volume of Dechambre; but the *Traité* of Charcot and Bouchard has passed through two editions, and there have been issued several works of a similar character, though on a less extensive scale. American publishers have shown no little enterprise in the same direction. The *System of Medicine*, by Loomis and Thompson (1897-1898); *The Twentieth Century Practice of Medicine* (1895-1900); Buck's *Reference Handbook*, second edition (1900-1904), and the American edition of selected volumes from Nothnagel's *System*, already referred to, have been of the greatest service to the profession.

The need for new works of this type is strongly emphasized by a comparison of the present volume with the first volume of Pepper's *System*. It seems scarcely credible that in so many directions in so short a time the entire outlook on the science of medicine can have been so revolutionized. To give three instances in illustration: our views on heredity have been profoundly modified by the studies of Weismann, Mendel, and others, and we are fortunate in *Modern Medicine* to have the subject presented by Professor Adami in so clear and attractive a manner that it will be most helpful to all students. In no direction has there been such progress as in our knowledge of the chemical processes of the body. At the same

time the necessarily imperfect state of organic chemistry has given an undue prominence to certain half-truths, and no department of medicine has lent itself more easily to pseudo-science. The elaborate sections by Professor Taylor and by Professor Chittenden illustrate how surely we are reaching a position of accurate and sound knowledge. More particularly is this the case with the complicated processes of normal metabolism, and we are in consequence better able to understand and study intelligently the perversions met with in disease. No articles in this volume are deserving of more careful study by all who wish to appreciate the new standpoint in physiological and pathological chemistry. In 1885 we had not realized clearly our position with regard to the infectious diseases. The extension of our knowledge of the causative agents of the acute infections has been followed by a study of the laws of immunity, which has not only revolutionized general pathology, but has also opened out new lines of treatment. Vaccines, antitoxins, curative sera of various kinds have been discovered, and with this rapid progress it is not astonishing that at times we have gone too fast and too far, and that there have been the disappointments and failures invariably associated with human endeavor, but these only serve to bring into sharper contrast the solid results which the labor of two decades has secured. No single advance is more striking than that relating to our knowledge of the protozoa as causes of disease. The brilliant researches of Theobald Smith on Texas fever were the first to make the profession appreciate the part which this class of organisms played in the acute infections, and gave, moreover, the demonstration of a scientific method and insight of a most remarkable character.

II.

Like other departments of philosophy, medicine began with an age of wonder. The accidents of disease and the features of death aroused surprise and stimulated interest, and a beginning was made when man first asked in astonishment, Why should these things be? Surrounded everywhere by mysteries, he projected his own personality into the world about him, and peopled heaven and earth with Powers, responsible alike for the good and for the evil, who were to be propitiated by sacrifices or placated by prayers. Satisfying the inborn longing of the human mind for an explanation, these celestial creatures of his handiwork presided over every action of his life. For countless ages man regarded disease as a manifestation of these powers; the evil eye and demoniacal possession, the murrain on the cattle, and the sickness that destroyeth in the noonday had alike a supernatural origin. Crude and bizarre among the primitive nations, these ideas of disease received among the Greeks and Romans a practical development worthy of these great peoples. There have been systems of so-called divine healing in all the great civilizations, but, for beauty of conception and for grandeur of detail in the execution, all are as nothing in comparison with the cult of the Son of Apollo, of Æsculapius, the God of healing. To him were raised superb structures which were filled with the most sublime products of Greek art, and which were at once temples and sanatoria. Among the most important

were those of Cos, Cnidos, Epidaurus, Croton, Cyrene and Rhodes.
The elaborate ritual of the cure is well described in the *Plutus* of
Aristophanes. Real cures were often effected and the inscriptions tell
of the touching and simple faith which, then as now, forms so impor-
tant a factor in the healing of many diseases. In other cases change
of air and scene, the baths, and massage effected a cure. Hypnotism (?),
diet, gymnastic exercises, and games formed part of the treatment.
In dreams which came in the "temple sleep" the god indicated the special
treatment to be carried out. These temples were really sacred sanatoria
situate in beautiful localities and greatly resorted to by people of all
classes. At first they appear to have had close associations with the
secular medicine of the day and to have represented depositories of
empirical knowledge, but later they become hot-beds of jugglery and
deception.

Scientific medicine, the product of a union of religion with philosophy,
had its origin in a remarkable conjunction of gifts and conditions among
the Greeks in the fifth and sixth centuries. "There was the teeming
wealth of constructive imagination united with the sleepless, critical
spirit which shrank from no test of authority; there was the most powerful
impulse to generalization coupled with the sharpest faculty for descrying
and distinguishing the finest shades of phenomenal peculiarity; there
was the religion of Hellas, which afforded complete satisfaction to the
requirements of sentiment, and yet left the intelligence free to perform its
destructive work; there were the political conditions of a number of
rival centres of intellect, of a friction of forces excluding the possibility of
stagnation, and, finally, of an order of state and society strict enough to
curb the excesses of 'children crying for the moon,' and elastic enough
not to hamper the soaring flight of superior minds. We have already
made acquaintance with two of the sources from which the spirit of
criticism derived its nourishment, the metaphysical and dialectical
discussions practised by the Eleatic philosophers and the semi-historical
method which was applied to the myths by Hecatæus and Herodotus.
A third source is to be traced to the schools of the physicians. These
aimed at eliminating the arbitrary element from the view and knowledge
of nature, the beginnings of which were bound up with it in a greater or
less degree, though practically without exception and by the force of an
inner necessity. A knowledge of medicine was destined to correct that
defect, and we shall mark the growth of its most precious fruits in the
increased power of observation and the counterpoise it offered to hasty
generalizations, as well as in the confidence which learned to reject unten-
able fictions, whether produced by luxuriant imagination or by *a priori*
speculations, on the similar ground of self-reliant sense perception."[1]

Greek medicine did not originate with Hippocrates, who in reality
represents to us the embodiment of a period in which he only forms the
most striking figure. As he remarks in the book *On Ancient Medicine,*
"but all these requisites belong of old to medicine, and an origin and
way have been found out by which many and elegant discoveries have
been made during a length of time, and others will yet be found out, if
a person possessed of the proper ability, and knowing these discoveries

---

[1] Gomperz, *Greek Thinkers*, vol. i.

which have been made, should proceed from them to prosecute his investigations."[1]   At the two most famous of the Æsculapian temples, Cnidos and Cos, rational medicine began to develop about the sixth century B.C.   "It was not the priests who were the pioneers of progress, but the temple doctors, the so-called Asclepiads, who in historic times had a very slight connection with the cult, possibly none whatever, and were free to practise their calling, at their own discretion, outside the sacred precincts or even in foreign countries.   In any case in the century immediately preceding the time of Hippocrates, the Asclepiads of Cnidos or Cos were only a sharply defined group of Greek doctors, distinguished from the rest by a rigid organization which found expression in definite rules and formalities.   These had for their object to incorporate in the guild of Asklepios those only who, closely united by their common veneration of the god of healing, and by similar scientific opinions, made it their goal to excel in the practice of medicine.   They bound themselves by oath to maintain the dignity of the art, to preserve a high morality in the practice of their calling, to show gratitude toward their teachers, fraternal feeling toward the offspring of those teachers, and to guard against profanation of the secrets of their profession."[2]

The view of disease in the Hippocratic writings shows how strong was the influence of the philosophers, particularly of Empedocles and Pythagoras.   As in the *Macrocosm* there were four elements, fire, air, earth, and water, so in man, the *Microcosm*, there were four elements, blood, mucus, yellow bile, and black bile, of which the blood represented the heat, the mucus the cold, the yellow bile the dryness, the black bile the moisture.   Health consisted in a harmony or due admixture of these humors, disease in a dyscrasia or imperfect admixture.   This humoral pathology of the Hippocratic school dominated the profession for more than two thousand years.   From Pythagoras may be traced directly the doctrine of critical days, which still lingers in the profession and of which one hears among the laity.   Hippocrates introduced into medicine the art of observation, the critical judgment of observed facts, and a rational induction from them, freed from speculation and theory.   This has been the objective, practical method followed since his day by all the great masters of medicine, and it has been the instrument by which we have obtained our descriptive knowledge of disease.   Briefly stated, from the Greeks we obtained in the first place the conception of medicine as an art based on careful observation, and as a science an integral part of the science of man and of nature; and, secondly, those high moral ideals which have always inspired the profession, so well expressed in the Hippocratic oath, which has been called one of the most memorable of human documents.

After the death of Hippocrates Greek medicine continued to flourish under the Macedonian *régime*, and at Alexandria, with the fostering care of the Ptolemies, reached a very high plane.   Anatomy and physiology, in particular, were studied with the greatest care and many important discoveries were made, particularly by Herophilus and Erasistratus.

[1] This is brought out very clearly in Mollet's *La Médecine che: les Grecs avant Hippocrate*, 1906.
[2] Neuberger, *Geschichte der Medizin*, vol. i.

Had we full knowledge of the writings of these two great physicians we should probably find that they had made many valuable observations in clinical medicine and pathology. For example, Erasistratus described ascites with great care, and knew of its associations with hardening of the liver and disease of the spleen.

In the intellectual capture of Rome by the Greeks, medicine played a not inconsiderable part, and Greek physicians rose to positions of dignity and importance which have rarely since been equalled in any country or at any period by the leaders of our profession. One of these, Asclepiades, the founder of the school of Methodists, opposed the prevailing humoral pathology and placed the changes met with in diseases largely in the solids of the body. The Methodists made no special contribution to diagnosis, but Asclepiades seems to have been a shrewd and careful physician, placing greater stress upon exercise, baths, massage, and diet than upon the treatment of disease by medicines. The centuries immediately preceding and following the birth of Christ saw medicine flourish remarkably throughout the Roman world. In addition to the Methodists there were the Dogmatists, the Eclectics, the Pneumatists, from none of whom did medicine receive any very fertile contributions. Clinically one of the most interesting figures of this period is Aretæus, whose works have a strong Hippocratic flavor and whose clinical pictures of disease have rarely been equalled. The student who wishes to get a picture of Greco-Roman medicine of this period should read, on the one hand, Celsus, who gives a remarkable summary of the medical and surgical knowledge of the day, and, on the other, Pliny, whose descriptions abound with the fads and fancies of popular medicine.

The great Greek practitioner of the period, and in some ways the greatest figure in the history of medicine, is Galen, who was born in Pergamos about the year A.D. 130. He lived only for part of his life in Rome, where he was the physician to successive emperors and occupied a position of commanding dignity. In every department of medicine this remarkable man was a reformer and an innovator. In opposition to the prevailing views of the Empirics and the Methodists, he placed the whole foundation of the art in anatomy and physiology. He restored the Hippocratic methods and the humoral pathology of the master. Galen's researches in anatomy were of the most extensive character, and in this subject, as well as upon the nature and treatment of disease, his views were accepted as gospel until the Renaissance. The four humors were somewhat modified by him under the influence of the Pneumatics, who introduced the doctrine of the spirits—animal, natural, and vital— which so long held sway. The special interest to us here is that to him may be traced the second great instrument which has influenced the advance of clinical medicine, namely, experiment. He was the first great experimental clinician. We owe to him elaborate studies upon the action of the heart, and he narrowly missed discovering the general circulation of the blood. He made careful observations on the physiology of respiration, and recognized the difference between diaphragmatic and intercostal breathing. By experiments on the nervous system he demonstrated the differences between the motor and the sensory nerves, and even distinguished the motor and sensory roots leaving the spinal cord. In these and other studies he far eclipsed his predecessors, and as an

experimenter he had no successor of the same calibre until Harvey. In treatment he was a follower of Hippocrates, trusting to nature, and both diet and gymnastics played an important role in his system. Greek medicine had now reached its climax, and with Galen the first great chapter in the history of scientific medicine closes. It is one of the most remarkable and in a way an inexplicable feature in history that, having made a beginning of such brilliancy, the scientific study of disease should have made little or no progress for the next fourteen or fifteen centuries. Into the causes of this sterility this is not the place to inquire. During the long period three great names ruled all minds, Ptolemy, Aristotle, and Galen, and men were content to accept the geographic system of the one, the natural history and philosophy of the other, while the infallibility of the great Pergamite became the first article of belief among all practitioners of medicine.

Through the middle ages the continuity of Greek medicine was maintained, first, by the writers of the Byzantine school, whose works are of value chiefly as compilations, of which those of Oribasius and Paul of Ægina are the most important; and secondly, by the Arabians, who came in contact with Greek medicine in the East and in Egypt. For them Aristotle and Galen were the great masters, but departing from the plain methods of observation and induction, Arabian writers rejoiced in dogmatism and subtle dialectics. They introduced a new pharmacy with many new drugs from the East, and with them came many new chemical processes. Sadly mixed as it was with alchemy, in their crude science we find the germs of modern chemistry. Some of the Arabians became great clinicians and made notable and accurate contributions to clinical medicine. To Rhazes we owe the first good account of smallpox. They also recognized measles. Avicenna became the greatest name in Arabian medicine, and throughout the latter part of the middle ages his authority rivalled that of Galen. There was a third narrow stream through which Greek medicine was preserved, namely, the old Universities, and particularly the school of Salernum in Southern Italy. In the early middle ages, from the tenth to the twelfth centuries, it maintained the Greek tradition and was recognized as the leading school of medicine in Europe. Though its derivation is unknown, the school possessed a continuity in thought with the old Greek writers. Later the school of Salernum became tinctured with Arabian medicine, but through it the writings of Galen and Hippocrates, mixed with the accretions from Arabian sources, filtered into modern Europe.

Practically throughout the middle ages there was no such thing as an accurate study of clinical medicine. In what is known as the scholastic period, the three centuries before the Renaissance, authority and dogma ruled supreme, and philosophy and medicine alike were a confused jumble of Greek and Arabian authorities. The Renaissance influenced clinical medicine in three ways: First, it restored once and for all the methods of Hippocrates and of Galen. The careful study of descriptive anatomy by Vesalius and his successors restored to men the lost art of clear, independent vision. Secondly, in the revolt against dogmatism and authority a new chemistry arose, at first, in the hands of Paracelsus and others, crude and unscientific, yet it laid the foundation for all our subsequent studies, and through van Helmont and the seventeenth

century chemists has led to the present most fruitful results. Thirdly, we may trace as a direct effect of the Renaissance the revival of experiment in medicine which had been introduced by Galen. The work on metabolism by Sanctorius, and the demonstration by Harvey of the circulation of the blood gave an immense impetus to the scientific investigation of the functions of the body and of the causes of disease. It cannot be said that Harvey's work had any very special influence on clinical medicine except in conjunction with the mechanical philosophy of Descartes and the foundation of the so-called iatro-mechanical school. How little actual progress had been made in clinical medicine is illustrated by what a leading practitioner, Willis, in the middle of the seventeenth century thought of such a disease as inflammation of the lungs. The essential cause was believed to be that the blood boiled feverishly, and "sticking within the more narrow passages of the lungs engendered there an obstruction causing inflammation." Neither in the description of the symptoms nor in the discussion of the prognosis is there any radical advance upon the position of Hippocrates and of Galen. A case, the particulars of which he gives, shows the heroic character of the treatment: "I drew blood twice or thrice day after day." "Frequent clysters were administered; moreover, apozems, juleps, also spirits of ammoniac and powder of fish shells were administered by turns," When phlebotomy was no longer safe very large blisters were applied to the arms and thighs. One is surprised to learn that the patient recovered, but he suffered greatly from the blisters which did "run hugely and afterwards for almost a month daily discharged great plenty of a most sharp ichor."

III.

Not truly scientific and uninfluenced by his friends, Boyle and Locke, (who appreciated fully the importance of the scientific movement of the day), Sydenham restored in a measure the practical methods of the Hippocratic school, careful observation, guided by common sense. If to that remarkable conception of diseases as objects of study and classification, as in the subjects of botany and natural history, Sydenham had added the methods of Harvey, experiment and postmortem observation, the real revolution in clinical medicine might not have had to wait until the beginning of the nineteenth century. A prince among practical physicians, the limitations imposed upon himself restricted his view, and Sydenham never got to the "seats and causes of disease" as did his great successor, Morgagni; but as a portrayer of their objective features he has had few equals, and in this he even bettered the instruction of his master, Hippocrates. In his study of fevers Sydenham displayed a remarkable independence, not more in the graphic pictures which he has left us than in his insistence upon the importance of a knowledge of their natural history as a basis of rational treatment. That he was led away by too great belief in an epidemic constitution was only to be expected in so close a follower of Hippocrates. No one before him had so clearly grasped the conception that the manifestations of a fever represented the efforts of nature to get rid of the injurious agents causing the disease. Many of his descriptions of chronic diseases have never been surpassed, and his

account of chorea, of hysteria, and of gout have become classical in the literature. But it was in treatment that he showed a still more revolutionary spirit. He had a supreme faith in nature as the true healer, to whom the physician played a secondary part, assisting her when she was feeble, restraining her when excessive and violent. That many diseases got well if left to themselves was a novel doctrine in the seventeenth century. But it was in his new method of treating fever, and particularly smallpox, by cooling measures, plenty of drink and fresh air, that he departed most strongly from the practice of his day and achieved signal success. One of the most interesting figures in the history of clinical medicine, Sydenham has impressed his method on his countrymen, who have always cared less for the theoretical conceptions than for the practical, common-sense aspects in the consideration of disease. Several of Sydenham's contemporaries in England were keen clinical physicians who have left on record valuable contributions to medicine. Glisson in particular may be mentioned as a man in whom were combined the anatomical and clinical features so characteristic of the teachers of this period. His treatise, *de Rachidide*, 1650, is the first extensive monograph on a single disease published in England (Caius' *Sweating Sickness*, published a century earlier, had not the same ambitious scope). Not only are the clinical aspects of the disease given in great detail, but the morbid anatomy and the etiology also are fully discussed. Morton, too, was an admirable systematic writer and his works *Pyretologia* (1692) and *Phthisiologia* (1689) show accurate study, and the subjects are presented in a more orderly and logical way than in the writings of Sydenham.

Brilliant and even revolutionary as was the work of this small group of English physicians, it did not immediately influence the progress of clinical medicine until the advent of the Dutch Hippocrates, Boerhaave, upon whom fell the mantle of Sydenham. But meanwhile there had arisen on the Continent the iatro-physical school, based upon the mechanical conceptions of the Cartesian philosophy and supported by the experiments of Sanctorius, of Harvey, of Borrelli and others. Silvius, of Leyden, and Pitcairn, Mead and Friend were the chief exponents of this system, in which everything was explained in terms of mathematical reasoning; and while it did good service in combating the dominant doctrine of the humors, the extravagance of its professors hastened the downfall of a school which, after all, rested on a strong basis of truth.

As with nearly everything of value in the practical aspects of modern life, agriculture, horticulture, banking, colonization, etc., so in clinical medicine the Dutch were our masters. The great Italian teachers of the sixteenth and seventeenth centuries were also practitioners, and there must have been some instruction in the art as well as in the science of medicine, but it was everywhere desultory and unsystematic until the Dutch physicians organized regular clinical instruction as part of the University teaching. Professor Pell tells me that the hospital clinic at Utrecht preceded that at Leyden, but it was at this latter place, under the influence of Boerhaave, that it became most effective. The history of this University illustrates the importance of men in forming an educational centre; students flocked to it from all parts of Europe to sit at the feet of such teachers as Silvius, Grotius, the younger Scaliger, Bidloo, and Pitcairn. After teaching botany and chemistry, Boerhaave succeeded

to the chair of physic in 1714. With an unusually wide general training, a profound knowledge of the chemistry of the day, and an accurate acquaintance with all aspects of the history of the profession, he had a strongly objective attitude of mind toward disease, following closely the methods of Hippocrates and Sydenham. He adopted no special system, but studied disease as one of the phenomena of nature. His clinical lectures, held bi-weekly, became exceedingly popular and were made attractive not less by the accuracy and care with which the cases were studied than by the freedom from fanciful doctrines and the frank honesty of the man. He was much greater than his published work would indicate, and, as is the case with many teachers of the first rank, his greatest contributions were his pupils. No teacher of modern times has had such a following. Among his favorite pupils may be mentioned Haller, the physiologist, and van Swieten, the founder of the Vienna school.

Edinburgh had had very close affiliations with Leyden, and one of Boerhaave's predecessors was Archibald Pitcairn, who subsequently returned to his native city and had an important influence in building up the university, the medical school of which was not organized until 1726. The Leyden methods of instruction were introduced by pupils of Boerhaave, of whom John Rutherford was the most distinguished. He began to teach at the Royal Infirmary in 1747. I have a manuscript of his clinical lectures delivered in the winter session of 1748–49, from which we may get a good idea of his plan of teaching. He says: "The method I propose to pursue is, to examine every patient before you, lest any circumstances should be overlooked. I shall undertake this by a plan which will be the most useful I can think of. I shall give you the history of his disease in general; secondly, inquire into the cause of it, and, thirdly, give you my opinion how the disease is likely to terminate and lay down the indication of cure, or when any extraordinary symptoms arise you shall have notice of it that you may see the reason of altering my prescriptions."

Those were happy days for the medical student, as a few paragraphs later he says: "I do not mean by this that you should all take degrees, for I am far from thinking that a diploma furnishes a man with medical knowledge. His improvement in this art depends on his own study and industry." Three, four, and even five patients were shown on the same day, and great care was taken to keep the students informed of the progress of patients who had been seen by them. Weeks afterward a memorandum is given, perhaps, of the postmortem. The history, the symptoms, and the prognosis are very well considered, but one misses the physical examination and an accurate consideration of the pathology and morbid anatomy. Groups of cases were considered together, as illustrated by Lecture 23, in which a series of cases of scurvy, that had been "in the house," were considered together.

Directly inspired from Leyden, the Edinburgh school soon outstripped all its compeers. In the main thoroughly practical and objective, as witnessed, for example, in the work of Whytt, it illustrated also the speculative nature of the Scottish character in two systems of medicine which had great vogue. Cullen, who was Whytt's successor in the chair of institutes, became the most prominent teacher of medicine in his day in

the English-speaking world. He was a most inspiring lecturer and a thoroughly good clinical teacher. While, perhaps, it is scarcely correct to say that he introduced a system, yet he was the first to attach special importance to the nervous system as influencing disease. A more definite system, comparable with the older ones which prevailed on the Continent in the seventeenth and eighteenth centuries, was the Brunonian, introduced by John Brown, a pupil of Cullen. The essence of this consisted in an insistence upon debility as the fundamental factor in disease, and the necessity of always maintaining a supporting line of treatment. Few systems of medicine have ever stirred such bitter controversy, and in Charles Creighton's account of Brown[1] we read that as late as 1802 the University of Göttingen was so convulsed by controversies on the merits of the Brunonian system that contending factions of students in enormous numbers, not unaided by the professors, met in combat in the streets on two consecutive days and had to be dispersed by a troop of Hanoverian horse.

In England and the colonies the influence of the Edinburgh school became supreme. London had no properly organized medical teaching. In the hospitals the surgeons gave good instruction and there was an admirable system of pupils and dressers. But to medicine proper little or no attention had been paid. One of the physicians of the hospital lectured on medicine, materia medica, and chemistry, chiefly to men who were to become apothecaries or general practitioners. To take the M.D. degree, men had to go to Edinburgh or abroad, or they took the Oxford or Cambridge M.D., after keeping a certain number of terms. Throughout the eighteenth century the methods and practice of Boerhaave had great influence in London. Many of the Fellows of the College of Physicians had been his pupils. His works were translated and frequently reprinted, but, without university organization and without systematic instruction, the clinical teaching was carried on in a very desultory manner. Toward the end of the century several men trained in Edinburgh methods became distinguished teachers and workers in the London hospitals, of whom William Saunders may be taken as an example. A pupil of Cullen, he became in 1770 physician to Guy's Hospital and at once began to lecture upon medicine and to give clinical instruction. He was a hard worker and a keen clinical observer, as his papers on lead colic, on the diseases of the liver, and on delirium tremens amply testify. Gilbert Blane and Matthew Baillie were both Glasgow men. The latter, a graduate of Oxford, was the best clinical physician of his day in London, but no doubt he got most of his pathological and clinical training from his uncles, William and John Hunter. Fothergill and Lettsom, Halford, Holland, Bright, Paris, Humphry Davy, Caleb Parry, and Marshall Hall were Edinburgh men.

To Edinburgh all the abler young men from the English colonies went for their medical education. Bard, Morgan, Shippen, Rush, Wistar, Hossack and others brought back to America the traditions and methods of its schools; and it was not until the third decade of the nineteenth century that the tide of students turned toward France. Early in that decade it was a group of young Edinburgh men, Holmes, Robertson,

[1] *Dictionary of National Biography.*

Stevenson, and Caldwell, who began medical instruction in Montreal, from which originated the Medical Faculty of McGill College.

Boerhaave and his pupils extended the range of observation and in a measure restored to medicine that robust common sense which had been the distinguishing feature of both Hippocrates and Sydenham. At the end of the eighteenth century men were floundering in a sea of speculation and there was no definiteness in diagnosis nor any safe basis for treatment. The next great step came from an extension of the Hippocratic method to the dead-house, the study of morbid anatomy in association with clinical observation.

IV.

Many of the sixteenth and seventeenth century physicians had keen appreciation of the value of postmortem examinations. Harvey has a most interesting paragraph on the subject,[1] and his works testify to the zeal with which he sought for the more hidden causes of disease; but with no one in the seventeenth century did morbid anatomy become a life study, and no one had realized its true position in the science of medicine until Morgagni (1683–1771) published the *De Sedibus et Causis Morborum per Anatomen Indagatis* (1761). Others before this date had made interesting collections of cases: Ridley in England, and Bonetus of Geneva, who published the *Sepulcretum Anatomicum* in 1679. Valuable as is this great work, it had not the profound influence of the *De Sedibus*, as it was a collection of cases from the literature, and lacked that freshness and interest which Morgagni was able to give to his reports. In them for the first time we find a careful clinical study of the symptoms of disease and an equally careful examination of the organs after death. It was the novelty of the mode of presentation quite as much as the vivid picture of disease that made Morgagni's work mark an epoch in the history of clinical medicine. Even today it is a storehouse of valuable facts, and several of the sections, more particularly that on the heart and bloodvessels, are so rich in original descriptions that no man's education in morbid anatomy can be said to be complete without an acquaintance with its pages. The example of the great Italian was soon followed in other countries, particularly in England and in France. John Hunter, with his insatiable hunger for knowledge of all sorts, was equally great as a morbid- and as a comparative anatomist. The Hunterian specimens in the great Museum at Lincoln's Inn Fields bear witness to the accuracy of his descriptions, to the insistence, when possible, upon clinical details, and to the keen appreciation which he had of the importance of the study of morbid anatomy in the education of medical men. His brother William, also an enthusiastic student of morbid anatomy, formed an important collection, and the specimens and notes in his museum, now at Glasgow, show that he too was alive to the value

---

[1] "The examination of a single body of one who has died of tabes or some other disease of long standing, or poisonous nature, is of more service to medicine than the dissection of the bodies of ten men who have been hanged." Letter to Riolan.

of the new method of combining clinical with anatomical work. Matthew Baillie, their nephew, gave to the world the fruits of their researches, combined with his own, in the *Morbid Anatomy* published in 1793 and followed in 1799 by his well-known *Atlas*. Texts and plates, alike admirable, formed the most important contribution to practical medicine made in England during the eighteenth century, if we exclude Jenner's vaccinations. The *Series of Engravings* was the first of its kind to be published, and the accuracy of the drawings and the careful descriptions made it for years a standard work, and indeed the plates may still be used in illustrating lectures. But the new science reached its fullest development in France, and helped to promote the revolution in clinical medicine which was effected in that country during the first three decades of the nineteenth century. To the school of Bichat, who was essentially a morbid anatomist, we owe the fruitful studies which gave us our modern outlook on the processes of disease. Corvisart and Bayle, Broussais, Laennec, Louis, Chomel, and Andral revived *Das Anatomischen Denken* (Virchow) of Morgagni.

With the old Hippocratic method, however, which had been used for centuries, and which Morgagni had simply transferred from the bedside to the dead-house, it would have been impossible to get beyond the great Italian. Hitherto the sense of sight had dominated in the examination of the patient, supplemented to some extent by the sense of touch. Now the hand and ear were to take an equal share, and the eye was to have its powers enormously extended by the use of the microscope. From the *Inventum Novum* of Auenbrugger (1761) we may date the introduction of modern clinical methods into medicine. His discovery illustrates the fate of a truth announced prematurely. The time was not ripe, and the art of percussion had to await the keen mind of Corvisart before its importance was recognized. The greatest stimulus ever given to internal medicine was the discovery of auscultation by Laennec, whose work *L'Auscultation Médiate* (1819) not merely introduced a new method, but was also a treatise on diseases of the heart and lungs, combining the results of clinical study and anatomical investigation. With this book began an entirely new era in medicine. Rich in the descriptions of diseases hitherto unrecognized and unrecognizable, this immortal work not only placed a new and powerful method in the hands of physicians, but also gave an enormous stimulus to the study of internal diseases. The researches of Louis correlated the symptoms and physical signs with the anatomical appearances in pulmonary tuberculosis and in typhoid fever. Chomel, Andral, Bretonneau, Rayer, Piorry, Cruveilhier and others caught the new spirit and made Paris the centre of medical instruction for the whole world. This revolution in internal medicine was effected simply by an extension of the Hippocratic method from the bedside to the dead-house and by the correlation of the signs and symptoms of a disease with its anatomical appearances. It was by this method that Richard Bright opened up an entirely new chapter in his studies on the relation of disease of the kidneys to dropsy and to albuminous urine. It had already been shown by Blackwell and by Wells, the celebrated Charleston (S. C.) physician, that the urine contained albumin in many cases of dropsy, but it was not until Bright began a careful investigation of the bodies of patients who had presented these symptoms, that he discovered the

association of various forms of disease of the kidney with anasarca and albuminous urine. In no direction was the harvest of this combined study more abundant than in the complicated and confused subject of fever. The work of Louis and of his pupils, W. W. Gerhard and others, revealed the distinction between typhus and typhoid fever, and so cleared up one of the most obscure problems in pathology.

Throughout the nineteenth century this clinico-pathological investigation of disease has widened enormously our diagnostic powers, and the physician today who wishes to obtain a sound knowledge of the natural history of disease must adopt Morgagni's method of "anatomical thinking." Skoda in Vienna, Schoenlein in Berlin, Graves and Stokes in Dublin, Marshall Hall, C. J. B. Williams, and many others introduced the new and exact methods of the French and created a new clinical medicine. A very strong impetus was given by the researches of Virchow on cellular pathology, which removed the seat of disease from the tissues, as taught by Bichat, to the individual elements, the cells. The introduction of the use of the microscope in clinical work widened greatly our powers of diagnosis, and we obtained thereby a very much clearer conception of the actual processes of disease. In another way, too, medicine was greatly helped by the rise of experimental pathology, which had been introduced by John Hunter, was carried along by Magendie and others, and reached its culmination in the epoch-making researches of Claude Bernard. Not only were valuable studies made on the action of drugs, but also our knowledge of cardiac pathology was revolutionized by the work of Traube, Cohnheim, and others. In no direction did the experimental method effect such a revolution as in our knowledge of the functions of the brain. Clinical neurology, which had received a great impetus by the studies of Todd, Romberg, Lockhart, Clarke, Duchenne and Weir Mitchell, was completely revolutionized by the experimental work of Hitzig, Fritsch and Ferrier. Under Charcot the school of French neurologists gave great accuracy to the diagnosis of obscure affections of the brain and spinal cord, and the combined results of the new anatomical, physiological, and experimental work have rendered clear and definite what was formerly the most obscure and complicated section of internal medicine.

The latter part of the nineteenth century saw a complete revolution in our conception of the etiology of infectious diseases. The idea of a *contagium vivum*, of a living agent which multiplied in the body and caused the symptoms of disease, had long been entertained, and the analogies between the fermentation of fluids and disease had been frequently suggested. The brilliant researches of Pasteur placed the bacterial origin of certain diseases on a firm scientific basis. Grasping the idea that the putrefactive and suppurative processes in wounds were due to bacteria, Lister revolutionized surgery, and has made possible operations which have widened enormously the work of surgeons, with a result that today our art is more medico-chirurgical than it has ever been before. But the full importance of the new studies was not realized until Robert Koch discovered in rapid succession the causes of several of the most destructive of epidemic diseases. Then with Laveran's description of the malarial parasite came the recognition of the importance of protozoa as causes of disease. All this work has modified clinical medicine in several important directions. The detection of specific parasites has been

a great help to diagnosis, as, for example, in tuberculosis. The knowledge of the precise etiology has enabled us to take intelligent precautions for the prevention of the disease, and the measures for sanitary control of the acute infections have been strengthened a hundredfold by the studies of the past quarter of a century. In another direction the new science has had a most fruitful application. With the introduction of vaccination against smallpox, Jenner laid the foundation for the modern work, still only in its beginnings, which deals with vaccines, antitoxins, and curative sera. When one considers the comparatively short space of time which has elapsed since Koch's discovery of the tubercle bacillus, we may be grateful that so much has been accomplished, and in spite of many disappointments the situation is one full of hope for the future.

However produced, the ultimate processes of disease represent chemical changes in the fluids and tissues of the body, and in this direction, too, the advances of the past half-century have had a profound influence on clinical medicine. Our knowledge of normal metabolism has progressed with startling rapidity and warrants the belief that before long we shall have a safe platform from which to investigate "to a finish" such serious perversions as are present in gout, diabetes, etc. Already the studies upon internal secretions have not only given us a clear conception of the functions of certain organs, but have also enabled us to treat successfully such otherwise incurable maladies as myxœdema. From the new science of physical chemistry much may be expected, and one of the most encouraging signs is the increasing attention paid by the younger physicians to problems which demand the most accurate chemical technique. In the immediate future it is along chemical lines that we may look for the greatest advance, and of this there is no more satisfactory indication than the simultaneous appearance quite recently in England and the United States of journals devoted to biochemistry.

V.

A work of the scope of the present one has a very different value to different persons. It is designed primarily for the practitioner who wishes to keep himself informed of the existing state of our knowledge in clinical medicine. Elaborate discussions upon doubtful problems have been avoided, and, as far as possible, a clear statement is given without unnecessary references to the literature. Authors have been selected who are acknowledged authorities, and while it is not always easy for a writer who is saturated, so to speak, with his subject to keep within limits, and to remember the practical character of the men for whom he is writing, I hope we have been able to keep an even balance between the condensation of the text-book and the elaborate treatment of the monograph. The first consideration in a work of this kind is that it shall be helpful. To fulfil this requirement we have had sometimes to introduce matter which may seem foreign to a system of medicine. A section on Protozoa, for example, such as that given by Professor Calkins, is indispensable for the appreciation of the importance of this class of parasites, and in a brief article written for the purpose the practitioner will get information of a character better suited to his needs

than from a manual of zoölogy. So, too, for the study and prevention of malaria and of yellow fever a knowledge of the structure, varieties, and life history of the mosquito is necessary, but the most recent information of this sort is not easily to be had from ordinarily procurable books.

There are several ways in which a work of this kind may be most helpful to a man in general practice. It may put him on the right course and give him his bearings when he has been blown about without compass by every wind of doctrine. For instance, studied carefully, the masterly presentation of the subject of Auto-intoxication by Dr. Taylor, in the present volume, will give him the "light and leading" necessary for an intelligent appreciation of one of the most complex and confused departments of medicine. While much remains to be done, we have enough positive knowledge to enable us to approach the clinical side of the question in an intelligent manner, unburdened from much of the nonsense of the auto-intoxication propaganda of the past twenty years. Accurate clinical investigation must accompany chemical research, and, while the two cannot often be combined by a man in active practice, there is no reason why he should not appreciate the problem with sufficient clearness to enable him to furnish unbiased observations of the greatest value and to give to his patients the benefit of the most advanced scientific knowledge. Since upon diet more than upon any other single factor depends the health of the community, it behooves every physician to give to this subject his closest attention. In fully one-half of the patients he is called upon to treat, indigestion plays a most important role, and this may be traced to improper food, improper methods of preparation, or to faulty habits of eating. The real difficulty is less with the profession than in getting the public to carry out certain plain and well-recognized rules. The Yale studies bring into prominence the importance of new views which will appeal strongly to physicians who have long held that we all take too much food and particularly too much meat. From the important section on Metabolism by Professors Chittenden and Mendel the practitioner will get the scientific data upon which he may base rational plans of dietetic treatment in many diseases, and much information of the greatest use in his incessant propaganda against the gastronomic follies of the public. In these and in other sections the authors will be found to have simplified the abstruse and complicated knowledge of the chemical laboratories, and to have presented it in a form readily assimilable by the men who have to use it. Such, I believe, is the chief function of a system of medicine.

VI.

It cannot be too often or too forcibly brought home to us that the hope of the profession is with the men who do its daily work in general practice. Our labors are in vain—all the manifold contributions of science, the incessant researches into the complex problems of life, normal and perverted, the profound and far-reaching conclusions of the thinkers and originators—all these are *Nehushtan*, sounding brass and tinkling cymbals, unless they result in making men better able to fight the battle against disease, better equipped for their ministry of healing. Gradually, often

insensibly, tne practical advances of the laboratory and of the hospital reach the men with whom, after all, rests the final testing of all our efforts. The work in practical sanitation, the last word in the prevention of disease, the carrying out new methods of treatment, the exchange of the old accoutrements for the new weapons and the new methods of warfare, these rest with the rank and file of the profession who make effective and translate into practice the new knowledge.

The medical journals, the medical societies, the post-graduate schools all help in this good work, and both the profession and the public now appreciate how important it is that physicians should keep well abreast of the times. The difficulty lies often with the individual men who fall into routine and slovenly habits of practice, and who never get more than a superficial smattering of the science and of the art of medicine. Even the most industrious and ambitious, absorbed in a limited field, find it hard to get new life into the old material, and, confronted on all sides by difficult problems which press for solution, they turn for aid to the men who have made these problems their special study, and it is in such works as the present that these teachers and workers embody or codify, so to speak, the current knowledge of the day.

After all, the important question for each young man to ask himself as he begins practice is: How can I carry on my education so as to get the best possible returns out of life and do the best that is in my power for my fellow-creatures? There are several cardinal defects which stand in the way of the evolution of the sound clinical practitioner: *Lack of preliminary practical training.* The medical curriculum is not yet so arranged as to give our young men enough clinical work in their senior years. So full and complicated has the course become that it is very hard for the teachers to adjust it to the new conditions. We ask too much, and expect too much, of the student; but if we could have him properly prepared at the schools and colleges, if everywhere the preliminary sciences were taught *outside* the medical school, there would be no difficulty in giving a man in four years a good start in his profession, and this is all that the best of teachers in the best of medical schools can do for him. In our well-organized physiological, anatomical, histological, embryological, chemical (physiological), pharmacological, and pathological laboratories the teaching has become more and more thorough and practical, but when we come to the "bread and butter" subjects we are not always prepared to give teaching of the same character. The hospitals and dispensaries are numerous enough, and there is no lack of patients; but there is not that constant, close, personal contact of student with patient in which alone the art of medicine can be learned. There is not that control of hospitals by the universities necessary to ensure proper facilities for students, nor are the arrangements of the hospitals always such as to meet the demands of modern clinical work. There is still too much theoretical teaching for senior students, and in a majority of the schools the number of teachers in medicine, surgery, obstetrics and the specialties is wholly inadequate. In only a few hospitals is the out-patient department arranged for clinical teaching, and the clinical laboratory is not everywhere recognized as a *sine qua non.* If we could turn our third and fourth year students into the hospitals and make them part and parcel of its machinery (just as much as the nurses who have

usurped, I fear, some of their duties, and have advantages that they do
not possess) we could give them at least a good introduction to their life-
work; and a man could enter upon practice with a rational outlook on
disease, and be prepared to continue his education with the help, not at
the expense, of the public. But all this is changing rapidly, and year by
year the men who leave our schools are better educated and in every way
better fitted to practise medicine intelligently. *Lack of critical judgment*
is another serious obstacle in the way of the young man. It is hard to
get life's spectacles adjusted, so hard to get clear vision, where so much
is obscure. The faculty of "right judgment in all things" is granted to
few men, but the physician to be of any value must at least aspire to that
round-about common sense which was so distinguishing a feature in
Sydenham. It may be cultivated, but with caution, as it is one of the
virtues more readily acquired when not too consciously sought. Slow
of growth, and the fruit of a seasoned experience, good clinical judgment
only comes with careful study, and is best seen in men who appreciate
the value of thoroughness in their work. The mental attitude controls
the course of a man's evolution as a clinical physician. While nothing
can be more fatal than a cold Pyrrhonism in which everything is doubted,
in the midst of so much credulity, lay and professional, it is well for the
young man to take as a motto the saying of that wise old pre-Hippocratic
poet-physician, Epicharmus, of Syracuse: "Be sober and distrustful;
these are the sinews of the understanding." Credulity is of the very
essence of human nature and we physicians are not exempt from the
common lot. Our work is an incessant collection of evidence, weighing
of evidence, and judging upon the evidence, and we have to learn early
to make large allowances for our own frailty, and still larger for the
weaknesses, often involuntary, of our patients. The history of medicine
is full of instances of self-deception on the part of the best of men, and it
is well that the young man should at the outset be humble, as he is not
likely to escape altogether. Science has done much in revolutionizing
mankind, but man remains the same credulous creature as he has been
in all ages. Tar-water, Perkin's tractors, laying on of hands, Christian
Science, Lourdes, and the other miracle-working shrines illustrate the
deep, intense credulity from which science has not yet freed mankind and
is not likely to do so. It is an aspect of human nature which we must
accept and sometimes utilize, remembering the remark of Galen: "He
cures the greatest number in whom most men have most faith."

It is for the practitioner to make the new facts of science efficient and
useful, to translate science into practice   Often a very prolonged affair
from inherent difficulties connected with the complicated mechanism
of man's body, this is sometimes a source of discouragement, and we
hear complaints of the slowness of progress in medicine, and of the
inability of physicians at once to turn to practical account some striking
discovery. The history of science teaches us that it takes many years
from the announcement of the fact to its full application. From Faraday's
work on electromagnetic induction to the making of dynamos for com-
mercial purposes was a longer period than from Claude Bernard's
discovery of internal secretion to the successful treatment of a case of
myxœdema with thyroid extract. In making a new application of science
the stages are well defined. First there is the discovery of the phenom-

enon capable of utilization. Then comes an inventor who recognizes the possibility of its practical application. He may require the help of a skilled engineer who correlates the commercial and manufacturing conditions to be dealt with; and finally there is the capitalist who furnishes the means to make the invention of practical utility. In the science of medicine, to make efficient in every-day practice the new discoveries regarding the functions of the body and the phenomena of disease is a very difficult matter. There is much knowledge which cannot always be made helpful. It may add to the clearness of the clinical picture and enable us perhaps to recognize the nature and state of a disease without benefiting in the slightest the poor victim of it. A knowledge of the structure and of the functions of the motor paths may be of no use whatever in a case of complete destruction by a clot in the internal capsule; but in the very next case, one of syphilis of the brain, or in one of tumor of the cord, in the full utilization of this same knowledge may rest the issues of life and death. Just as in the mechanical sciences, it takes a combination of human activities in several stages of effort to reap the benefit of any discovery, so it is in medicine. The anatomist, the physiologist, the pathologist, the clinician, and the surgeon—in as many stages as from Faraday's discovery of electromagnetic induction to the manufacture of a dynamo—all had to combine before a brain tumor could be removed successfully. Between Claude Bernard's discovery of internal secretion and the cure of a case of myxœdema every department of medicine was taxed. To be exploited prematurely in practice is the common fate of all new scientific facts. Not content to wait for full knowledge, men hastily draw conclusions from imperfect data. Consider the dross with which the pure gold of Claude Bernard's discovery has been mixed in an organotherapy often as irrational as that practised in the middle ages.

VII.

Intertwined as the subject is with the complicated sciences of physiology, organic chemistry, and physics, to make solid contributions to clinical medicine we must systematize the work much more than has hitherto been possible. The trustees and managers of hospitals should appreciate more fully than they do at present the scientific needs of these institutions. To do justice to the patients, to carry out modern lines of treatment, indeed, to diagnosticate skilfully, require now the assistance of trained laboratory workers who should form part of the staff. It is impossible for any man, no matter how industrious, to keep abreast at all points with the chemical and bacteriological technique. Two important changes are necessary before hospitals are in a position to do the best possible work in clinical medicine:

First, in many institutions the number of attending physicians should be reduced. In small hospitals of a total capacity of one hundred and fifty beds the medical wards should be placed in charge of one man. In the larger city hospitals separate medical services should be arranged with from sixty to one hundred beds in each. The profession should learn to recognize the worker in internal medicine as a man who has to devote so much time to his studies that it is impossible for him to take general

practice, and in a way he is a specialist, in the broad sense of the term, like the surgeon. The development of clinical medicine is retarded by the present system of appointing general practitioners, often the busiest and most successful men, in charge of the wards. Nowadays only under exceptional circumstances does a man of energy and perseverance evolve from these surroundings into a thoroughly trained clinical investigator. In saying this I do not forget that from these conditions arose the very men who have contributed most to medicine in America, men of the stamp of W. W. Gerhard, Austin Flint, Da Costa and Pepper. But the times are changing, and I know that I express the feelings of hospital physicians themselves when I state that a reorganization is urgently demanded along the lines here indicated. Not only in the larger cities, but in towns of from fifty to one hundred thousand inhabitants *the well-equipped medical clinic is the most urgent need of the profession.* Secondly, the internal organization of the hospitals must be changed to meet the new demands. A larger number of house physicians is required, who should be graded so that raw, inexperienced graduates should not be put at once in full charge of patients. A clinical laboratory with chemical and bacteriological assistants should be provided for each service, or, in the smaller hospitals, one would suffice for all departments. This need, now generally recognized for hospitals connected with medical schools, is of equal importance in the smaller hospitals. An example of what organization can do in this direction is afforded by the remarkable clinic which has been built up in Rochester, Minnesota, by the Mayo brothers, who have made that little town a world-known resort for both physicians and surgeons, and whose success has been due as much to their careful attention to the laboratory side of their work as to the technique for which they have become so famous.

Lastly, my earnest hope is that this series of volumes may be of service in that education which each one of us has to work out for himself in practice. Set on the right path in the schools it should not be difficult for a man to keep in touch with the advances of science, and to give his patients the benefit of all those accessories which are so important in the recognition and successful treatment of disease. Just as the clinical laboratory is a necessity to the hospital physician engaged in the solution of the most advanced problems in medicine, so the private laboratory is indispensable in the every-day work of the busy practitioner. Urine analysis, blood counts, sputum examinations, chemical analysis of stomach contents, all these should be done at home: at first, by the physician himself, while not too busy; later by an assistant. This may seem to be asking a great deal in the heavy routine of the day, but it is not asking too much, and it will be done more and more when we send out our students familiar by long practice with the use of the microscope and other instruments of precision. It makes the practice of medicine of absorbing interest when one feels he is approaching the study of a case equipped with modern methods, and it is the neglect of these accessories that makes so many men fall into slipshod habits of diagnosis, and still more careless methods of treatment. Asked the single most powerful weapon today in the hands of the profession against quackery of all sorts, I would answer: the little laboratory room attached to the office of the general practitioner. Nor is it asking

the impossible. I know many busy men who utilize to the full all these resources of our art. I would like to call the attention of my colleagues to the papers on this question by my friend, M. H. Fussell,[1] of Philadelphia. Nor is it impossible in general practice to become an active and valued contributor to the literature of the profession. It should not be forgotten that Robert Koch was a district physician when he made his memorable researches upon anthrax. One of the most distinguished scholars of his day was Robert Adams, a village surgeon.

The young physician should not be disturbed by the thought that it requires special abilities to rise superior to one's environment. It is the average man with a set and steady determination to equip himself at all points who is more likely to succeed than any other. The way is open to all. For those whose training in the medical school has been defective the post-graduate school is available, and a month or two every few years spent at a good hospital and in laboratory work add to a man's mental capital and make him of greater value to the public and to his colleagues.

It is astonishing how much there is in the daily round if men would but keep the open mind and look upon life as a progressive education. The times have changed, and we have travelled far from the days when the father of medicine jotted down his notes upon fever cases in Abdera and elsewhere. We know more and enjoy larger opportunities, and with them have greater responsibilities, but could Hippocrates return he would find no change in those essential duties in which he is still our great exemplar. They are four: so to study our cases as to acquire facility in the art of diagnosis, which must everywhere precede the rational treatment of disease; so to grow in critical judgment that we may learn to appreciate the relative value of the symptoms and physical signs, and give to the patient and to his friends a forecast or prognosis; so to conduct the treatment that the patient may be restored to health at the earliest possible period, or, failing that, be given the greatest possible measure of relief, whether by drugs, the action of which he should carefully study, so as to have a strong and abiding faith in those which have been tried and not found wanting, by diet, by exercise, or by all the physical means available, and often by the exercise of his own strong personality; and, lastly, so to arrange sanitary and hygienic measures that, wherever possible, disease may be prevented. Could Hippocrates meet again a class of students at some modern Cos, and discuss the changes which twenty-five centuries had wrought, he would dwell upon this latter development of the science and of the art as the crowning benefit which the profession has bestowed upon the race, and he would repeat again those noble words which have found in this triumph their practical realization: To serve the art of medicine as it should be served, one must love his fellow-men.

[1] *The University Medical Magazine*, 1891, 1896, 1898, 1900. *The Journal of the American Medical Association*, 1901, 1902. *The Philadelphia Medical Journal*, 1901, 1902.

THE TREATMENT
OF DISEASE

THE ADDRESS IN MEDICINE BEFORE THE
ONTARIO MEDICAL ASSOCIATION
TORONTO, JUNE 3, 1909

BY

WILLIAM OSLER, M.D., F.R.S.

REGIUS PROFESSOR OF MEDICINE
UNIVERSITY OF OXFORD

THE TREATMENT
OF DISEASE

THE ADDRESS IN MEDICINE BEFORE THE
ONTARIO MEDICAL ASSOCIATION
TORONTO, JUNE 3, 1909

BY

WILLIAM OSLER, M.D., F.R.S.

REGIUS PROFESSOR OF MEDICINE
UNIVERSITY OF OXFORD

THE TREATMENT OF DISEASE

I

As true to-day as when Celsus made the remark, ' The dominant view of the nature of disease controls its treatment.' As is our pathology so is our practice ; what the pathologist thinks to-day the physician does to-morrow. Roughly grouped, there have been three great conceptions of the nature of disease. For long centuries it was believed to be the direct outcome of sin, *flagellum Dei pro peccatis mundi*, to use Cotton Mather's phrase, and the treatment was simple—a readjustment in some way of man's relation with the invisible powers, malign or benign, which had inflicted the scourge. From the thrall of this ' sin and sickness ' view man has escaped so far as no longer, at least in Anglo-Saxon communities, to have a proper saint for each infirmity. Against this strong bias towards the supernatural even the wisdom of Solomon could not prevail ; was not the great book of his writings which contained medicine for all manner of diseases and lay open for the people to read as they came into the temple removed by Hezekiah lest out of confidence in remedies they should neglect their duty in calling and relying upon God ? And the modern book of reason, which lies open to all, is read only by a few in the more civilized countries. The vast majority are happy in the childlike faith of the childhood of the world. I am told that annually more people seek help

at the shrine of Ste. Anne de Beaupré, in the Province of Quebec, than at all the hospitals of the Dominion of Canada. How touching at Rome to see the simple trust of the poor in some popular Madonna, such as the Madonna del Parto ! It lends a glow to the cold and repellent formalism of the churches. In all matters relating to disease credulity remains a permanent fact, uninfluenced by civilization or education.

From Hippocrates to Hunter the treatment of disease was one long traffic in hypotheses ; variants at different periods of the doctrine of the four humours, as dominated by some strong mind in active revolt it would undergo temporary alteration. The peccant humours were removed by purging, bleeding, or sweating, and until the early years of the nineteenth century there was very little change in the details. To a very definite but entirely erroneous pathology was added a treatment most rational in every respect, had the pathology been correct ! The practice of the early part of the last century differed very little from that which prevailed in the days of Sydenham, except, perhaps, that our grandfathers were, if possible, more ardent believers in the lancet.

In the past fifty years—in the memory, indeed, of some present—our conception of the nature of disease has been revolutionized, and with a recognition that its ultimate processes, whether produced by external agents or the result of modifications in the normal metabolism, are chemico-physical, we have reached a standpoint from which to approach the problems of prevention and cure in a rational way. Let me indicate briefly the directions in which the new science has transformed the old art.

In the first place, the discovery of the cause of many of the great scourges has changed not only its whole aspect, but, indeed, we may say, the very outlook of humanity. No longer is our highest aim to cure, but to prevent disease ; and in its career of usefulness the profession has never before had a triumph such as we have witnessed in the abolition of many fearful scourges. Great as have been the Listerian victories in surgery, they are but guerrilla skirmishes, so to speak, in comparison with the Napoleonic campaigns which medicine is waging against the acute infections. These are glorious days for the race. Nothing has been seen like it on this old earth since the destroying angel stayed his hand on the threshing-floor of Araunah the Jebusite. For seven years Cuba, once a pest-house of the tropics, has been free from a scourge which has left an indelible mark in the history of the Englishman, Spaniard, and American in the New World. To-day the Canal Zone of Panama, for years the graveyard of the white man, has a death-rate as low as that in any city of the United States. In the island of Porto Rico, where many thousands have died annually of tropical anaemia, the death-rate has been cut in half by the work of Ashford and others. But, above all, the problem of life in the tropics for the white man has been solved, since malaria may now be prevented by very simple measures. These are some of the recent results of laboratory studies which have placed in our hands a power for good never before wielded by man.

Secondly, a fuller knowledge of etiology has led to a return to methods which have for their object, not so much the combating of the disease germ or of its products,

as the rendering of conditions in the body unfavourable for its propagation and action. How fruitful in practical results, for example, have been the new views on tuberculosis! Not that the discovery of the bacillus itself modified immediately our treatment of the disease, but, as so often happens, a combination of circumstances was responsible for the happy revolution—the recognition of the widespread prevalence of the infection, the great frequency with which healed lesions were found, and the knowledge of the importance of the character of the tissue soil, led to the substitution of the open-air and dietetic treatment for the nauseous mixtures with which our patients were formerly drenched. We scarcely appreciate the radical change which has occurred in our views even within a few years. Contrast a recent work on tuberculosis with one published twenty-five or thirty years ago. In the latter the drug treatment takes up the larger share, while in the former it is reduced to a page or two. And it is not only in the acute infections that the use of the 'non-naturals', as the old writers called them, has replaced other forms of treatment, but in diet, exercise, massage, and hydrotherapy, we are every day finding out the enormous importance of measures which too often have been used with greatest skill by those outside or on the edge of the profession.

Thirdly, the study of morbid anatomy combined with careful clinical observations has taught us to recognize our limitations, and to accept the fact that a disease itself may be incurable, and that the best we can do is to relieve symptoms and to make the patient comfortable. The relation of the profession to this group, particularly

to certain chronic maladies of the nervous system, is a very delicate one. It is a hard matter, and really not often necessary (since Nature usually does it quietly and in good time), to tell a patient that he is past all hope. As Sir Thomas Browne says : ' It is the hardest stone you can throw at a man to tell him that he is at the end of his tether ' ; and yet, put in the right way to an intelligent man it is not always cruel. Let us remember that we are the teachers, not the servants, of our patients, and we should be ready to make personal sacrifices in the cause of truth, and of loyalty to the profession. Our inconsistent attitude is, as a rule, the outcome of the circumstances that of the three factors in practice, heart, head, and pocket, to our credit, be it said, the first named is most potent. How often does the consultant find the attending physician resentful or aggrieved when told the honest truth that there is nothing further to be done for the cure of his patient ! To accept a great group of maladies, against which we have never had and can scarcely ever hope to have curative measures, makes some men as sensitive as though we were ourselves responsible for their existence. These very cases are ' rocks of offence ' to many good fellows whose moral decline dates from the rash promise to cure. We work by wit and not by witchcraft, and while these patients have our tenderest care, and we must do what is best for the relief of their sufferings, we should not bring the art of medicine into disrepute by quack-like promises to heal, or by wire-drawn attempts at cure in what old Burton calls ' continuate and inexorable maladies '.

Fourthly, the new studies on the functions of organs

and their perversions have led to most astonishing results
in the use of the products of metabolism, which time out
of mind physicians have employed as medicines. The
old recipe-books are full of directions for the use of parts
of animals or of various secretions and excretions. Much
of the humbuggery and quackery inside and outside of
the profession has been concerned with some of the most
unsavoury of these materials. The seventeenth-century
pharmacopoeias were full of them, and in his oration at
the Hunterian Society, 1902, Dr. Arthur T. Davies has
given an interesting historical sketch of their use in
practice. Metabolic therapy represents one of the greatest
triumphs of science. The demonstration of insufficiency
of the thyroid gland is a brilliant example of successful
experimental inquiry, and as time has passed the good
results of treatment in suitable cases have become more
and more evident. Before long, no doubt, we shall be
able to meet, in the same happy way, the perverted
functions which lead to such diseases as exophthalmic
goître, Addison's disease, and acromegaly; and as our
knowledge of the pancreatic function and carbo-hydrate
metabolism becomes more accurate we shall probably be
able to place the treatment of diabetes on a sure founda-
tion. And it is not only on the organic side that progress
has been made. Important discoveries relating to the
metabolism of the inorganic constituents, such as those
relative to acidosis, have opened a new and most hopeful
chapter in scientific medicine.

But the best of human effort is flecked and stained
with weakness, and even the casual observer may note
dark shadows in the bright picture. Organotherapy illus-

trates at once one of the great triumphs of science and the very apotheosis of charlatanry. One is almost ashamed to speak in the same breath of the credulousness and cupidity by which even the strong in intellect and the rich in experience have been carried off in a flood of pseudo-science. This has ever been a difficulty in the profession. The art is very apt to outrun or override the science, and play the master where the true rôle is that of the servant.

And, lastly, we have advanced firmly along a new road in the treatment of diseases due to specific micro-organisms, with the toxic products of which we are learning to cope successfully. The treatment with anti-toxins and bacterial vaccines, so successfully started, bears out the truth of that keen comment of Celsus : ' He will treat the disease properly whom the first origin of the cause has not deceived.' We are still far from the goal in some of the most important and fatal infec-tions, but any one acquainted in even slight measure with the progress of the past ten years cannot but have confidence in the future. Considering that the generation is still active which opened the whole question, we cannot but feel hopeful in spite of disappointments here and failures there. But in our pride of progress let us remem-ber cancer and pneumonia. The history of the latter disease affords a good illustration of the truth of the remark of Celsus with which I began this address. Year by year the lesson of pneumonia is a lesson of humility. For purposes of comparison statistics are not available, but it is not likely that the great masters from Galen to Grisolle lost a larger number of cases than we do.

B

Pneumonia has always been, as to-day, a dreaded and
a fatal disease. For one thing let us be thankful. We
have had the courage to abandon the expectorant mix-
tures, the depressants, the cardiac sedatives, the blisters,
the emetics, the resulsives, the purges, the poultices, and,
to a great extent, the bleedings. Surely our forefathers
must have killed some patients by the appalling ferocity
of their treatment, or to have stood it the constitutions
of those days must have been more robust. We still
await, but await in hope, the work that will remove the
reproach of the mortality bills in this disease. I say
reproach because we really feel it, and yet not justly,
for who made us responsible for its benign or malignant
nature ? We can relieve symptoms, but we must find
the means which will, on the one hand, limit the extension
of the process, loosen the exudate, minimize the fluxion,
control the alveolar diapedesis, and, on the other hand,
diminish the output of the toxins, neutralize those in
circulation, or strengthen the opsonic power of the blood.
But some one will say, Is this all your science has to
tell us ? Is this the outcome of decades of good clinical
work, of patient study of the disease, of anxious trial
in such good faith of so many drugs ? Give us back the
childlike trust of the fathers in antimony and in the
lancet rather than this cold nihilism. Not at all ! Let
us accept the truth, however unpleasant it may be, and
with the death-rate staring us in the face, let us not be
deceived with vain fancies. Not alone in pneumonia, but
in the treatment of certain other diseases, do we need
a stern, iconoclastic spirit which leads, not to nihilism,
but to an active scepticism—not the passive scepticism

born of despair, but the active scepticism born of a know-
ledge that recognizes its limitations and knows full well
that only in this attitude of mind can true progress be
made.   There are those among us who will live to see
a true treatment of pneumonia ; we are beginning to
learn the conditions of its prevalence, it may yet come
within the list of preventable diseases, and let us hope
that before long we may be able to cope with the products
of the pneumococcus itself.

II

Along these five lines the modern conception of the
nature of disease has radically altered our practice.   The
personal interest which we take in our fellow creatures
is apt to breed a sense of superiority to their failings,
and we are ready to forget that we ourselves, singularly
human, illustrate many of the common weaknesses which
we condemn in them.   In no way is this more striking
than in the careless credulity we display in some matters
relating to the treatment of disease.   The other day the
Times had an editorial upon a remark of Bernard Shaw
that the cleverest man will believe anything he wishes
to believe, in spite of all the facts and textbooks in the
world.   We are at the mercy of our wills much more
than of our intellect in the formation of our beliefs,
which we adopt in a lazy, haphazard way, without taking
much trouble to inquire into their foundation.   But I
am not going to discuss, were I able, this Shavian philo-
sophy, but it will serve as an introduction to a few remarks
on the Nemesis of Faith which in all ages readily over-

takes doctors and the public alike. Without trust, without confidence, without faith in himself, in his tools, in his fellow men, no man works successfully or happily. For us, however, it must never be the blind unquestioning trust of the devotee, but the confidence of the inquiring spirit that would prove all things. But it is so much easier to believe than to doubt, for doubt connotes thinking and the expenditure of energy, and often the disruption of the *status quo*. And then we doctors have always been a simple, trusting folk ! Did we not believe Galen implicitly for 1,500 years and Hippocrates for more than 2,000 ? To have the placid faith of the simple believer, instead of the fighting faith of the aggressive doubter, has ever been our besetting sin in the matter of treatment.

In the progress of knowledge each generation has a double labour—to escape from the intellectual thralls of the one from which it has emerged and to forge anew its own fetters. Upon us whose work lay in the last quarter of the nineteenth century fell the great struggle with that many-headed monster, Polypharmacy—not the true polypharmacy which is the skilful combination of remedies, but the giving of many—the practice of at once discharging a heavily-loaded prescription at every malady, or at every symptom of it. Much has been done and an extraordinary change has come over the profession, but it has not been a fight to the finish. Many were lukewarm ; others found it difficult to speak without giving offence in quarters where on other grounds respect and esteem were due. As an enemy to indiscriminate drugging, I have often been branded as a therapeutic

nihilist. That I should even venture to speak on the
subject calls to mind what Professor Peabody, of Harvard,
remarked about Jacob Bigelow, that, ' for his professor-
ship of Materia Medica he had very much the same
qualifications that a learned unbeliever might have for
a professorship of Christian theology. No other man of
his time had so little faith in drugs.' I bore this reproach
cheerfully, coming, as I knew it did, from men who did
not appreciate the difference between the giving of medi-
cines and the treatment of disease ; moreover it was for
the galled jade to wince, my withers were unwrung.
The heavy hands of the great Arabians grow lighter in
each generation. Though dead, Avicenna and Averroes
still speak, not only in the Arabic signs which we use, but
in the combinations and multiplicity of the constituents
of too many of our prescriptions. We are fortunately
getting rid of routine practice in the use of drugs. How
many of us now prescribe an emetic ? And yet that
shrewd old man, Nathanial Chapman, who graced the
profession of Philadelphia for so long, used to say :
' Everything else I have written may disappear, but my
chapter on emetics will last ! ' How much less now does
habit control our practice in the use of expectorants ?
The blind faith which some men have in medicines
illustrates too often the greatest of all human capacities—
the capacity for self-deception. One special advantage
of the sceptical attitude of mind is that a man is never
vexed to find that after all he has been in the wrong.
It is an old story that a man may practise medicine
successfully with a very few drugs. Locke had noticed
this, probably in the hands of his friend Sydenham, since

he says : ' You cannot imagine how far a little observa-
tion carefully made by a man not tied up to the four
humours . . . would carry a man in the curing of diseases,
though very stubborn and dangerous, and that with very
little and common things and almost no medicine at all.'
Boerhaave commented upon this truth in a remark of
Sydenham ' that a person well skilled in cases seldom
needs remedies '.   The study of the action of drugs,
always beset with difficulties, is rapidly passing from the
empirical stage, and this generation may expect to see
the results of studies which have already been most
promising.   It is very important that our young men
should get oriented early in this matter of drug treat-
ment.   Our teachers used to send us to the works of
Forbes (*Nature and Art in the Treatment of Diseases*) and
to Jacob Bigelow (*Nature and Disease*) for clear views on
the subject.   A book has been written by Dr. Harrington
Sainsbury, the well-known London physician and teacher
(*Principia Therapeutica*, Methuen), which deals with these
problems in the same philosophic manner.   It opens with
a delightful dialogue between the pathologist and the
physician.   He lays his finger on the weak point of the
pure morbid anatomist who thinks of the lesion only,
and not enough of the function which even a seriously
damaged organ may be able to carry on.   The book
should be in the hands of every practitioner and senior
student.   Some of you may have heard of the lecture-
room motto of that distinguished pathologist and surgeon,
and the first systematic writer on morbid anatomy in
the United States, S. D. Gross : ' Principles, gentlemen,
principles ! principles ! ! '   And it is upon these funda-

mental aspects that Dr. Sainsbury dwells in his most suggestive work, which I would like to see adopted as a textbook in every medical school in the land.

And we are yet far too credulous and supine in another very important matter. Each generation has its therapeutic vagaries, the outcome, as a rule, of attempts to put prematurely into practice theoretical conceptions of disease. As members of a free profession we are expected to do our own thinking ; and yet the literature that comes to us daily indicates a thraldom not less dangerous than the polypharmacy from which we are escaping. I allude to the specious and seductive pamphlets and reports sent out by the pharmaceutical houses, large and small. We owe a deep debt to the modern manufacturing pharmacist, who has given us pleasant and potent medicines in the place of the nauseous and weak mixtures ; and such firms as Parke, Davis & Company, of the United States, and Burroughs & Wellcome, of England, have been pioneers in the science of pharmacology. But even the best are not guiltless of exploiting in the profession the products of a pseudo-science. Let me specify three items in which I think the manufacturing pharmacists have gone beyond their limit and are trading on the credulity of the profession to the great detriment of the public. The length to which organotherapy has extended (not so much on this side of the water as on the European continent) beyond the legitimate use of certain preparations is a notorious illustration of the ease with which theoretical views place us in a false position. Because thyroid extract cures myxoedema and adrenalin has a powerful action, it has been taken almost for granted

that the extract of every organ is a specific against the diseases that affect it. This forcing of a scientific position is most hurtful, and I have known an investigator hesitate to publish results lest they should be misapplied in practice. The literature on the subject issued by reputable houses indicates, on the one hand, the pseudo-science upon which a business may be built up, and, on the other, the weak-minded state of the profession on whose credulity these firms trade. A second most reprehensible feature is the laudatory character of literature describing the preparations which they manufacture. Foisted upon an innocent practitioner by a travelling Autolycus, the preparation is used successfully, say, in six cases of amenorrhoea ; very soon a report appears in a medical journal, and a few weeks later this report is sent broadcast with the auriferous leaflets of the firm. A day or two before I left England a pamphlet came from X. & Co., characterized by brazen therapeutic impudence, and indicating a supreme indifference to anything that could be called intelligence on the part of the recipients. That these firms have the audacity to issue such trash indicates the state of thraldom in which they regard us. And I would protest against the usurpation on the part of these men of our functions as teachers. Why, for example, should Y. & Co. write as if they were directors of large genito-urinary clinics instead of manufacturing pharmacists ? It is none of their business what is the best treatment for gonorrhoea—by what possibility could they ever know it, and why should their literature pretend to the combined wisdom of Neisser and Guyon ? What right have Z. & Co. to send on a card directions for

the treatment of anaemia and dyspepsia, about which subjects they know as much as an unborn babe, and, if they stick to their legitimate business, about the same opportunity of getting information ? For years the profession has been exploited in this way, until the evil has become unbearable, and we need as active a crusade against pseudo-science in the profession as has been waged of late against the use of quack medicines by the public. We have been altogether too submissive, and have gradually allowed those who should be our willing helpers to dictate terms and to play the rôle of masters. Far too large a section of the treatment of disease is to-day controlled by the big manufacturing pharmacists, who have enslaved us in a plausible pseudo-science. The remedy is obvious : give our students a first-hand acquaintance with disease, and give them a thorough practical knowledge of the great drugs, and we will send out independent, clear-headed, cautious practitioners who will do their own thinking and be no longer at the mercy of a meretricious literature which has sapped our independence.

Having confessed some of our own weaknesses, I may with better grace approach the burning question of the day in the matter of treatment. An influenza-like outbreak of faith-healing seems to have the public of the American continent in its grip. It is an old story, the oldest, indeed, in our history, and one in which we have a strong hereditary interest, since scientific medicine took its origin in a system of faith-healing beside which all our modern attempts are feeble imitations. Lincoln's favourite poem, beginning ' We think the same thoughts

C

that our fathers have thought ', expresses a tendency in
the human mind to run in circles. Once or twice in each
century the serpent entwining the staff of Aesculapius
gets restless, untwists, and in his gambols swallows his
tail, and at once in full circle back upon us come old
thoughts and old practices, which for a time dominate
alike doctors and laity. As a profession we took origin
in the cult of Aesculapius, the gracious son of Apollo,
whose temples, widespread over the Greek and Roman
world, were at once magnificent shrines and hospitals,
with which in beauty and extent our modern institutions
are not to be compared. Amid lovely surroundings,
chosen for their salubrity, connected usually with famous
springs, they were the sanatoriums of the ancient world.
The ritual of the cure is well known, and has been beauti-
fully described by Pater in *Marius the Epicurean.* Faith
in the god, suggestion, the temple sleep and the inter-
pretation of its dream were the important factors.
Hygienic and other measures were also used, and in the
guild of secular physicians which grew up about the
temples scientific medicine took its origin. No cult
resisted so long the progress of Christianity ; and so
imbued were the people with its value, that many of the
practices of the temple were carried on into the Christian
ritual. The temple sleep and the interpretation of its
dreams were continued long into the Middle Ages, and,
indeed, have not yet disappeared. The popular shrines
of the Catholic Church to-day are in some ways the
direct descendants of this Aesculapian cult, aud the cures
and votive offerings at Lourdes and Ste. Anne are in
every way analogous to those of Epidaurus.

As I before remarked, credulity in matters relating to disease remains a permanent fact in our history, uninfluenced by education. But let us not be too hard on poor human nature. Even Pericles, most sensible of men, when on his deathbed, allowed the women to put an amulet about his neck. And which one of us, brought up from childhood to invoke the aid of the saints and to seek their help—which one of us under these circumstances, living to-day in or near Rome, if a dear child were sick unto death, would not send for the Santo Bambino, the Holy Doll of the Church of Ara Coeli ? Has it not been working miracles these four hundred years ? The votive offerings of gold and of gems from the happy parents cover it completely, and about it are grateful letters from its patients in all parts of the world. No doll so famous, no doll so precious ! No wonder it goes upon its ministry of healing in a carriage and pair, and with two priests as its companions ! Precious perquisite of the race, as it has been called, with all its dark and terrible record, credulity has perhaps the credit balance on its side in the consolation afforded the pious souls of all ages and of all climes, who have let down anchors of faith into the vast sea of superstition. We drink it in with our mother's milk, and that is indeed an even-balanced soul without some tincture. We must acknowledge its potency to-day as effective among the most civilized people, the people with whom education is the most widely spread, yet who absorb with wholesale credulity delusions as childish as any that have ever enslaved the mind of man.

Having recently had to look over a large literature on

the subject of mental healing, ancient and modern, for a new edition of my textbook, just issued, I have tried to put the matter as succinctly as possible. In all ages and in all climes the prayer of faith has saved a certain number of the sick. The essentials are first a strong and hopeful belief in a dominant personality, who has varied naturally in different countries and in different ages. Buddha in India, and in Japan, where there are cults to match every recent vagary; Aesculapius in ancient Greece and Rome; our Saviour and a host of saints in Christian communities; and lastly, an ordinary doctor has served the purpose of common humanity very well. Faith is the most precious asset in our stock-in-trade. Once lost, how long does a doctor keep his *clientèle*? Secondly, certain accessories—a shrine, a grotto, a church, a temple, a hospital, a sanatorium—surroundings that will impress favourably the imagination of the patient. Thirdly, suggestion in one of its varied forms—whether the negation of disease and pain, the simple trust in Christ of the Peculiar People, or the sweet reasonableness of the psycho-therapeutist. But there must be the will-to-believe attitude of mind, the mental receptiveness—in a word, the *faith* which has made bread pills famous in the history of medicine. We must, however, recognize the limitations of mental healing. Potent as is the influence of the mind on the body, and many as are the miracle-like cures which may be worked, all are in functional disorders, and we know only too well that nowadays the prayer of faith neither sets a broken thigh nor checks an epidemic of typhoid fever.

What should be the attitude of the clergy, many of

whom have been drawn into the vortex of this move-
ment ? I feel it would be very much safer to hand over
this problem to us. It is not a burden which we should
ask a hard-working and already overwrought profession
to undertake or to share. It might be a different matter
if it were really a gift of healing in the apostolic sense,
but we know this was associated with other signs and
wonders at present conspicuous by their absence. Then
think of the possibilities for self-deception—of the saintly
Edward Irving and the gift of tongues ; of Monsieur de
Paris, the French Priest, and the miracles at his tomb,
to the truth of which two fine quarto volumes, with
' before and after ' pictures, attest ! The less the clergy
have to do with the bodily complaints of neurasthenic
and hysterical persons the better for their peace of mind
and for the reputation of the Cloth. As wise old Fuller
remarked, Circe and Aesculapius were brother and sister,
and the wiles of the one are very apt to entrap the
wisdom of the other.

III

It adds immensely to the interest in life to live in the
midst of these problems which concern us so closely. We
must meet them with an intelligent cheerfulness, in the
full confidence that the Angel of Bethesda never stirred
the waters without happy results. It is for us to see that
the soldiers we are training for the fight against disease,
bodily and mental, are well equipped for the battle ; and
let me briefly, in conclusion, indicate how I believe we
should teach the art—the management of patients and

the cure of disease. To know how to deal with disease is the final goal, to reach which the whole energies of the student should be directed. We all recognize that it is in the out-patient departments and in the wards—I wish I could add in the homes of the general practitioners—that he must get this part of his training, not in an elaborate course of lectures on the properties and action of drugs. In the congested curriculum it is by no means easy to find the proper amount of time even for this, the most essential part of his education. But as we learn the futility of the lecture-room as an instrument of teaching men the Art, so, I think, we shall gradually be able to adapt the courses so that plenty of time may be given to the practical study of the treatment of cases under skilled direction. We should take over to the hospital side of the school the whole subject known in the curriculum as therapeutics. The composition of drugs, the method of their preparation, and the study of their physiological action should be taught in practical classes in the pharmaceutical laboratories. In the out-patient departments and in the wards much more systematic practical instruction should be given how to treat disease and how to manage patients. If we could only get the students for a sufficiently long period in the hospital, what helpful courses could be arranged in the senior years ! Certain aspects of the subject must be ever kept before the assistants [1] and the students, considered, per-

[1] A post-graduate course in medical pedagogy would be most helpful organized by five or six of the large colleges and conducted by them in rotation with teachers selected from the different schools. Many able young fellows take years to acquire methods to which they might be introduced in a six-months' course.

haps, by different men associated with the clinic according to the special capacity of each one. The fundamental law should be ingrained that the starting-point of all treatment is in the knowledge of the natural history of a disease. Typhoid fever, tuberculosis, pneumonia, and, where possible, malaria, should be used for this important lesson, and in the everyday routine observation of cases the student would learn to know the course of the disease, its obvious features, the complications likely to arise ; and he would be taught how to discriminate between the important and the unimportant symptoms of a case. This work should form the very basis of his course in medicine, and it should be accompanied by a *seminar* to take the place of set lectures, in which the features of all the common diseases would be discussed.

The hygienic and dietetic management of patients has now come to be such a prominent part of the work of our hospitals that the student may become acquainted with the open-air treatment, the various modifications of diet suitable to different diseases, and the use of massage, electricity, and other physical agents. But too often he is allowed to pick up this information in a haphazard, irregular fashion. One assistant of the clinic should be detailed to see that every member of the class knows, for example, how to arrange the open-air treatment for a tuberculous patient, and how to supervise the diet of a diabetic case. The student should prepare personally the various nutritive enemata, and be able to give the different kinds of massage, and I would have him thoroughly versed in all branches of hydrotherapy. A serious difficulty is that nowadays the nurse does

a great many things that it is essential the medical student should know how to do—the administration of hypodermics, the giving of a cold pack, &c.

Much more attention should be paid to the important subject of psychotherapy. It is not every teacher who has a special gift for this work, but if the professor himself does not possess it, he should, at any rate, have sense enough to have an assistant familiar with and interested in the modern methods. How many of our graduates have been shown how to carry out a Weir Mitchell treatment or to treat a patient by suggestion ? The student should be taught that the very environment of a well-managed clinic is in itself an important factor in psychical treatment. A Philadelphia friend once jokingly defined my practice at the Johns Hopkins Hospital as a mixture of hope and nux vomica, and the grain of truth in this statement lies in the fact that with many hospital patients once we gain their confidence and inspire them with hope, the battle is won.

And lastly, from the day the student enters the hospital until graduation, he should study under skilled supervision the action of the few great drugs. Which are they ? I am not going to give away my list. A story is told that James Jackson, when asked which he considered the greatest drugs, replied : ' Opium, mercury, antimony, and Jesuit's bark ; they were those of my teacher, Jacob Holyoke.' ' Yes,' replied his interlocutor, ' and they were those of Holyoke's master, James Douglas, in the early part of the eighteenth century.' Mine is a much longer one ! The student should follow most carefully the action of those drugs the pharmacology of

which he has worked out in the laboratory. He should be sent out from the hospital knowing thoroughly how to administer ether and chloroform. He should know how to handle the various preparations of opium. Each ward should have its little case with the various preparations of the ten or twelve great drugs, and when the teacher talks about them he should be able to show the preparations. He should study with special care the action of digitalis on the circulation in cases of heart disease. He should know its literature, from Withering to Cushney. It should be taken as the typical drug for the study of the history of therapeutics—the popular phase, as illustrated by the old woman who with it cured the Principal of Brasenose ; the empirical stage, introduced by Withering in his splendid contribution, a model of careful clinical work of which every senior student should know ; and the last stage, the scientific study of the drug, which he will already have made in the pharmacological laboratory. He should day after day personally give a syphilitic baby inunctions of mercury ; he should give deep injections of calomel, and he should learn the history of the drug from Paracelsus to Fournier. He should know everything relating to the iodides and the bromides, and should present definite reports on cases in which he has used them. He must know the use of the important purgatives, and he should have a thorough acquaintance with all forms of enemata. He should know cinchona historically, its derivatives chemically, and its action practically. He should study the action of the nitrites with the blood-pressure apparatus, and he should over and over again have tested for himself the action,

or the absence of action, of strychnine, alcohol, and other drugs supposed to have a stimulating action on the heart and blood-vessels. While I would, on the one hand, imbue him with the firmest faith in a few drugs, ' the friends he has and their adoption tried,' on the other hand, I would encourage him in a keenly sceptical attitude towards the pharmacopoeia as a whole, ever remembering Benjamin Franklin's shrewd remark that ' he is the best doctor who knows the worthlessness of the most medicines '. You may well say this is a heavy contract, and one which it is impossible to carry out. Perhaps it is with our present arrangements, but this is the sort of work which the medical student has a right to expect, and this is what we shall be able to give him when in his senior years we give up lecturing him to death, and when we stop trying to teach him too many subjects.

OLD AND NEW.

ANNUAL ORATION ON THE OCCASION OF THE OPENING OF THE NEW BUILD-
ING OF THE MEDICAL AND CHIRURGICAL FACULTY OF THE STATE OF
MARYLAND, MAY 13, 1909.

BY WILLIAM OSLER.

Regius Professor of Medicine, Oxford.

In the collegiate churches and cathedrals of England before the sermon, the preacher, in what is known as the "bidding prayer," asks the people, often in very quaint phraseology, to pray, among other things for the estates of the realm, and then he offers a special prayer of thanks for the

liberality of founders and benefactors, "men in their generation famous and in ours never to be forgotten." At Oxford in the University church every Sunday in term it is interesting to hear recalled the memory of the Duke Humphrey, the Lady Margaret and other worthies. And whoever the preacher may be he finally mentions the founders and famous men of his particular college. Following this happy custom I would ask you in the first place to be profoundly thankful to the men of 1799 who gave this Faculty to the country and who made this day possible. Out of the speechless years let us recall their good deeds, and I would ask that this occasion be blessed by invoking their memory. Part at least of the success of this Faculty may be attributed to the pious care with which their example has been cherished. Long before I knew this city, Dr. Quinan's History of the Medical Profession of the State of Maryland was familiar to me; and we have to thank our indefatigable colleague, Dr. Cordell, in whose *Annals* (by far the most complete history of the profession of any State in the Union) we can read of the planting of the acorn, of the day of small things in which we had our origin. As Emerson says, "we cannot overstate our debt to the past." The plans, the money, the anxious thought, the long hours spent in meetings, the labors of the various committees represent but the completion of a great work, the foundations of which were laid in other generations. All the same let us be profoundly grateful to the Building, Finance and Arrangement Committees, and to our Presidents of the past five years—Dr. Brush, Dr. Earle, Dr. Woods, Dr. C. O'Donovan and Dr. Goldsborough for their extraordinary efforts. I hope somewhere in this building a brass tablet will permanently record their names.

It would take a long bidding prayer to express the thanks of an academic wanderer like myself, who has had so much given to him in so many places. In deeds rather than in words I have tried to be thankful, but it is hard to find gratitude enough to go round. My heart resembles one of those old manuscripts, the parchment of which has been used over and over again and while it looks as if there was only one writing, the expert is able to decipher beneath the palimpsest, as it is called. It is hard on the parchment and it is not always easy to decipher the writing, but the characters traced by my associations in this city must ever remain fresh and clear. A unique opportunity indeed was the founding of the Johns Hopkins Hospital. That those of us entrusted with its organization should have won your esteem and should have been adopted by the city and by the State is by far the best testimonial of our character and of our work. Considering the circumstances it might easily have been otherwise. But the success of that experiment must not be attributed altogether to the professional side. Such men as Francis T. King, Judge Dobbin, Dr.

Carey Thomas and Francis White were equal to the occasion and we owe much to their wisdom and good management. But to one man more than all others I would like to express my personal thanks—Daniel C. Gilman, whose name will be forever associated with fundamental reforms in American educational methods. And at the Johns Hopkins Hospital we shall always cherish his memory for the work done in connection with its organization, and for his unfailing interest in the work of the medical school. When I heard of his happy death the words of Elisha rose to my lips, "My father, my father! the chariot of Israel and the horsemen thereof." It is one of my deep regrets to miss on this occasion the greetings of a man whose encouragement and support meant so much in my life here.

I would recall with gratitude the kind reception given to me and to my colleagues by the older men of this Faculty, to whose genial influence it was that we were soon made its devoted children. This might indeed have been no easy matter had not the way been prepared by a man whose Galenic touch has ever been an "open sesame." Better men than Frank Donaldson, Christopher Johnson, Allan Smith, George Miltenberger, Henry P. C. Wilson, John Van Bibber, John Morris, Aaron Friedenwald, Francis T. Miles and A. B. Arnold never served the State. And there were the younger generation with whom the work of the Faculty brought me into close contact. Brune, cut off so prematurely; Michel, devoted to its interests; Rohé, so versatile and energetic; Chatard, whose family in this city forms a sort of hereditary Æscupalian guild; Atkinson, type of the ideal physician; George Preston, always faithful and hopeful, and the lovable Ridge Trimble. How glad would they have been to see this day.

The living well know how deeply I appreciate your friendship of which you have given this new and enduring testimony. It does not often happen that a man is called upon to participate in the dedication of a Hall to himself. More often it is a posthumous honor for which the thanks are tendered by relatives or friends. It is difficult for me to express the deep gratitude I feel for this singular mark of affection on your part. The distinction is not a little enhanced by the association with corresponding halls in other cities of the names of some of the most distinguished of American physicians, Oliver Wendell Holmes in Boston, David Hossack in New York, and S. Weir Mitchell in Philadelphia. If by any process from the large lump of your gracious kindness the grains of merit on my part could be extracted they would be found to consist of that all precious material faith—the pure gold of faith which I always had in the future of the Faculty. Just twenty years ago I joined this society and began my professional life here by giving the Annual Oration. Its history and tradition appealed to me strongly and I soon began to find my way to the old quarters under the Historical Society's Hall. Dismal, dark and dusty

yet the rooms contained much of interest and there were always a few choice spirits to be found, most often our learned historian, then the librarian, George Preston, Bond, Brune and others.

We liked the old place with all its dust and dirt, and it represented much solid effort on the part of better men than ourselves. For years there had been a strongly expressed wish to move to larger quarters, and with many misgivings and by a not very large majority it was decided in 1895 to buy the house, 847 N. Eutaw Street. Our optimistic Treasurer, Dr. Ashby, really made us move. Knowing frenzied finance thoroughly and running the Faculty on credit, yet he inspired faith in his colleagues who were financial babies in his hands. No one knows how he succeeded in paying for No. 847 and for the Hall we there built. We were always hard up, always spending more than our income and Dr. Ashby had to meet our ever-increasing extravagances, but you all know how well it was done, and how in a few years, somehow, the house and the Hall were paid for. With our increasing library it was soon found that we needed skilled assistance and one extravagance, as some thought, has proved a great blessing. In securing a well-trained librarian, Miss Noyes, to take charge of our books we did one of the best strokes of business ever done for the Faculty, and it appeals to one's sense of the fitness of things that after years of labor in very cramped surroundings she should now have library accommodations equal to the best in the country. How much the success of this meeting is due to the efforts of Miss Noyes and her staff the members of the various committees can testify.

It is an immense gratification to think that my name will remain permanently associated with this Faculty. Among many kind tributes for which I have to thank my friends none has ever touched me so closely. As a boy some of my happiest recollections, in the early sixties, are of school days in a small Canadian town, where in the summer evenings we paraded the streets, company formation, with a bonnie blue flag bearing a single star and singing "Maryland, my Maryland." Little then—or later— did I dream that my affiliation would be so close with this State, and that with it, through your gracious act today, my name may find its most enduring remembrance. These festivals illustrate how quickly the memory of a name perishes. In how many minds did the mention of David Hossack arouse a thrill of remembrance? His works—and they were good ones— have perished, and his most enduring association is with the Hall of the Academy of Medicine which bears his name—and this is likely to be my fate. We can imagine a conversation in a library—2009—between two assistants wearily sorting a pile of second-hand books just sent in. "What are we to do with all this old rubbish by a man named Osler? He must have had very little to do to spoil so much paper. Where did he live any

way?" "Oh, I don't know. Baltimore, I think. Anyhow they have a Hall there that bears his name."

And now that you see fulfilled the desire of your eyes in the possession of the beautiful new building, what is the special message of such an occasion? A double one—to the profession at large and to ourselves in particular. This is the home of the physicians of this State, with all the advantages and association which we connect with that word. The Faculty, as has already been remarked upon, represents a unique type of organizaion in this country. State societies exist everywhere, state examining boards are universal, and libraries are multiplying rapidly, but only in this State are the three so combined as to give to the profession its proper solidarity. This means much more than is represented by the Academy of Medicine, New York, the Library Association of Boston and the College of Physicians, Philadelphia, which are local civic institutions. Here the organized profession of the entire State is in control. It is to be hoped that the good example of Maryland may be followed, and that other state medical societies may secure in each capital a building for the accommodation of the Examining Board, the State society and a library. The leaven of progress and of unity has been working and the reorganization of the American Medical Association has aroused great activity in the State and county societies. And to the energy and business skill of one man may be attributed much of the phenomenal success of late years of the American Association and its Journal. Dr. Simmons has done a work of which every member of the profession should be proud. In part this building may be attributed to the new spirit and we may hope to see before long in Trenton, Richmond, Harrisburg, Albany and other capitals homes on similar lines. No one can have participated as I did in the work of this society without feeling that it is one of the most potent factors for good in the city and State. The annual and semi-annual meetings, benefiting alike hearts and heads, have brought us together in friendly rivalry, and have strengthened the bonds of good fellowship. All crave companionship and encouragement, particularly when young, and these gatherings help to counteract the sterilizing influence of that isolation in which so many men have to work. Look about and ask who are the happiest men in our ranks! Those who do not neglect the gathering of themselves together at our meetings. Who are the busiest? Those who are the most faithful in the discharge of their duties to the society. Who are the most prosperous? Those who have given to it much of their time and substance. I could enumerate other benefits, but we are fortunate to have this year as our President one of those typical products of the Faculty, a man whose family has had affiliation with it since the foundation, and who represents in his character the highest type of physician and the best stamp of citizen-

ship. It is one of the great merits of this society that it holds up to emulation and delights to honor men of this stamp, who have loyally maintained our best traditions while living the exacting lives of general practitioners.

This Faculty represents an organic pattern in which the old and the new form the warp and the woof of the life of the profession of this State. Father Time, who plies the shuttle to and fro, has inserted webs of innovation as in 1895 and 1909, but the pattern remains essentially the same. We, the members, pass on, the Faculty endures, the lives which make it die, but its life survives. The past has a charm and a use not always evident to ordinary eyes. In the orderly evolution of nature the old and the new are never dissociated. Of this our bodies offer many illustrations. In the very temple of the mind itself, stowed away in its depths, lies the mysterious pineal gland, the seat of the soul, said the old philosophers; but to him who can read, here, in the presence of the latest and most complicated bit of nature's mechanism is a remnant of the very old, of a third eye which was of use to an early vertebrate ancestor as he flopped about in the primeval marshes. Why should it be there? Of what use? Why should we be full of these vestiges, useless, often harmful? It is part of the purpose of life ever in this way to blend the old with the new. Habits, customs, opinions, beliefs influence us out of the past, sometimes helpfully, at others hurtfully. For example, in any medical organization on such an occasion as the present, when a device was needed for the beautiful medal which has been designed by Max Broedel, it was not possible to use anything else but the Æsculopian serpent, an emblem which speaks to us of a long past, when we took our origin in the most gracious and useful of the Grecian cults. Every prescription we write tells of the days when the Arabian was our master, when Avicenni swayed the profession to a unit. And still more does our every day language call back theories and opinions which have long since passed into oblivion and are as useless as the pineal gland or the vermiform appendix.

The secret of success in an institution of this kind is to blend the old with the new, the past with the present in due proportion, and it is not difficult if we follow Emerson's counsel: "We cannot overstate," he says, "our debt to the past, but the moment has the supreme claim; the sole terms on which the past can become ours are its subordination to the present." Let me indicate very briefly how the old and the new may be interwoven in the life of this Faculty.

The written records of the profession of the State will be found on our shelves. Let it be known that collections of letters and of documents of all sorts will here be housed in a fireproof building, catalogued bound and indexed, and there will soon be additions of value to the interesting papers already in our possession. The Nathan Smith letters should be here on

deposit with the story of that noble man's work at Dartmouth and at Yale. Perhaps it might be more fitting to see them in the library of one or other of those institutions, but for three generations the family has been intimately associated with this Faculty and with the life of this State. Let people know that we are not greedy in this matter, but only anxious that such priceless treasures should be on deposit where they are absolutely safe. From these records, the private letters of the old doctors written to their friends, patients and relatives, we get a vivid picture of the past and are enabled to reconstruct their lives and their times. Throughout the State there are scores of documents which it is to be hoped will gradually find their way to our archives. In each generation some one man knows the value of such documents and is willing to collect and classify them. It makes one sad to think what we missed in American medical history when the Toner collection slipped out of our hands, and I am glad to think an accident of that sort could never happen again. A good start has been made and you will see treasures which the care of former librarians has preserved. The first medical diploma issued in America, to Dr. John Archer, a Maryland man, hangs on the wall, and a picture of his old Medical Hall, a sort of private cross-roads medical school. I would urge upon the Library Committee the importance of fostering this side of its work. Nowadays the arrangements for binding, cataloguing, and displaying letters and manuscripts have reached a high grade of perfection and the knowledge that there is here a fireproof building should attract many important documents relating to the profession. The Library has more than doubled since our removal to 847 N. Eutaw Street, and now contains 17,533 volumes and 10,869 monographs and reprints. A great majority of these additions are new, the books having been bought by the Frick Fund, and by The Book and Journal Club.

Nothing neutralizes the new more effectively than the presence of old books. An Aldine here and there, a few fine parchment-bound Juntas, an Oporinus or a Froben in the original boards and stamped pigskin, a fine Paris Stephanus, an Elzevir or a Plantin give tone to the shelves, just as do the Stuarts and Copleys to the dining-room in an old mansion. The difficulty is that for library purposes nearly all books are old. Nothing ages so quickly as a book—no life so short. Often still-born from the press, not one in ten thousand has the life of its generation, not one in a hundred thousand lives out the allotted years of its author; one or two in each generation are immortal, having in them that potency of life of which Milton speaks. On what principle then should a library of this character select old books? For reading purposes a decade will age every book issued from the press this year; that, no doubt, is the hidden meaning of the old proverb about every book having its fate. Under such circumstances

deliberately to buy old books may seem a superfluity of naughtiness on the part of a librarian. There is an immense old literature which it is not worth while to seek. In our large collections miles, literally miles, of shelves are filled with books as dry as the bones in the catacombs. Some one library in the country must have all the books, and in the Surgeon-General's library there is a collection which aims at completeness. If you wish to see all the Junta editions of Galen, go there; if you wish to see a pamphlet by John Smith, of New Orleans, on the treatment of yellow fever by the application of sulphur to the soles of the feet, go there; all the odd and out of the way literature may there be consulted, and the student who wishes to know the story of Valentine Greatrakes and of Perkins Tractors has only to go to Washington. We cannot be too grateful to the men who have established this great national institution, one of the most successful of modern libraries—to Surgeon-General W. A. Hammond, the founder, to Dr. Billings, the maker, to successive Surgeons-General, the promoters, to Dr. Billings and to Dr. Fletcher for the Index Catalogue, one of the most important works on bibliography ever undertaken. To the national library then may be left the duty of indiscriminate purchase, on the principle that it should have everything that any one can possibly ask for. The local libraries have a much more limited, but not less interesting field to cultivate. In the first place all the medical literature of the State should be here—the Journals, the Reports, the Transactions and the editions of all the books written by men who have been connected with the State. By no means an easy task; it takes years of anxious hunting to fill gaps. This work generally falls to the lot of some enthusiast on the Library Committee. Fortunately keen eyes for many years looked out for these items and this part of our collection is on a fair way to completion. Then there is a group of books which may be called American medical classics, the more notable contributions to medicine and surgery made in the eighteenth and nineteenth centuries; Morgan's Essay, which led to the foundation of the University of Pennsylvania; Jones' Manual of Military Surgery; Nathan Smith on Typhus Fever—works of this sort should be on our shelves. Thirdly, the bibliography of the more distinguished American physicians and surgeons should be made as complete as possible. Of the writings of some forty or fifty men every scrap deserves to be sought for—men of the stamp of Nathan and Nathan R. Smith, the Bigelows, Samuel D. Gross, Austin Flint, Henry I. Bowditch, W. A. Gerran, Daniel Drake, and Oliver Wendell Holmes.

And, lastly, a library with any ambition will wish to have the original editions of the great medical books of the world. Care must be exercised not to allow a library to be made the dumping ground for all the old quartos and folios of the seventeenth and eighteenth centuries. There are plenty

of very handsome volumes not worthy of shelf room. This part of the work takes time and money and more of both than are usually at the disposal of the Library Committee. In every city of this size there is usually a physician with the happy combination of literary tastes, leisure and a long purse—to whom should be entrusted this part of the literary work. With only the taste and the knowledge he can use his colleagues' purses and induce *Dr. Blank* to give an original Harvey *de motu cordis* or a Jenner pamphlet or an early Mundinus. The fine old books on exhibition show that much has been done already in this direction and I have no doubt that within a few years this department will grow rapidly. To mark this happy occasion, and to rejoice Miss Noyes' heart I could not resist buying in Rome the original edition of Vesalius, 1543—one of the two medical works which has most powerfully influenced modern medicine. Special collections are of exceptional interest and we are fortunate to have the library of Dr. Upton Scott, our first President, of Dr. Charles Frick and a unique group of 120 Edinburgh theses by American students of the colonial and early 19th century days.

With manuscripts and books, pictures are naturally associated, and our gallery, old and new, grows rapidly. You remember how the centennial celebration brought out a group of fine portraits and we benefited in getting the Baker, the Buckler, Miltenberger, Wilson, Frick, Arnold, Friedenwald, Archer, Stokes, N. R. Smith, Atkinson, Rohé, Preston and other pictures. There are many others in the State and city whose ultimate destiny should be these walls—if not the original, good copies supplied by our families are very welcome. This is our Pantheon in which there should be a memorial of some sort to every distinguished Old Maryland physician. When we look about and see what has been done since the removal to Eutaw Street the Faculty may well feel encouraged. One of the most fortunate events of the past fifteen years was the memorial room and library given by Mr. W. F. Frick in memory of his brother Charles, a most distinguished physician of this city and a devoted member of the Faculty. To the Frick family we are under a deep debt; not only has the special library been an inestimable boon, as with the money annually given a large proportion of the new books have been bought, but it has been also a happy example followed in the new building and there rooms are devoted to the memory of Dr. Aaron Friedenwald and Dr. Samuel Baker. In what happier way could these families have paid for themselves and for us the debt of the past?

But let us not forget that the moment, the Now, the Present has, as Emerson says, the supreme claim to which the Past must be subordinate. The most important single function of this corporation is educational. This is really a post-graduate college of which the members remain students.

I am delighted to see that a room has been provided, through the liberality of Dr. Hugh Young, in which members may do their own laboratory work. This is a feature in the life of the Faculty which should develop and be most helpful. It should be the ambition of every young man as soon as possible after registration, to join the Faculty. Until within the fellowship he can scarcely be called a member of the guild. Take the group which has joined recently, bringing in youth and enthusiasm; year by year they will grow into the life of the Faculty and upon them time will stamp the slow insensible changes which hall-mark the generations, but which shade so gradually that there is no sharp cleavage, but the seniors and the juniors, the new and the old are blended into one homogeneous body.

By far the most important channel through which the new pours in to mingle with the old is the current literature of all lands with which our shelves groan. An important function of this Faculty is to furnish first-hand information from every medical center in the world, and this it does through journals, transactions and reports. A library such as this has to cater to three groups—the laboratory workers, the specialists, the general practitioners. and it has become increasingly difficult to meet their demands. In a city with large laboratories there should be close coöperation, so that expensive journals are not duplicated, and workers should know just where to look for sets of rare proceedings or transactions. In the present congested condition of medical literature only Washington can hope for complete-ness and the laboratory men and specialists must not complain at the large size of the lacunæ on our shelves. It is not so difficult to keep up with the demands of the man in active practice, who wants the current journals, the new editions, the monographs and the systems, and it is upon these the main energies of the library must be spent, but it passes the capacity of all but a few great libraries to deal with the perfect avalanche of special literature at the present day. In certain directions the Index Medicus is an immense help and meets a pressing demand, but we have reached the stage when every tenth year, or indeed every fifth year, stock should be taken by some international coöperative organization which should deal with the large problems of analyzing the data pouring in from every quarter, upon every possible subject.

During the next century the new and the old will fight it out in these rooms in keen discussions, just as they have done since the days of Hippocrates. Time and again it will happen that the new will not be true and the true will not be new. The yesterday is forever being brought to trial at the bar of today and the verdict is rarely unanimous, often it is wisely a case of judgment deferred. Look over the questions discussed twenty years ago—some are dead, judgment gone by default; some are still pend-

ing; a few are settled, or we think they are; many seem antiquated. Turn to the programme of the present meeting and we find new problems propounded, sometimes in language which requires interpretation, old problems that the present seems never able to get rid of, and in others we recognize old friends in disguise. How interesting to look back over the Faculty attitude towards the subject of tuberculosis, with the modern history with which it is coeval! Brought up in the hazy pre-tuberculosis days, what did Upton Scott, our first President, think of the young men fresh from Paris, and their demonstrations of Laennec's views? A generation or two later Power and Buckler and Charles Frick were propounding Louis. Then in the seventies the heresies of Niemeyer and Virchow were discussed by Donaldson, Chew, W. T. Howard and others. How the hosts of the past fought against the bacillus when it was announced, and did not prevail; how the public was finally awakened; how tuberculosis was put in the list of preventable and curable diseases that are questions of recent history. In this quintette of problems in but one disease, which it has taken a century to solve, the new and the old are curiously blended again; they are not in clear-cut strata. The idea of contagion in tuberculosis goes back to Fracastorius and even earlier, while you will find in Celsus excellent direction for the fresh-air cure combined with a milk diet. To meet the educational side of the Faculty the entire organization has been changed and the special sections and the publication of its own journal are important new departures.

Amid these hopeful and splendid surroundings, which cannot but influence it profoundly, the old organization enters a new era. Do not forget that it takes some time for the domestic machinery to get into good working order, but the rapidity with which the rooms have been prepared, the books moved and the whole place made comfortable speaks for the great efficiency of the staff.

In one of his Hibbert lectures last year at Oxford, William James made a remark that clung—" We live forward, we understand backwards. The philosophers tell us that there is no present, no now—the fleeting moment *was* as we try to catch it." In the opening of this new building we have today made a happy addition to a happy past. Towards this day we have all lived forward, and the future should still be in our thoughts. This old Faculty must continue to be our rallying ground—once inside its portals, schools, colleges, hospitals, societies, all other affiliations are absorbed in something vastly greater, which includes all and claims from all devoted service, *the united profession of the state.* The progressive evolution of such an organization demands the loyal support of every member. In all societies differences of opinion are not only inevitable but salutary. From time to time many of you will not approve the policy of

the officers of the day—do not let your annoyance dim your loyalty. Professional politics have never been, and I hope may never be, a marked feature of this body, but whenever any of you feel sore at the action of those in charge let me ask you to find a cure in devotion to the scientific work of the sections or to the library.

The best of all old things about this Faculty is that subtle force by which the men of the past influence us today—not by tradition, by the spoken word, handed on from father to son, teacher to pupil; not by the written record in which one generation reads of the deeds of another, but by that intangible, mysterious force hard to define but best expressed in the words *noblesse oblige*—that obligation to act in a certain way, to foster certain habits, to conform to certain unwritten laws—a sacred obligation, as potent now as in the time of Hippocrates, the alchemy of which at once turns to gold whatever may be leaden in the new of today.

Friday, May 14, was devoted mainly to scientific sessions of the Faculty, many interesting and instructive papers being read. In the evening the Annual Dinner was served in Osler Hall, about 150 members being seated. Dr. Goldsborough presided and Dr. Robert W. Johnson acted as Toastmaster. After-dinner speeches were made by Mayor Mahool, Hon. Charles J. Bonaparte, and Drs. William H. Welch, Thomas A. Ashby and Charles O'Donovan.

On Saturday, May 15, a special train carried the members of the Faculty and state officials to Sabillasville to participate in the dedication of the new State Sanatorium for Tuberculosis. The dedicatory address was delivered by United States Senator John Walter Smith. On returning, in the evening the closing exercises of the annual meeting of the Faculty were held, the principal business being the final reports of the Building Committee, presented by Drs. Brush and Linthicum.

MICHAEL SERVETUS

BY

WILLIAM OSLER, M.D., F.R.S.

REGIUS PROFESSOR OF MEDICINE
UNIVERSITY OF OXFORD

MICHAEL SERVETVS HIS... DE ARAGONIA

Front.

MICHAEL SERVETUS

BY

WILLIAM OSLER, M.D., F.R.S.

REGIUS PROFESSOR OF MEDICINE
UNIVERSITY OF OXFORD

LONDON
HENRY FROWDE
OXFORD UNIVERSITY PRESS
AMEN CORNER, E.C.

1909

MICHAEL SERVETUS[1]

THE year 1553 saw Europe full of tragedies, and to the earnest student of the Bible it must have seemed as if the days had come for the opening the second seal spoken of in the Book of Revelation, when peace should be taken from the earth and men should kill one another. One of these tragedies has a mournful interest this year, the four hundredth anniversary of the birth of its chief actor; yet it was but one of thousands of similar cases with which the history of the sixteenth century is stained. On October 27, shortly after twelve o'clock, a procession started from the town-hall of Geneva—the chief magistrates of the city, the clergy in their robes, the Lieutenant Criminel and other officers on horseback, a guard of mounted archers, the citizens, with a motley crowd of followers, and in their midst, with arms bound, in shabby, dirty clothes, walked a man of middle age, whose intellectual face bore the marks of long suffering. Passing along the rue St. Antoine through the gate of the same name, the cortège took its way towards the Golgotha of the city. Once outside the walls, a superb sight broke on their view: in the distance the blue waters and enchanting shores of the Lake of Geneva, to the west and north the immense amphitheatre of the Jura, with its snow-capped mountains, and to the south and west the lovely valley of the Rhone; but we may

[1] This address did double duty—at the Johns Hopkins Medical School Historical Club, and as an Extension lecture in the Summer School, Oxford.

well think that few eyes were turned away from the central figure of that sad procession. By his side, in earnest entreaty, walked the aged pastor, Farel, who had devoted a long and useful life to the service of his fellow citizens. Mounting the hill, the field of Champel was reached, and here on a slight eminence was the fateful stake, with the dangling chains and heaping bundles of faggots. At this sight the poor victim prostrated himself on the ground in prayer. In reply to the exhortation of the clergyman for a specific confession of faith, there was the cry, ' Misericordia, misericordia! Jesu, thou Son of the eternal God, have compassion upon me!' Bound to the stake by the iron chain, with a chaplet of straw and green twigs covered with sulphur on his head, with his long dark face, it is said that he looked like the Christ in whose name he was bound. Around his waist were tied a large bundle of manuscript and a thick octavo printed book. The torch was applied, and as the flames spread to the straw and sulphur and flashed in his eyes, there was a piercing cry that struck terror into the hearts of the bystanders. The faggots were green, the burning was slow, and it was long before in a last agony he cried again, 'Jesu, thou Son of the eternal God, have mercy upon me!' Thus died, in his forty-fourth year, Michael Servetus Villanovanus, physician, physiologist, and heretic. Strange, is it not, that could he have cried, ' Jesu, thou Eternal Son of God!' even at this last moment, the chains would have been unwound, the chaplet removed, and the faggots scattered ; but he remained faithful unto death to what he believed was the *Truth* as revealed in the Bible.

The story of his life is the subject of my address.

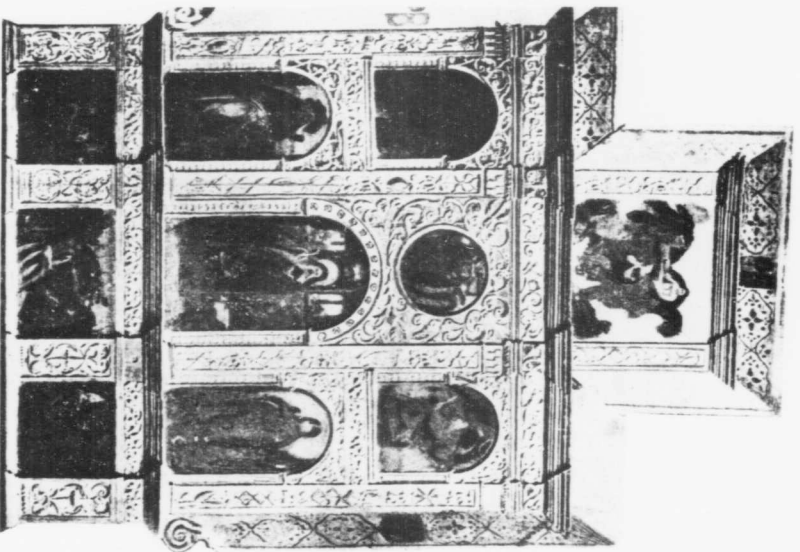Michael Servetus, known also as Michel Villeneuve, or Michael Servetus Villanovanus, or, as he puts in one

Fig. 2: Altar Screen at Barcelona

of his books, *alias* Reves, was a Spaniard born at Villanueva de Sigena, in the present province of Huesca. When on trial at Vienna, he gave Tudela, Navarre, as his birthplace, at Geneva, Villanueva of Aragon; and at one place he gave as the date of his birth 1509, and at the other 1511. The former is usually thought to be the more correct. As at Villanueva de Sigena there are records of his family, and as the family altar, made by the father of Servetus, still exists, we may take it that at any rate the place of his birth is settled. The altar-screen is a fine piece of work, with ten paintings. I am indebted to Signor Antonio Virgili, of Barcelona, for the photograph of it here reproduced (fig. 2). Servetus seems to have belonged to a good family in easy circumstances, and at his trial he said he came of an ancient race, living nobly.

From the convent school he probably went to the neighbouring University of Saragossa. Possibly he may have studied for the priesthood, but however that may be, there is evidence that he was a precocious youth, and well read in Latin, Greek, and Hebrew, the last two very unusual accomplishments at that period.

We next hear of him at Toulouse, studying canon and civil law. He could not have been twenty when he entered the service of the Friar Quintana, confessor to the Emperor Charles V, apparently as his private secretary. In the suite of the Emperor he went to Italy, and was present when Pope and Emperor entered Bologna, and 'he saw the most powerful prince of the age at the head of 20,000 veterans kneeling and kissing the feet of the Pope.' Here he had his first impression of the worldliness and mercenary character of the Papacy, hatred of which, very soon after, we find to have become an obsession.

In the summer of 1530 the Emperor attended the

Diet of Augsburg, where the Princes succeeded in getting Protestantism recognized politically. Such a gathering must have had a profound influence on the young student, already, we may suppose, infected with the new doctrines. Possibly at Saragossa, or at Toulouse, he may have become acquainted with the writings of Luther. Such an expression of opinion as the following, written before his twenty-first year, could scarcely have been of a few months' growth : ' For my own part, I neither agree nor disagree in every particular with either Catholic or Reformer. Both of them seem to me to have something of truth and something of error in their views ; and whilst each sees the other's shortcomings, neither sees his own. God in his goodness give us all to understand our errors, and incline us to put them away. It would be easy enough, indeed, to judge dispassionately of everything, were we but suffered without molestation by the churches freely to speak our minds.' (Willis.)

How far he held any personal communication with the German reformers is doubtful. It is quite possible, and Tollin, his chief biographer, makes him visit Luther. We do not know how long he held service with Quintana, Tollin thinks a year and a half. It is not unlikely that the good friar was glad to get rid of a young secretary infected with heresy so shocking as that contained in his first book, published in 1531 ; indeed, there is a statement to the effect that a monk in the suite of Quintana found the book in a shop at Ratisbon and hastened to tell the confessor of its terrible contents. Servetus had plunged headlong into studies of the most dangerous character, and had even embooked them in a small octavo volume, entitled *De Trinitatis Erroribus*, which appeared without the printer's name, but on the title-page the author, Michael Serveto, *alias* Reves

in
a
ie
th
at
he
as
ld
ny
lar
:m
of
r's
d-
ne
ed,
ut
to

:he
ind
We
na,
hat
ary
in
is
of
ind
nts.
iost
i in
bus,
the
ves

DE TRINI-
TATIS ERRORIBVS
LIBRI SEPTEM.

Per Michaelem Serueto , aliàs
Reues ab Aragonia
Hispanum.

Anno **M. D. XXXI.**

FIG. 3

r. 6

ab Aragonia, Hispanum, and with the date MDXXXI. In the innocency of his heart he thought the work would be a good introduction to the more liberal of the Swiss reformers, but they would have none of it, and were inexpressibly shocked at its supposed blasphemies. Nor did he fare better at Strassburg; and even the kind-hearted Bucer said that the author of such a work should be disembowelled and torn in pieces.

In thorny theological questions a layman naturally seeks shelter, and I am glad to quote the recent opinion of a distinguished student of the period, Professor Emerton,[1] on this youthful phase of the life of Servetus. 'He would not admit that the eternal Son of God was to appear as man, but only that a man was to come who should be the Son of God. This is the earliest intimation we have as to the speculations which were occupying the mind of the young scholar. It is highly significant that from the start he was impressed with what we should now call the historical view of theology. As he read the Old Testament, its writers seemed to him to be referring to things that their hearers would understand. Their gaze into the future was limited by the fortunes of the people at the moment. To imagine them possessed of all the divine mysteries, and to have in mind the person of the man Jesus as the ultimate object of all their prophetic vision, was to reflect back the knowledge of history into a past to which such knowledge was impossible. So far as I can understand him, this is the key to all Servetus' later thought. His manner of expressing himself is confusing and intricate to the last degree, so much so that neither in his own time nor since has any one dared to say that he understood it. To his contemporaries he was a half-

---

[1] *Harvard Theological Review*, April, 1909.

mad fanatic; to those who have studied him, even sympathetically, his thought remains to a great extent enigmatical; but this one point is fairly clear: that he grasped, as no one up to his time had grasped, this one central notion, that, whatever the divine plan may have been, it must be revealed by the long, slow movement of history—that, to understand the record of the past, it must be read, so far as that is possible, with the mind of those to whom it was immediately addressed, and must not be twisted into the meanings that may suit the fancy of later generations.'

'To have seized upon such an idea as this—an idea which has begun to come to its rights only within our memories—was an achievement which marks this youth of twenty as at all events an extraordinary individual, a disturbing element in his world, a man who was not likely to let the authorities rest calmly in possession of all the truth there was.'

In the following year, 1532, two dialogues appeared, explanatory and conciliatory, a little book which only aggravated the offence, and feeling the Protestant atmosphere too hot, Servetus went to Paris. Dropping this name by which he has been known, and closing this brief but stormy period, for the next twenty-one years we now follow Michel Villeneuve, or Michael Villanovanus, in a varied career as student, lecturer, practitioner, author and editor, still nursing the unconquerable hope that the world might be reformed could he but restore the primitive doctrine of the Church.

II

We know very little of this his first stay in Paris. Possibly he found employment as teacher, or as reader to the press. At this period his path first crossed that of Calvin, then a young student. Of about the same age,

CLAVDII PTOLE

MAEI ALEXANDRINI
GEOGRAPHICAE ENAR-
RATIONIS

LIBRI OCTO.

EX BILIBALDI PIRCKEYMHERI
tralatione , sed ad Græca & prisca exemplaria à Mi-
chaele Villanouano iam primum recogniti.
Adiecta insuper ab eodem Scholia,
quibus exoleta urbium no-
mina ad nostri secu
li morē expo
nuntur.

✳

QVINQVAGINTA ILLAE QVOQVE CVM
uctcrum tum recentium tabulæ adornantur, partúq;
incolentium ritus & mores
explicantur.

LVGDVNI
EX OFFICINA MELCHIORIS ET
GASPARIS TRECHSEL FRATRVM.
M. D. XXXV.

FIG. 4

both ardent students, both on the high road of emancipation from the faith of their birth, they must have had many discussions on theological questions. One may conclude from the reproachful sentence of Calvin many years later, 'Vous avez fuy le luite', that arrangements had been made for a public debate.

After a short stay at Avignon and Orleans, we next find Servetus at Lyons, in the employ of the Trechsels brothers, the famous printers. Those were the days of fine editions of the classics and other books, which required the assistance of scholarly men to edit and correct. He brought out a splendid folio of Ptolemy's Geography, 1535 (Fig. 4), with commentaries on the different countries, which show a wide range of knowledge in so young a man. It is marked also by many examples of independent criticism, as, when speaking of Palestine, he says that the 'Promised Land' was anything but a 'promising land', and instead of flowing with milk and honey, and a land of corn, olives and vineyards, it was inhospitable and barren, and the stories about its fertility nothing but boasting and untruth. He seems to have been brought to task for this, as in the second edition, 1541, this section does not exist. For this work he was paid by the Trechsels 500 crowns.

It is possible that Servetus and Rabelais may have met at Lyons, as at this time the 'great Dissimulator' was physician to the Hôtel-Dieu, but there is nothing in the writings of either to indicate that their paths crossed. The man who had the greatest influence upon him at Lyons was Symphorien Champier, one of the most interesting and distinguished of the medical humanists of the early part of the sixteenth century. Servetus helped him with his French *Pharmacopoeia*, and Pastor Tollin will have it that Champier even made a home

B

for the poor scholar. An ardent Galenist, an historian, the founder of the hospital and of the medical school, Champier had the usual predilection of the student of those days for astrology. Probably from him Servetus received his instructions in the subject. At any rate, when the distinguished Professor of Medicine of Tübingen, Fuchsius, attacked Champier on the ground of his astrological vagaries, Servetus took up his pen and replied in defence with a pamphlet entitled 'In Leonhardum Fuchsium defensio apologetica pro Symphoriano Campeggio', an exceedingly rare item, the only one indeed of the writings of Servetus that I have not seen in the original.

Stimulated doubtless by the example and precept of Champier, Servetus returned to Paris to study medicine. Fairly rich in pocket with the proceeds of his literary work, he attached himself first to the College of Calvi, and afterwards to that of the Lombards, and it is said that he took the degrees of M.A. and M.D., but of this I am told that there is no documentary evidence.

Of his life in Paris we have very little direct evidence, except in connexion with a single incident. We know that he came into intimate contact with three men— Guinther of Andernach, Jacobus Sylvius, and Vesalius. Guinther and Sylvius must have been men after his own heart, ripe scholars, ardent Galenists, and keen anatomists. In the *Institutiones Anatomicae* (Basel, 1539), Guinther speaks of Servetus in connexion with Vesalius, who was at this time his fellow pro-sector. 'And after him by Michael Villanovanus, distinguished by his literary acquirements of every kind, and scarcely second to any in his knowledge of Galenical doctrine.' With their help he states that he has examined the whole body, and demonstrated to the students all of the muscles, veins, arteries, and nerves. There was at this

time a very keen revival in the study of anatomy in Paris, and to have been associated with such a young genius as Vesalius, already a brilliant dissector, must have been in itself a liberal education in the subject. It is easy to understand whence was derived the anatomical knowledge upon which was based the far-reaching generalization with which the name of Servetus is associated in physiology.

But the Paris incident of which we know most is connected with certain lectures on judicial astrology. We have seen that at Lyons, Servetus had defended his friend and patron Symphorien Champier, through whom he had doubtless become familiar with its practice. Though forbidden by the Church, judicial astrology was still in favour in some universities, and was practised largely by physicians occupying the most distinguished positions. In those days few were strong minded enough to defy augury, and in popular belief all were 'servile to skiey influences'. It was contrary to the regulations of the Paris Faculty to lecture on the subject, though at this time the king had in his employ a professional astrologist, Thibault. Shortly after reaching Paris Servetus began a course of lectures on the subject, which very soon brought him into conflict with the authorities.

The admirable practice for the Dean to write out each year his report, has preserved for us the full details of the procedure against Servetus. Duboulay, in his *History of the University of Paris*, vol. vi, has extracted the whole affair from the Dean's Commentary, as it is called, of the year. He says that a certain student of medicine, a Spaniard, or as he says, from Navarre, but with a Spanish father, had taught for some days in Paris in 1537 judicial astrology or divination. After having found out that this was condemned

by the Doctors of the Faculty, he caused to be printed
a certain apology in which he attacked the doctors, and
moreover declared that wars and pests and all the
affairs of men depended on the heavens and on the
stars, and he imposed on the public by confounding
true and judicial astrology.   The Dean goes on to
state that, accompanied by two of his colleagues, he
tried to prevent Villanovanus from publishing the
apology, and met him leaving the school where he had
been making a dissection of the body with a surgeon,
and in the presence of several of the scholars, and of
two or three doctors, he not only refused to stop the
publication, but he threatened the Dean with bitter
words.

The Faculty appears to have had some difficulty in
getting the authorities to move in the matter.   Possibly
we may see here the influence of the court astrologer,
Thibault.   After many attempts, and after appealing to
the Theological Faculty and the Congregation of the
University, the question was taken up by Parliament.
The speeches of counsel for the Faculty, for the Uni-
versity, for Villanovanus, and for the Parliament are
given in full.   The Parliament decided that the printed
apology should be recalled, the booksellers were for-
bidden to keep them, the lectures on astrology were
forbidden, and Villanovanus was urged to treat the
Faculty with respect.   But on their part they were
asked to deal with the offender gently, and in a parental
fashion.   It is a very interesting trial, and the Dean
evidently enjoyed his triumph.   He says that he took
with him three theologians, two doctors in medicine,
the Dean of the Faculty of Canonical Law, and the
Procurator-General of the University.   The affair was
discussed by Parliament with closed doors.

The *Apologetica disceptatio pro astrologia*, the rarest of

the Servetus items, the only copy known being in the Bibliothèque Nationale, is an eight leaf pamphlet, without title-page, pagination, or printer's name. The friends of the Faculty must have been very successful in their confiscation of the work. Tollin, who discovered the original, has reprinted it (Berlin, 1880). It was not hard for Servetus to cite powerful authorities on his side, and he summons in his defence the great quartette, Plato, Aristotle, Hippocrates, and Galen. A practical star-gazer, he took his own observations, and the pamphlet records an eclipse of Mars by the moon. He must, too, have been a student of the weather, as he speaks of giving in his lectures public predictions which caused great astonishment. The influence of the moon in determining the critical days of diseases, a favourite doctrine of Galen, is fully discussed, and he says that Galen's opinion should be written in letters of gold. He rests content with these great authorities, referring very briefly to one or two minor lights. He scoffs at the well-known bitter attack on divination by Picus.

It took several generations to eradicate completely from the profession a belief in astrology, which lingered well into the seventeenth century. In his *Vulgar Errors*, discussing the 'Canicular' or 'Dog Days', Sir Thomas Browne expresses his opinion of astrology in the most characteristic language. 'Nor do we hereby reject or condemn a sober and regulated Astrology; we hold there is more truth therein than in Astrologers; in some more than many allow, yet in none so much as some pretend. We deny not the influence of the Starres, but often suspect the due application thereof; for though we should affirm that all things were in all things; that heaven were but earth celestified, and earth but heaven terrestrified, or that each part above

had an influence upon its divided affinity below; yet how to single out these relations, and duly to apply their actions, is a work oft times to be effected by some revelation, and Cabala from above, rather then any Philosophy, or speculation here below.'

Among the auditors of Servetus was a young man, Pierre Paumier, the Archbishop of Vienne, who appears to have befriended him in Paris, and who a few years later asked him to be his body physician. The astrology trial was settled in March, 1537.

Servetus cannot have been very long a student of medicine, but never lacking in assurance, he came before the world as a medical author in the little treatise on *Syrups and their use* (Fig. 5). Association with Champier, whom he had helped in an edition of his French *Pharmacopoeia*, had made him familiar with the subject. The first three chapters are taken up with the views on 'Concoctions' or 'Digestions', of which at that time a series, from the first to the fourth, was recognized. He pleads for a unity of the process, and, as Willis remarks, he makes the very shrewd remark at that day, 'that diseases are only perversions of natural functions and not new entities introduced into the body.' The greater part of the treatise is taken up with theoretical discussions on the opinions of Galen, Hippocrates, and Avicenna. The 'Composition and use of the Syrups' is deferred to the fifth and a concluding (sixth) chapter.

The little book appears to have been popular, and was reprinted twice at Venice, 1545 and 1548, and twice at Lyons, 1546 and 1547.

III

Whether the adverse decision of Parliament disgusted him with Paris, or whether through some friend the

Syruporum vni-

VERSA RATIO, AD GA-

leni cenſuram diligenter

expolita.

Cui, poſt integrã de concoctione diſceptationem,
præſcripta eſt uera purgandi methodus, cum ex-
poſitione aphoriſmi: Concocta medicari.

Seruето

Michaële Villanouano authore.

Πρὸς τὸν φιλίατρον.
Εὔροα ποιήσων τά τε σώματα, τά τε πιπάνων
Ωμὰ χυμῶν, ταύτης δ᾽ όγματα ἰσθι βίβλ8.

Fig. 5

BIBLIA

ſacra ex Santi Pagnini trala-
TIONE, SED AD HEBRAI-
cæ linguæ amuſsim nouiſsimè ita recognita, &
ſcholiis illuſtrata , ut planè noua edi-
tio uideri poſsit.

Accesſit præterea Liber interpretationum Hebraicorum, Arabicorum, Græcorumǭ,
nominum, quæ in ſacris literis reperuntur, ordine alphabetico digeſtus, eodem authore.

AETERNITATI

LIBERTATEM
MEAM
MECVM
PORTO

LVGDVNI,
Apud HVGONEM à Porta.
M. D. XLII.
Cum priuilegio ad annos ſex.

FIG. 6

opportunity to settle in practice had offered, we next
hear of Villeneuve at Charlieu, a small town about
twelve miles from Lyons, where he spent a year, or
part of the year 1538-9. Here his old Paris friend
Paumier sought him and induced him to settle at
Vienne, offering him apartments in the palace, and an
appointment as his body physician. After nearly ten
years of wandering, at last, in a peaceful home in the
fine old Roman city, with its good society, and under
the protection of the Primate of all France, Servetus
spent the next fourteen years as a practising physician.

Few details of his life are known. He retained his
association with the Trechsels, the printers, who had
set up a branch establishment in Vienne. In 1541 he
brought out a new edition of Ptolemy, with a dedication
to the Archbishop. From the preface we have a
glimpse of a genial group of companions, all interested
in the new studies. Several critical items in the
edition of 1535 disappear in the new one of 1541, e.g.
the scoffing remarks about Palestine; and in mentioning
the royal touch, instead of, 'I have myself seen the
King touching many with this disease (i.e. Scrofula),
but I have not seen that they were cured,' he says,
'I have heard that many were cured.' Perhaps he felt
it unbecoming in a member of an ecclesiastical circle,
and living under the patronage of the Archbishop, to
say anything likely to give offence.

In the following year he issued an edition of Pagnini's
Bible in a fine folio (Fig. 6). Its chief interest to us is
the testimony that Servetus was still deep in theological
studies, for the commentaries in the work place him
among the earliest and boldest of the higher critics.
The prophetic psalms, and the numerous prophecies
in Isaiah and Daniel are interpreted in the light of
contemporary events, but as Willis remarks, 'These

numerous excessively free and highly heterodox interpretations appear to have lost Villeneuve neither countenance nor favour at Vienne.

For another Lyons publisher, Frelon, he edited a number of educational works, and through him the Vienne physician was put in correspondence with the Geneva reformer.

A dreamer, an enthusiast, a mystic, Servetus was possessed with the idea that could but the doctrines of the Church be reformed the world could be won to a primitive, simple Christianity. We have already seen his attempt to bring the Swiss Reformers into what he thought correct views upon the Trinity. He now began a correspondence with Calvin on this subject, and on the question of the Sacraments. The letters, which are extant, in tone and contents shocked and disgusted Calvin to such a degree that in a communication to Farel, dated February, 1546, after stating that Servetus had offered to come to Geneva, he adds, 'I will not pledge my faith to him; for did he come if I have any authority here I should never suffer him to go away alive.'

For years Servetus had in preparation the work which he fondly hoped would restore primitive Christianity. Part of a MS. of this he had sent to Calvin. Having tried in vain to get it published, he decided to print it privately at Vienne. Arrangements were made with a local printer, who set up a separate press in a small house, and in a few months 1,000 copies were printed. The title-page here reproduced (Fig. 7) has the date 1553, and on the last page the initials of his name, 'M. S. V.'

He must have known that the work was likely to cause great commotion in the Church, but he hoped that the identity of the author would be as little sus-

CHRISTIANI-

SMI RESTITV,

TIO.

Totius ecclesiæ apostolicæ est ad sua limina vo-
catio, in integrum restituta cognitione Dei, fidei
Christi, iustificationis nostræ, regenerationis bapti
smi, & cænæ domini manducationis. Restituto de-
nique nobis regno cælesti, Babylonis impiæ captiui-
tate soluta, & Antichristo cum suis penitus de-
structo.

בעת ההיא יעמור מיכאל חשׂר

καὶ ἐγένετο πόλεμος ἐν τῷ οὐρανῷ.

M. D. LIII.

Danielis Márkos Szent
Jvani Transylvano-
Hungari.

Londini 1665 die
13 Maij

Nunc Michaelis Almási
Futuro Episcopo dandus

FIG. 7

pected as that the Vienne physician, Michael Villeneuve, was Michael Servetus of the heretical *de Trinitatis Erroribus*. Intended for distribution in Germany, Switzerland, and Italy, the work was made up into bales of 100 copies for distribution to the trade. Probably from their mutual friend Frelon Calvin received a couple of copies. The usual story is that through one William Trie as a medium, Calvin denounced Villeneuve to the inquisition at Vienne. This was the view of Servetus himself, and is supported by Willis, Tollin, and others; but advocates of Calvin continue to deny that there is sufficient evidence of his active participation at this stage.

There was at this time at Lyons the well-known inquisitor Orry, who ten years before had brought Étienne Dolet to the stake. No sooner had he got scent of the affair than he undertook the prosecution with his customary zeal, and Servetus was arrested. The preliminary trial at Vienne is chiefly of interest on account of the autobiographical details which Servetus gives. The evidence against him was so overwhelming that he was committed to prison. Surrounded by his friends, who must have been greatly shocked and distressed to find their favourite physician in so terrible a plight, abundantly supplied with money, with the prison discipline very lax as the jailer was his friend, it is not surprising that the day after his commitment Servetus escaped, greatly no doubt to the relief of the Archbishop and the authorities. The inquisitor had to be content with burning an effigy of the heretic with some 500 copies of his work.

From April 7 until the middle of July Servetus disappears from view, and we next meet with him, of all places in the world, at Geneva. Why he should have run this risk has been much discussed, but the

c

explanation given by Guizot is probably the correct
one. At that time the Liberals, or 'Libertines', as they
were called because of their hostility to Calvin, fully
expected to triumph. 'One of their leaders, Ami Perrin,
was first Syndic: a man of their party, Gueroult, who
had been banished from Geneva, had been corrector of
the press at the time when the *Restoration of Christianity*
was published, and thanks to the influence of his patrons,
the Libertines, he had returned to Geneva, and would
naturally be the medium between them and Servetus.
Taking a comprehensive view of the whole case and
the antecedents of all those concerned in it, I am con-
vinced that Servetus, defeated at Vienne, went to
Geneva, relying on the support of the Libertines, whilst
they on their side expected to obtain efficacious help
from him against Calvin.' He seems to have been
nearly a month in Geneva before his arrest on the
morning of August 14.

The full account of this famous heresy trial has lost
much of its interest so far as the doctrinal details are
concerned. At this distance, with our modern ideas,
the procedure seems very barbarous. Servetus was
cruelly treated in prison, and there is a letter from him
which speaks of his shocking condition, without proper
clothing, and a prey to vermin. Mademoiselle Roch
has well depicted this phase of the martyr's career in
her fine statue which has been erected at Anamnese,
and which is here reproduced (Fig. 8). The full report
of the trial may be followed in the account given by
Willis, and the 'Procès-Verbal' was in existence at
Geneva in manuscript.

One thing seems clear, that while at first the accusa-
tions were largely concerned with the heretical views
of Servetus, later the public prosecutor laid more stress
upon the political side of the case, accusing him of

FIG. 8: SERVETUS IN PRISON

conspiracy with the Libertines. The trial divided
Geneva into hostile camps, and it sometimes looked as
though Calvin, quite as much as Servetus, was on trial.
To strengthen their hands the clerical party appealed
to the Swiss churches. The answer, strong enough in
condemning the heresy and blasphemy, refrained from
specifying the kind of punishment.

Accustomed in France to hear the Swiss Reformers
branded as the worst type of heretics, Servetus appears
never to have understood why he should not have been
received with open arms by the Protestants, whose
one desire was the same as his own, the restoration of
primitive faith and practice. He made a brave fight,
and brought strong countercharges against Calvin,
whom he accused specifically of causing his arrest at
Vienne. He offered to discuss the questions at issue
publicly, an offer which Calvin would have accepted
had the syndics allowed. The whole city was in a
ferment, and Sunday after Sunday Calvin and the other
pastors thundered from their pulpits against the
blasphemies of the Spaniard. After dragging its weary
length for nearly two months, the public feeling veered
strongly to the side of Calvin, and on October 27 the
Council, by a majority vote, resolved that in considera-
tion of his great errors and blasphemies, the prisoner
should be burnt alive.

Servetus appears to have been a curious compound
of audacity and guilelessness. The announcement of
the condemnation appears to have completely stunned
him, as he seems never to have considered its possi-
bility. He sent for Calvin and asked his pardon, but
there was bitterness in the heart of the great reformer
whose account of the interview is not very pleasant
reading.

On the morning of the 27th, the Tribunal assembled

before the porch of the Hôtel de Ville to read to the prisoner his formal condemnation, under ten separate heads, the two most important of which relate to the doctrine of the Trinity, and Infant Baptism. It is curious that under one of the headings he should be denounced as an arrogant innovator, and an inventor of heresies against Popery! The entreaty of Servetus for a more merciful mode of death (for which, to his credit, be it said, Calvin also pleaded) was in vain. The procession at once formed to the place of execution.

Nothing in his life, it may be said, became him like the leaving of it. As Guizot remarks, 'The dignity of the philosopher triumphed over the weakness of the man, and Servetus died heroically and calmly at that stake the very thought of which had at first filled him with terror.'

There will be dedicated next year at Vienne a monument commemorating the services of Servetus as an independent spirit in theology, and as a pioneer in physiology.

It has been said that Sappho survives because we sing her songs, and Aeschylus because we read his plays, but it would be difficult to explain the widespread interest in Servetus from any knowledge men have of his writings. The pathos of his fate, which scandalized Gibbon more profoundly than all the human hecatombs of Spain or Portugal, accounts for it in part. Then there is the limited circle of those who regard him as a martyr to the Unitarian confession; while scientific men have a very definite interest in him as one of the first to make a substantial contribution to our knowledge of the circulation of the blood. His theological and physiological views call for brief comments.

IV

Next to theology itself the study of medicine has been a great heresy breeder. From the days of Arnold of Villanova and Pierre of Abano, there have been noted heretics in our ranks. Bossuet defines a heretic as 'One who has opinions'. Servetus seems to have been charged with opinions like a Leyden jar. His most notable ones concerned the Trinity and Infant Baptism. Wracked almost to destruction in the third and fourth centuries on the subject of the Trinity, the final conquest of Arianism found its expression in that magnificent human document the Athanasian Creed, with which the Catholic Church has for ever settled the question, in language which sends a cold shudder down the backs of heretics. But there have always been turbulent souls who could not rest satisfied, and who would bring up unpleasant points from the Bible—men who were not able to accept Dante's wise advice :—
'Mad is he who hopes that our reason can traverse the infinite way which one Substance as Three Persons holds. Be content oh human race with the Quia'.

The doctrine has been a great breeding ground of heretics, the smoke of whose burning has been a sweet savour in the nostrils alike of Catholics and Protestants. Even to-day, so deeply ingrained is the catholic creed, that nearly everything in the way of doctrinal vagary is forgiven save denial of the Trinity, which is thought to put a man outside the pale of normal Christianity. If this is the feeling to-day, imagine what it must have been in the middle of the sixteenth century!

Servetus wrote two theological works—*de Trinitatis Erroribus*, published in 1531, followed by a supplement in 1532. To these I have already referred. Living a double life at Vienne, to the inhabitants he was the

careful and kind practitioner of medicine, to whom they had become devoted, but all the while, nourishing the dream of his youth, he had in preparation a work which he believed would win the world to Christ by purifying the Church from grave errors in doctrine.

I have already spoken of the printing of the *Christianismi Restitutio*. Mainly concerned with most abstruse questions concerning the Trinity and Infant Baptism, it is a most difficult work to read, and, as theologians confess, a still more difficult one to understand. Professor Emerton, in his article from which I have already quoted, gives in a few paragraphs the essence of his views. 'He finds the central fact of Christian speculation, not in the doctrine of the Trinity as formulated by the schools, but in the fact of the divine incarnation in the person of Jesus. He admits the divine birth, explaining it as in harmony with a general law of divine manifestation whereby the spiritual is revealed in the material. He would not accept the idea of an eternal sonship, except in this sense, that the divine Word, the Logos, had always been active as the expression in outward form of the divine activity. So, in the fullness of time, this same Logos produced a being from a human mother upon whom at the moment of his birth the divine Spirit was breathed. Obviously this is not the "eternal Son" of the creeds, and herein lay the special theological crime of Servetus. In his criticism of the church order, of the papal government, of the sacramental system, he does not differ essentially from the more radical of the reformers. On the essential matters of baptism and the Eucharist he goes quite beyond the established reforming churches. In both cases he invokes the principle of plain reason. He rejects Infant Baptism on the ground that the infant can have no faith, and that the practice is therefore

mere incantation. He denies transubstantiation on the rational basis that substances and accidents may not be separated, and does not spare the reforming leaders for what seemed to him their half-hearted attitude on this point. His language throughout is harsh and violent, except where, as at the close of his chapters, he passes over into the forms of devotion and closes his diatribes with prayers of great beauty and spirituality.'

The Christian Church early found out that there was only one safe way of dealing with heresy. From the end of the fourth century, when the habit began, to its climax on St. Bartholomew's Day, it was universally recognized that only dead heretics ceased to be trouble-some. History affords ample evidence of the efficacy of repressive measures, often carried out on a scale of noble proportions. France is Catholic because of a root and branch policy; England's Protestantism is an enduring testimony to the thoroughness with which Henry VIII carried out his measures. As De Foe says in his famous pamphlet, *Shortest way with Dissenters*, if a man is obstinate and persists in having an opinion of his own, contrary to that held by a majority of his fellows, and if the opinion is pernicious and jeopardizes his eternal salvation, it is much safer to burn him than to allow his doctrines to spread! For 1,200 years this policy kept heresy within narrow limits until the great outbreak. The very best men of the day were con-senting to the death of heretics. The spirit of Pro-testantism was against it; Luther nobly so. Judged by his age Servetus was a rank heretic, and as deserving of death as any ever tied to a stake. We can scarcely call him a martyr of the Church.—What Church would own him? All the same, we honour his memory as a martyr to the truth as he saw it.

Servetus was a student of medicine in Paris with

Sylvius and Guinther, two of the most ardent of the revivers of the Galenic anatomy. More important still, he was a fellow student and pro-sector with Vesalius. He wrote one little medical book of no special merit. The works which he edited, which brought him more money than fame, indicate an independent and critical spirit. Vienne was a small town, in which we cannot think there was any scientific stimulus, though it was in a region noted for its intellectual activity.

In possession of a fact in physiology of the very first moment, Servetus described it with extraordinary clearness and accuracy. But so little did he think of the discovery, of so trifling importance did it appear in comparison with the great task in hand of restoring Christianity, that he used it simply as an illustration when discussing the nature of the Holy Spirit in his work *Christianismi Restitutio*. The discovery was nothing less than that of the passage of the blood from the right side of the heart to the left through the lungs, what is known as pulmonary, or lesser circulation.

In the year 1553 the views of Galen everywhere prevailed. The great master had indeed effected a revolution in the knowledge of the circulation almost as great as that made by Harvey in the seventeenth century. Briefly stated there were two bloods, the natural and the vital, in two practically closed systems, the veins and the arteries. The liver was the central organ of the venous system, the 'shop' as Burton calls it, in which the chylus was converted into blood and from which it was distributed by the veins to all parts of the body for nourishment. The veins were rather vessels containing the blood than tubes for its transmission—irrigating canals Galen called them. Galen knew the structure of the heart, the arrangement of its valves, and the direction in which the blood passed, but

its chief function was not, as we suppose, mechanical, but in the left ventricle, the seat of life, the vital spirits were generated, being a mixture of inspired air and blood. By an alternate movement of dilatation and collapse of the arteries the blood with the vital spirits were kept in constant motion.[1] Galen had demonstrated that the arteries and the veins communicated with each other at the periphery. A small quantity of the blood went, he believed, from the right side of the heart to the lungs, for their nourishment, and in this way passed to the left side of the heart; but the chief communication between the two systems was through pores in the ventricular septum, the thick muscular wall separating the two chief chambers of the heart.

The literature may be searched in vain for any other than the Galenic view up to 1553. Even Vesalius, who could not understand from its structure how even the smallest quantity of blood could pass through the septum dividing the ventricles, offered no other explanation. The more one knows of the Galenic physiology, the less one is surprised that it had so captivated the minds of men. The description of the new way which Servetus describes is found in the fifth book of the *Christianismi Restitutio*, in which he is discussing the nature of the Holy Spirit. After mentioning the threefold spirit of the body of man, natural, vital, and animal, he goes on to discuss the vital spirit, and in

[1] So firmly entrenched was the Galenic physiology that the new views of Harvey made at first very slow progress. In Burton's *Anatomy of Melancholy*, which is a sort of epitome of medical knowledge of the seventeenth century, is the following description : 'The left creek (i. e. ventricle) has the form of a cone, and is the seat of life, which, as a torch doth oil, draws blood unto it begetting of it spirits and fire, and as a fire in a torch so are spirits in the blood; and by that great artery called aorta, it sends vital spirits over the body, and takes air from the lungs.'

a few paragraphs describes the pulmonary circulation. ' Rightly to understand the question here, the first thing to be considered is the substantial generation of the vital spirit—a compound of the inspired air with the most subtle portion of the blood. The vital spirit has, therefore, its source in the left ventricle of the heart, the lungs aiding most essentially in its production. It is a fine attenuated spirit, elaborated by the power of heat, of a crimson colour and fiery potency—the lucid vapour as it were of the blood, substantially composed of water, air, and fire ; for it is engendered, as said, by the mingling of the inspired air with the more subtle portion of the blood which the right ventricle of the heart communicates to the left. This communication, how-ever, does not take place through the septum, partition, or midwall of the heart, as commonly believed, but by another admirable contrivance, the blood being trans-mitted from the pulmonary artery to the pulmonary vein, by a lengthened passage through the lungs, in the course of which it is elaborated and becomes of a crimson colour. Mingled with the inspired air in this passage, and freed from fuliginous vapours by the act of expiration, the mixture being now complete in every respect, and the blood become fit dwelling-place of the vital spirit, it is finally attracted by the diastole, and reaches the left ventricle of the heart.

' Now that the communication and elaboration take place in the lungs in the manner described, we are assured by the conjunctions and communications of the pulmonary artery with the pulmonary vein. The great size of the pulmonary artery seems of itself to declare how the matter stands ; for this vessel would neither have been of such a size as it is, nor would such a force of the purest blood have been sent through it to the lungs for their nutrition only ; neither would the heart

have supplied the lungs in such fashion, seeing as we do that the lungs in the foetus are nourished from another source—those membranes or valves of the heart not coming into play until the hour of birth, as Galen teaches. The blood must consequently be poured in such large measure at the moment of birth from the heart to the lungs for another purpose than the nourishment of those organs. Moreover, it is not simply air, but air mingled with blood that is returned from the lungs to the heart by the pulmonary veins.

' It is in the lungs, consequently, that the mixture (of the inspired air with the blood) takes place, and it is in the lungs also, not in the heart, that the crimson colour of the blood is acquired. There is not indeed capacity of room enough in the left ventricle of the heart for so great and important an elaboration, neither does it seem competent to produce the crimson colour. To conclude, the septum or middle portion of the heart, seeing that it is without vessels and special properties, is not fitted to permit and accomplish the communication and elaboration in question, although it may be that some transudation takes place through it. It is by a mechanism similar to that by which the transfusion from the *vena portae* to the *vena cava* takes place in the liver, in respect of the blood, that the transfusion from the pulmonary artery to the pulmonary vein takes place in the lungs, in respect of the spirit' (Willis's translation). I here reproduce from the Vienna example the two pages from which the greater part of this description is taken (Figs. 9 and 10).

The important elements here are: First, the clear statement of the function of the pulmonary artery; secondly, the transmission of the impure or venous blood through the lungs from the right side of the heart to the left; thirdly, the recognition of an

170   DE TRINITATE

lē, quā nunc audies. Hinc dicitur anima esse in sanguine, & anima ipsa esse sanguis, siue sanguineus spiritus. Non dicitur anima principaliter esse in parietibus cordis, aut in corpore ipso cerebri, aut hepatis, sed in sanguine, vt docet ipse Deus genes. 9. Leuit. 17. et Deut. 12.

Ad quam rem est prius intelligenda substantialis generatio ipsius vitalis spiritus, qui ex aëre inspirato & subtilissimo sanguine componitur, & nutritur. Vitalis spiritus ī sinistro cordis vētriculo suā originē habet, iuuātibus maximē pulmonibus ad ipsius generationem. Est spiritus tenuis, caloris vi elaboratus, flauo colore, ignea potentia, vt sit quasi ex puriori sanguine lucidus vapor, substantiam in se continens aquæ aëris & ignis. Generatur ex facta in pulmonibus mixtione inspirati aëris cū elaborato subtili sanguine, quē dexter vētriculus cordis sinistro communicat. Fit autem cōmunicatio hæc, non per parietem cordis mediū, vt vulgo creditur. Sed magno artificio à dextro cordis ventriculo, longo per pulmones ductu, agitatur sanguis subtilis: à pulmonibus præparatur, flauus efficitur: & à vena arteriosa in arteriā venosam transfunditur. Deinde in ipsa arteria venosa inspirato aëri miscetur, & expiratione à fuligine repurgatur, Atque ita tandem à sinistro cordis ventriculo totum mixtum per diastolem attrahitur, apta suppellex, vt fiat spiritus vitalis.

Quòd ita per pulmones fiat cōicatio, & præparatio, docet cōiunctio varia, & cōicatio, venæ arteriosæ cū arteria venosa i pulmonibus. Cōfirmat hoc magnitudo insignis venæ arteriosæ, quæ nec talis, nec tāta facta esset, nec tātā à corde ipso vim purissimi sanguinis in pulmones emitteret, ob solū eorū nutrimentum, nec cor pulmonibus hac ratione seruiret: cū præsertim antea in embryone solerent pulmones ipsi aliunde nutriri, ob membranulas illas, seu valuu

FIG. 9

valuulas cordis,vſq; ad horã natiuitaris nõdũ aper tas ,vt
docet Galenus.Ergo ad alium vſum effunditur ſanguis à
corde in pulmones hora ipſa natiuitatis,& tã copioſus.I-
tē,à pulmonibus ad cor non ſimplex aër,ſed mixtus ſan-
guine mittitur,per arteriam venoſam:ergo in pulmoni-
bus fit mixtio.Flauus ille color à pulmonibus datur ſan
guini ſpirituoſo,non à corde.In ſiniſtro cordis ventriculo
non eſt locus capax tantæ & tam copioſæ mixtionis, nec
ad flauum elaboratio illa ſufficiēs.Demum,paries ille me-
dius,cùm ſit vaſorum & facultatum expers,non eſt aptus
ad communicationē & elaborationē illam,licet aliquid re
ſudare poſsit.Eodem artificio,quo in hepate fit transfuſio
à vena porta ad venam cauam propter ſanguinem , fit e-
tiam in pulmone transfuſio à vena arterioſa ad arte-
riam venoſam propter ſpiritum . Si quis hæc conferat
cum ijs quæ ſcribit Galenus lib.6.& 7.de vſu partium,ve
ritatem penitus intelliget, ab ipſo Galeno non animad-
uerſam.

Ille itaq; ſpiritus vitalis à ſiniſtro cordis ventriculo in
arterias totius corporis deinde transfunditur,ita vt qui te
nuior eſt, ſuperiora petat , vbi magis adhuc elaboratur,
præcipuè in plexu retiformi,ſub baſi cerebri ſito,in quo
ex vitali fieri incipit animalis , ad propriam rationalis
animæ ſedem accedens . Iterum ille fortius mentis ignea
vi tenuatur,elaboratur,& perficitur,in tenuiſsimis vaſis,
ſeu capillaribus arterijs , quæ in plexibus choroidibus
ſitæ ſunt, & ipſiſsimam mentem continent . Hi plexus
intima omnia cerebri penetrant , & ipſos cerebri ven-
triculos internè ſuccingunt , vaſa illa ſecum compli-
cata ,& contexta ſeruantes , vſque ad neruorum origi-
nes , vt in eos ſentiendi & mouendi facultas inducatur .
Vaſa illa miraculo magno tenuiſsimè contexta , ta-
metſi arteriæ dicantur , ſunt tamen fines arteriarum ,
tenden

FIG. 10

elaboration or transformation in the lungs, so that with the freeing the blood of 'fuliginous vapours', there was at the same time a change to the crimson colour of the arterial blood; fourthly, the direct denial of a communication of the two bloods, by means of orifices in the septum between the ventricles.

He had no idea of the general or systematic circulation, and so far as the left heart and the arteries were concerned he believed them to be the seat of the vital blood and spirits.

It is not hard to imagine how Servetus had become emancipated from the old views. A student at Paris at a most opportune period, when dissection had become popular, he had had as pro-sector to Guinther exceptional opportunities. But more important still, he had as fellow worker the anatomical arch-heretic, Andreas Vesalius, already imbued with the conviction that his teachers were wrong in regarding Galen as inspired and infallible. It was at this very period that Vesalius had pointed out to his teacher Sylvius the error of Galen about the aortic valves; and when one considers the extraordinary rapidity with which Vesalius reformed human anatomy, before he had completed his twenty-eighth year, it is not surprising that his colleague and co-worker should have discovered one of the great truths of physiology.

The *Christianismi Restitutio* was never published, and the discovery of Servetus remained unrecognized until the attention of Wotton was called to it by Charles Bernard, a St. Bartholomew's Hospital surgeon.[1] Meanwhile it had been rediscovered, and among the many vagaries with which the history of the circulation of the blood is marked, not the least striking is the attempt to

[1] William Wotton, *Reflections upon ancient and modern learning*, 1697, page 229.

rob Servetus of his credit. In 1559 there was published a work by Realdus Colombo,[1] a student of Vesalius and his successor at Padua, in which the circulation of the blood from the right side of the heart to the left is clearly described. It is impossible to say that he had added anything to the account just given, and the far-fetched view has been maintained that Italian students at Paris had acquainted Servetus with the views of Colombo. It is claimed for Colombo also that he had a better idea of the function of respiration in the purification of the blood, by its mingling with the air, but Servetus distinctly states that the mixture takes place in the lungs, not, as was usually understood at the time, in the heart itself.

Caesalpinus (1569), for whom elaborate claims are made, also knew of the pulmonary circulation, but he thought part of the blood went through the median septum. A more important claim is made for him of the discovery of the general circulation, but it is remarkable that any one knowing the history of the subject could read into his physiology anything more than the old Galenic views.

The history of the circulation bristles with controversy and widely divergent opinions are held as to the merits of the different observers. That Servetus first advanced a step beyond Galen, that Colombo and Caesalpinus reached the same conclusion independently—all three recognizing the lesser circulation, is quite as certain as that it remained for Harvey to open an entirely new chapter in physiology, and to introduce modern experimental methods by which the complete circulation of the blood was first clearly demonstrated.[2]

[1] *De re Anatomica : Venetiis.*
[2] John C. Dalton's *History of the Circulation*, 1884, gives by far the best and fullest account of the whole subject in English.

A word about the book *Christianismi Restitutio, liber inter rariores longe rarissimus*. Only two complete copies are known, one in the Bibliothèque Nationale, Paris, and the other in the Imperial Library, Vienna, from which I was very kindly permitted to have the photographs of the title-page and the pages describing the circulation of the blood which are here reproduced. A third copy, imperfect, with the first sixteen pages in MS., is in the University Library, Edinburgh. The Paris copy is of special interest, as it belonged to Dr. Richard Mead, the distinguished physician and book collector, by whom it was exchanged with M. de Boze for a series of medals. In 1784 it was secured for the Royal Library. It may now be seen in one of the show cases of the Bibliothèque Nationale, of which it is one of the rare treasures. An added interest is in the fact that on the title-page occurs the name 'Germain Colladon', the Geneva barrister, who prosecuted Servetus ; and it is in the highest degree probable that this was the identical copy used at the trial. In one place the book is stained, some suppose by moisture ; others think it possible this was the very copy bound upon the victim himself, and snatched from the flames by some one who wished to preserve so interest-ing a record of the great heretic. The question has been examined carefully by the late Professor Labou-bene and M. Hahn, the distinguished librarian of the Paris Faculty of Medicine, both of whom are in favour of fire, not moisture, as the cause of the staining.

In 1791 the Vienna copy was reprinted at Nuremberg in facsimile, page for page, but Dr. de Murr, who was responsible for the reprint, very wisely put the date 1791 at the bottom of the last page. Copies of this edition are not uncommon in the larger libraries. In 1723 Mead attempted to have a reprint made from his copy,

but when nearly completed the Bishop of London had it suppressed, and (it is stated) the copies were burnt. A few, however, escaped, and Willis says that he saw one in the library of the London Medical Society. I regret to say that the librarian informs me that this no longer is to be found. A copy of the Mead partial reprint is in the Bibliothèque Nationale, and two copies are in the British Museum.

A last word on the attitude of John Calvin towards Servetus. Much scorn has been heaped upon the great reformer, and one cannot but regret that a man of such magnificent achievements should have been dragged into a miserable heresy hunt like a common inquisitor. Let us not estimate him by his century, as his friends plead, but frankly by his life, and as a man of like passions with ourselves. He had bitter provocation. Flouted for years by the persistent assaults of Servetus, and shocked out of all compassion by his blasphemies, is it to be wondered that the old Adam got the better of his Christian charity? Not only is it impossible to acquit Calvin of active complicity in this unhappy affair, but there was mixed up with it a personal hate, a vindictiveness unbecoming in so great a character, and we may say foreign to it. But let the long record of a self-denying life, devoted in an evil generation to the highest and the best, wipe for all reasonable men this one blot. Let us, if we may judge him at all, do so as a man, not as a demi-god. We cannot defend him, let us not condemn him; let his one grievous fault, even though we may fear he never repented of it, be the shadow which throws into stronger relief the splendid outlines of a noble life. In his defence,[1] the original edition of which I have here, and

---

[1] *Defensio Orthodoxae, &c.*, 1554.

E

which is concerned largely with doctrinal questions, not only are there no expressions of regret for the part he played in the tragedy, but the work is filled with insults to his dead enemy, couched in the most vindictive language.   On the spot where Servetus was burnt there stands to-day an expiatory monument (Fig. 11), which expresses the spirit of modern Protestantism. On one side is the record of his birth and death, on the other an inscription, of which the following is a translation : ' Duteous and grateful followers of Calvin our great Reformer, yet condemning an error which was that of his age, and strongly attached to liberty of conscience according to the true principles of the Reformation and the Gospel, we have erected this expiatory monument.   Oct. 27, 1903.'

The erection next year at Vienne of a quater-centenary monument will complete the recognition by the modern world of the merits of one of the strangest figures on the rich canvas of the sixteenth century. The wandering Spanish scholar, the stormy disputant, the anatomical pro-sector, the mystic dreamer of a restored Christianity, the discoverer of one of the fundamental facts of physiology, has come at last to his own.   There are those, I know, who feel that perhaps more than justice has been done ; but in a tragic age Servetus played an unusually tragic part, and the pathos of his fate appeals strongly to us.

These, too, are days of retribution, of the restoration of all things, the days of the opening of the fifth seal, when the souls under the altar see their blood avenged, when we clothe in the white robes of charity those who were slain for the testimony which they held, little noting whether the martyr was Catholic or Protestant, caring only to honour one of that great company which no man can number, 'whose heroic sufferings,' as

LE XXVII OCTOBRE MDLIII
MOVRVT SVR LE BVCHER
A CHAMPEL
MICHEL SERVET
DE VILLENEVVE D'ARAGON
NE LE XXIX SEPTEMBRE MDXI

FIG. 11

Carlyle says, 'rise up melodiously together to heaven out of all lands and out of all time, as a sacred Miserere, their heroic actions also as a boundless everlasting Psalm of Triumph.'

Note.—The Servetus bibliography is fully given to 1890 in Professor A. V. D. Linde's *Michael Servetus*, Groningen, 1891. My personal interest dates many years back when Pastor Tollin's delightful sketches enlivened the numbers of Virchow's *Archives*. No one has ever had a more enthusiastic biographer, and to the writings of the Madgeburg clergyman we owe the greater part of our modern knowledge of Servetus. The best account in English is by Willis—*Servetus and Calvin*, 1877. A German translation of the *Christianismi Restitutio* by Dr. Bernhard Spiess appeared in 1895 (2nd edition, Wiesbaden, Chr. Limbarth). I am indebted to Professor Harper of Princeton for an historical drama, *The Reformer of Geneva*, by Professor Shields (privately printed, Princeton University Press, 1897), which gives an admirable picture of Geneva at the time of the trial. From Chéreau's *Histoire d'un Livre*, 1879, I have 'cribbed' the idea of the introduction. The name of Mosheim must be mentioned, as his writings were for years the common tap from which all Servetus knowledge was derived. The Servetus portrait, of which Mosheim speaks, has disappeared; I have reproduced the engraving from Allworden's *Historia* (1727), also the Roch statue at Anamnese.

Michael Servetus [1]

Ein Märtyrer der Wissenschaft

Von

William Osler, M. D., F. R. S.

Professor der Medizin an der Universität Oxford

I

Das Jahr 1553 brachte über Europa eine lange Reihe von Tragödien, und dem ernsten Bibelkenner muß es den Eindruck gemacht haben, als ob die Tage der Eröffnung des zweiten Siegels gekommen wären, von dem in der Offenbarung Johannis die Rede ist, wo „der Friede von der Erde genommen" sein und die Menschen „sich untereinander erwürgen" sollen. Eine jener Tragödien ist in diesem Jahr, in dem die vierhundertjährige Feier der Geburt des Hauptakteurs begangen worden ist, von besonderem, traurigem Interesse; doch war es nur einer von tausenden ähnlicher Fälle, mit denen die Geschichte des sechzehnten Jahrhunderts befleckt ist. Am 27. Oktober kurz nach 12 Uhr setzte sich vom Rathaus in Genf aus ein langer Zug in Bewegung — die hohen Magistratsherren der Stadt, die Geistlichkeit in ihren Talaren, der Seigneur Leutnant und andre Beamte zu Pferd, eine Wache von berittenen Bogenschützen, die Bürger mit einem bunten Gefolge, und in ihrer Mitte ging mit gebundenen Armen, in abgetragenen, schmutzigen Kleidern ein Mann von mittlerem Alter, dessen geistvolles Gesicht die Spuren langen Leidens trug. Durch die Rue St. Antoine und durch das Tor gleichen Namens nahm der Zug seinen Weg nach dem Richtplatz der Stadt. Außerhalb der Mauern bot sich den Blicken ein herrliches Bild: in der Ferne die blauen Wasser und zauberisch schönen Ufer des Genfersees, gegen Westen und Norden das riesige Amphitheater des Jura mit seinen schneebedeckten Gipfeln, und im Süden und Westen das liebliche Tal des Rhone; aber wir können uns wohl denken, daß sich wenig Blicke von der Gestalt in der Mitte dieses traurigen Zuges abwandten. An der Seite des Mannes schritt, ihm eindringlich zusprechend, der betagte Prediger Farel, der ein

---

[1] Rede, gehalten im Johns Hopkins Medical School Historical Club.

langes und nützliches Leben dem Dienste seiner Mitbürger gewidmet hatte. Der
Zug ging den Berg hinauf und gelangte auf die Ebene von Champel. Hier be-
fand sich auf einer leichten Erhöhung der verhängnisvolle Marterpfahl mit den
herabhängenden Ketten und den angehäuften Holzbündeln. Bei diesem Anblick
warf sich das arme Opfer im Gebet zu Boden. Als Antwort auf das Zureden
des Geistlichen, ein bestimmtes Glaubensbekenntnis abzulegen, ertönte der Ruf:
„Barmherzigkeit! Barmherzigkeit! Jesu, du Sohn des ewigen Gottes, erbarme
dich meiner!" Mit der eisernen Kette an den Pfahl gefesselt, auf dem Kopf
einen mit Schwefel getränkten Kranz aus Stroh und grünen Zweigen, sah der
Verurteilte, heißt es, mit seinem langen, dunkeln Gesicht wie Christus aus, in
dessen Namen er gefesselt war. An seinen Leib wurde ein großes Bündel von
Manuskripten und ein dicker Oktavband geschnürt. Die Fackel wurde angesetzt,
und als die Flammen nach dem Stroh und Schwefel züngelten und ihm in die
Augen loderten, vernahm man einen durchdringenden Schrei, der die Herzen der
Umstehenden mit Entsetzen erfüllte. Die Holzbündel waren noch grün, das Ver-
brennen ging langsam, und es dauerte lange, bis er im letzten Todeskampf aber-
mals rief: „Jesu, du Sohn des ewigen Gottes, habe Erbarmen mit mir!" So
starb in seinem vierundvierzigsten Lebensjahre Michael Servetus Villanovanus,
Arzt, Physiologe und Ketzer. Seltsam — wenn er hätte rufen können: „Jesu,
du ewiger Sohn Gottes!", so würden, selbst noch in diesem letzten Augenblick, seine
Ketten gelöst, der Kranz von seinem Haupte abgenommen und die Holzbündel
zerstreut worden sein; aber er blieb bis in den Tod dem getreu, was seiner
Ueberzeugung nach die Wahrheit war, wie sie in der Bibel offenbart worden ist.

Die Geschichte seines Lebens ist das Thema meiner Rede.

Michael Servetus, auch bekannt als Michel Villeneuve oder Michael Ser-
vetus Villanovanus oder, wie er in einem seiner Bücher schrieb, alias Reves,
war ein in Villanueva de Sigena, in der heutigen Provinz Huesca, geborener
Spanier. Als er in Wien verhört wurde, gab er Tudela in Navarra, in Genf
Villanueva in Aragonien als seinen Geburtsort an; und an dem einen Ort gab
er als sein Geburtsjahr 1509, an dem andern 1511 an. Das erstere wird
gewöhnlich als das richtige angesehen. Da in Villanueva de Sigena auf seine
Familie bezügliche Urkunden vorhanden sind, und da der von Servetus' Vater
verfertigte Familienaltar noch existiert, so können wir annehmen, daß jedenfalls
sein Geburtsort feststeht. Der Altarschrein ist ein schönes Kunstwerk mit zehn
Gemälden. Servetus scheint einer guten, wohlhabenden Familie angehört zu
haben, und bei seinem Verhör erklärte er, daß er einem alten, vornehmen Ge-
schlecht entstamme.

Von der Klosterschule ging er wahrscheinlich auf die benachbarte Universität
von Saragossa. Vielleicht wollte er sich anfangs dem geistlichen Beruf widmen,
aber wie dem auch sein mag, erwiesen ist, daß er ein frühreifer Jüngling und
im Lateinischen, Griechischen und Hebräischen sehr belesen war. Kenntnisse in den
beiden letzteren Sprachen waren zu jener Zeit etwas sehr Ungewöhnliches.

Später hören wir von ihm, daß er in Toulouse kanonisches und bürgerliches

Recht studierte. Er kann noch nicht zwanzig Jahre alt gewesen sein, als er in den Dienst des Paters Quintana, des Beichtvaters Kaiser Karls V., trat, wie es scheint, als sein Privatsekretär. Im Gefolge des Kaisers ging er nach Italien und war dabei, als der Papst und der Kaiser in Bologna einzogen, und „er sah den mächtigsten Fürsten der Zeit an der Spitze von zwanzigtausend alten Kriegern niederknien und die Füße des Papstes küssen". Hier empfing er seine ersten Eindrücke von dem weltlichen und eigennützigen Charakter des Papsttums, gegen das wir ihn sehr bald von einem erbitterten Haß beseelt finden.

Im Sommer des Jahres 1530 wohnte der Kaiser dem Reichstag zu Augsburg bei, auf dem die Fürsten es durchsetzten, daß der Protestantismus politisch anerkannt wurde. Eine solche Versammlung mußte einen tiefgehenden Einfluß auf den jungen Gelehrten ausüben, der damals schon, wie wir annehmen können, von den neuen Lehren angesteckt war. Wahrscheinlich ist er in Saragossa oder in Toulouse mit den Schriften Luthers bekannt geworden. Eine Meinungsäußerung wie die folgende, die er vor seinem einundzwanzigsten Jahre niedergeschrieben hat, kann nicht die Frucht weniger Monate gewesen sein: „Was mich selbst betrifft, so kann ich mich weder mit den Katholiken noch mit den Reformatoren in jeder Einzelheit einverstanden erklären. Beide scheinen mir ein gewisses Maß von Wahrheit und ein gewisses Maß von Irrtümern in ihren Ansichten zu haben; und während jeder die Mängel des andern sieht, sieht keiner die eignen. Gott in seiner Güte lasse uns alle unsre Fehler erkennen und mache uns willig, sie abzulegen. Es wäre in der Tat leicht genug, über alles leidenschaftslos zu urteilen, wenn man uns nur ohne Belästigung von seiten der Kirchen frei unsre Gedanken aussprechen lassen würde." (Willis.)

Ob er irgendwelche persönliche Beziehung zu den deutschen Reformatoren unterhielt, ist zweifelhaft. Möglich ist es sehr wohl, und Tollin, sein Hauptbiograph, läßt ihn Luther besuchen. Wir wissen nicht, wie lange er im Dienste Quintanas stand; Tollin meint, anderthalb Jahre. Es ist nicht unwahrscheinlich, daß der gute Pater froh war, einen jungen Sekretär loszuwerden, der von solch anstößiger Ketzerei angesteckt war, wie sie sein erstes im Jahre 1531 veröffentlichtes Buch enthielt; in der Tat wird in dieser Hinsicht berichtet, daß ein Mönch im Gefolge Quintanas das Buch in einem Laden in Regensburg fand und eiligst dem Beichtvater von seinem schrecklichen Inhalt erzählte.

Servetus hatte sich kopfüber in Studien von gefährlichstem Charakter gestürzt und hatte ihr Ergebnis sogar in einem kleinen Oktavband niedergelegt, der „De Trinitatis erroribus" betitelt ist und ohne den Namen des Druckers erschien, aber auf dem Titelblatt den des Verfassers „Michael Serveto, alias Reves ab Aragonia" und die Jahreszahl MDXXXI trägt. In der Unschuld seines Herzens dachte er, daß das Werk eine gute Empfehlung für ihn bei den freisinnigen Schweizer Reformatoren sein würde, aber sie wollten nichts davon wissen und waren unsagbar empört über seine vermeintlichen Gotteslästerungen. In Straßburg erging es ihm nicht viel besser, und selbst der gutherzige Bucer

sagte, daß dem Verfasser eines solchen Werkes der Bauch aufgeschlitzt und er in Stücke zerrissen werden sollte.

In schwierigen theologischen Fragen sucht natürlich ein Laie Zuflucht bei andern, und ich freue mich, die Ansicht, die unlängst ein hervorragender Kenner jener Zeit, Professor Emerton, über diese Jugendphase im Leben des Servetus ausgesprochen hat,[1] anführen zu können: „Er wollte nicht zugeben, daß der ewige Sohn Gottes als Mensch erscheinen mußte, sondern nur, daß ein Mensch kommen mußte, der der Sohn Gottes sein sollte. Das ist die früheste Andeutung, die wir über die Spekulationen haben, die den Geist des jungen Gelehrten beschäftigten. Es ist in hohem Grade bezeichnend, daß er von Anfang an von dem, was wir heute die historische Auffassung der Theologie nennen würden, erfüllt war. Als er das Alte Testament las, schien es ihm, als ob dessen Verfasser auf Dinge Bezug nähmen, die ihre Hörer verstehen würden. Ihr Blick in die Zukunft war durch die augenblicklichen Schicksale des Volkes beschränkt. Sie sich im Besitz aller göttlichen Geheimnisse vorzustellen und sich die Person des Menschen Jesus als das letzte Ziel aller ihrer prophetischen Visionen zu denken, hieß die Kenntnis der Geschichte in eine Vergangenheit zurückstrahlen lassen, in der eine solche Kenntnis unmöglich war. Soweit ich ihn verstehen kann, ist dies der Schlüssel zu allen späteren Gedanken des Servetus. Seine Art, sich auszudrücken, ist verwirrend und verwickelt im höchsten Grade, so sehr, daß weder in seiner eignen Zeit noch seitdem irgend jemand sich getraut hat zu sagen, daß er sie verstanden habe. Seinen Zeitgenossen galt er als ein halbverrückter Fanatiker; denen, die ihn studiert haben, auch mit aller Sympathie, bleiben seine Gedanken zum großen Teil rätselhaft; aber der eine Punkt ist völlig klar, daß er, wie es bis zu seiner Zeit niemand getan hatte, den Grundgedanken aufgegriffen hat, daß, was immer der göttliche Plan gewesen sein mag, er durch die lange, langsame Entwicklung der Geschichte geoffenbart werden muß — daß man, um das Dokument der Vergangenheit zu verstehen, es, soweit das möglich ist, mit dem Verstand derjenigen lesen muß, an die es unmittelbar gerichtet war, und es nicht mit Anschauungen verflechten darf, die den Vorstellungen späterer Generationen entsprechen mögen.

Einen Gedanken wie diesen aufgegriffen zu haben — einen Gedanken, der erst in unsrer Zeit angefangen hat, zu seinem Recht zu kommen —, war ein Werk, das diesen zwanzigjährigen Jüngling unter allen Umständen zu einer außergewöhnlichen Persönlichkeit, einem aufrührerischen Element in seiner Welt stempelt, zu einem Mann, der nicht danach aussah, als ob er die Autoritäten ruhig im Besitz all der Wahrheit, die es gab, lassen wollte.“

Im folgenden Jahre, 1532, erschienen zwei erläuternde und vermittelnde Dialoge, ein kleines Buch, das das Ärgernis nur noch verschlimmerte, und da Servetus die protestantische Atmosphäre zu heiß fand, ging er nach Paris. Mit der Ablegung jenes Namens, unter dem er bekannt geworden ist, beschloß er

---

[1] „Harvard Theological Review“, April 1909.

diesen kurzen, aber stürmischen Abschnitt seines Lebens, und in den nächsten ein=
undzwanzig Jahren setzt Michel Villeneuve oder Michael Villanovanus seine
wechselvolle Laufbahn als Gelehrter, Dozent, praktischer Arzt, Autor und Heraus=
geber fort, noch immer von der unerschütterlichen Hoffnung beseelt, daß die Welt
reformiert werden könnte, wenn er nur die ursprüngliche Lehre der Kirche wieder=
herzustellen vermöchte.

II

Wir wissen sehr wenig über diesen seinen ersten Aufenthalt in Paris.
Wahrscheinlich fand er eine Anstellung als Lehrer oder als Korrektor. Zu
dieser Zeit kreuzte sein Weg zum erstenmal den Calvins. Die beiden fast gleich=
altrigen jungen Männer, die beide eifrige Forscher und beide auf dem Wege
zur Emanzipation vom Glauben ihrer Väter waren, müssen viele Gespräche über
theologische Fragen miteinander gehabt haben. Aus dem vorwurfsvollen Aus=
spruch, den Calvin viele Jahre später tat: „Vous avez fuy la luite" (Ihr habt
den Kampf gemieden), läßt sich schließen, daß Vorbereitungen zu einer öffentlichen
Disputation getroffen worden waren.

Nach einem kurzen Aufenthalt in Avignon und Orleans finden wir Servetus
zunächst in Lyon im Dienste der Gebrüder Trechsel, der berühmten Drucker. Es
war die Zeit der schönen Ausgaben der Klassiker und andrer Bücher, bei deren
Herausgabe und Korrektur Männer von gelehrter Bildung mitwirken mußten.
Servetus besorgte eine herrliche Folioausgabe der „Geographie" des Ptolemäus
(1535) mit Kommentaren über die verschiedenen Länder, die Zeugnis für ein
umfangreiches Wissen bei einem so jungen Manne ablegen. Es weist auch viele
Beispiele unabhängiger Kritik auf; so zum Beispiel sagt er, wo er von Palästina
spricht, daß das „Land der Verheißung" nichts weniger als ein verheißungs=
volles Land war und, statt von Milch und Honig überzufließen und ein Land
voll Korn, Oliven und Wein zu sein, im Gegenteil unwirtlich und unfruchtbar
und die Erzählungen von seiner Fruchtbarkeit nichts als Prahlerei und Lüge
waren. Es scheint, daß er wegen dieser Behauptung zur Rede gestellt worden
ist, denn in der zweiten Ausgabe, die vom Jahre 1541 datiert ist, fehlt dieser
Abschnitt. Für diese Arbeit wurden ihm von den Trechsels 500 Kronen bezahlt.

Es ist möglich, daß Servetus und Rabelais einander in Lyon begegnet
sind, zu der Zeit, da der „große Spötter" Arzt am Hotel=Dieu war, aber es
steht nichts in den Schriften beider, was andeutet, daß sich ihre Wege gekreuzt
haben. Der Mann, der in Lyon den größten Einfluß auf ihn hatte, war
Symphorien Champier, einer der interessantesten und hervorragendsten Vertreter
der Medizin unter den Humanisten in der ersten Hälfte des sechzehnten Jahr=
hunderts. Servetus half ihm bei seiner französischen „Pharmacopoeia", und
Pastor Tollin behauptet, daß Champier dem armen Gelehrten sogar ein Heim
schuf. Champier, ein eifriger Galenist und Historiker, der Gründer des Spitals
und der medizinischen Schule, hatte die gewöhnliche Vorliebe des Gelehrten jener
Zeit für Astrologie. Wahrscheinlich verdankte Servetus ihm seine Kenntnisse auf
diesem Gebiet. Jedenfalls griff Servetus, als der berühmte Professor der

Medizin Fuchsius in Tübingen Champier wegen seiner astrologischen Schrullen angriff, zur Feder und antwortete zu seiner Verteidigung mit einem Pamphlet, das betitelt war: „In Leonhardum Fuchsium defensio apologetica pro Symphoriano Campeggio" — ein äußerst seltenes Buch, die einzige von Servetus' Schriften, die ich nicht im Original gesehen habe.

Zweifellos durch das Beispiel und die Lehre Champiers angeregt, kehrte Servetus nach Paris zurück, um Medizin zu studieren. Mit ziemlich reichlichen Mitteln, dem Ertrag seiner literarischen Arbeit, versehen, gehörte er zuerst dem Kollegium Calvi und später dem der Lombarden an, und es wird behauptet, daß er die Grade eines Magister artium und eines Doctor medicinae erwarb, aber dafür existiert, wie mir gesagt wird, kein urkundlicher Beweis.

Von seinem Leben in Paris haben wir sehr wenig direkte Kunde, abgesehen von dem, was uns über einen einzigen besonderen Zwischenfall berichtet worden ist. Wir wissen, daß er mit drei Gelehrten in enge Berührung gekommen ist — mit Günther von Andernach, Jacobus Sylvius und Vesalius. Günther und Sylvius müssen Männer nach seinem eignen Herzen gewesen sein, grundgelehrte Forscher, leidenschaftliche Galenisten und eifrige Anatomen. Günther spricht in seinen „Anatomicae Institutiones" (Basel 1539) von Servetus in Verbindung mit Vesalius, der zu dieser Zeit sein Mitprosektor war. „. . . Und nach ihm von Michael Villanovanus, hervorragend durch seine literarischen Kenntnisse jeder Art und kaum irgend jemand nachstehend in seinem Wissen von der Galenischen Lehre." Er erklärt, daß er mit ihrer Hilfe den ganzen menschlichen Körper untersucht und den Studenten alles über die Muskeln, Venen, Arterien und Nerven vordemonstriert habe. In jener Zeit vollzog sich ein sehr lebhafter Aufschwung des Studiums der Anatomie in Paris, und die enge Verbindung mit einem solchen jungen Genie wie Vesalius, der damals schon ein glänzender Anatom war, muß an und für sich schon eine unvergleichliche Schule auf diesem Gebiet gewesen sein. Es ist leicht zu verstehen, woher das anatomische Wissen stammte, auf dem die weitgehende Verallgemeinerung beruht, mit der der Name Servetus in der Physiologie verbunden ist.

Das Ereignis in Paris jedoch, von dem wir am meisten wissen, steht mit einigen Vorlesungen des Servetus über Judizialastrologie in Verbindung. Wir haben gesehen, daß Servetus in Lyon seinen Freund und Gönner Symphorien Champier, durch den er ohne Zweifel mit jener Kunst vertraut geworden war, verteidigt hatte. Obwohl von der Kirche verboten, stand die Judizialastrologie an einigen Universitäten noch in Flor und wurde von Ärzten, die die hervorragendsten Stellungen einnahmen, in weitgehendem Maße betrieben. In jener Zeit waren wenige geistesstark genug, nichts vom Wahrsagen zu halten, und nach dem Volksglauben waren alle „himmlischen Einflüssen unterworfen". Es war gegen die Statuten der Pariser Fakultät, über dieses Fach zu lesen, obwohl damals der König einen professionellen Astrologen, Thibault, in seinen Diensten hatte. Kurz nachdem Servetus in Paris angekommen war, begann er einen Kursus von Vorlesungen über Astrologie, die ihn sehr bald mit den Behörden in Konflikt brachten.

Der vortrefflichen Gepflogenheit des Dekans, alljährlich seinen Bericht abzufassen, ist es zu verdanken, daß wir über sämtliche Details des Verfahrens gegen Servetus unterrichtet sind. Duboulay hat in seiner „Geschichte der Pariser Universität", Band VI, die ganze Angelegenheit nach dem sog. Kommentar des Dekans für das betreffende Jahr geschildert. Der Dekan berichtet, daß ein gelehrter Mediziner, ein Spanier, oder, wie er sagt, aus Navarra, aber von einem spanischen Vater, in Paris im Jahre 1537 mehrere Tage hindurch Judizialastrologie oder Weissagung gelehrt habe. Nachdem er erfahren habe, daß dies von den Doktoren der Fakultät mißbilligt wurde, habe er eine Verteidigungsschrift drucken lassen, in der er die Doktoren angriff und überdies erklärte, daß Kriege und Seuchen und alle Angelegenheiten der Menschen vom Himmel und von den Sternen abhingen, und er habe das Volk getäuscht, indem er die wahre und die Judizialastrologie miteinander vermengt habe. Der Dekan erklärt ferner, daß er, begleitet von zwei seiner Kollegen, versucht habe, Villanovanus von der Veröffentlichung der Verteidigungsschrift abzuhalten, und ihn beim Verlassen der Schule getroffen habe, wo er mit einem Chirurgen die Sektion eines Körpers vorgenommen habe, und in Gegenwart von mehreren seiner Schüler und zwei oder drei Doktoren habe er sich nicht nur geweigert, die Veröffentlichung zu hindern, sondern auch dem Dekan mit scharfen Worten gedroht.

Die Fakultät scheint einige Schwierigkeit gehabt zu haben, die Behörden in dieser Sache in Bewegung zu setzen. Vielleicht ist hier der Einfluß des Hofastrologen Thibault wahrzunehmen Nach vielen Versuchen und nach einem Appell an die theologische Fakultät und dem gesamten Lehrkörper der Universität kam die Angelegenheit vor das Parlamentsgericht. Die Reden der Vertreter der Fakultät, der Universität, des Villanovanus und des Parlamentsgerichts sind vollständig wiedergegeben. Das Parlamentsgericht entschied, daß die gedruckte Verteidigungsschrift zurückzuziehen sei, den Buchhändlern wurde verboten, sie zu führen, die Vorlesungen über Astrologie wurden verboten, und Villanovanus wurde aufgefordert, die Fakultät mit Respekt zu behandeln. Aber es wurde auch an sie das Ersuchen gerichtet, mit dem Beleidiger höflich und in väterlicher Weise zu verfahren. Es war eine sehr interessante Verhandlung, und der Dekan freute sich offenbar über seinen Sieg. Er sagt, daß er drei Theologen, zwei Doktoren der Medizin, den Dekan der Fakultät des kanonischen Rechts und den Generalprokurator der Universität mitgenommen hatte. Die Angelegenheit wurde vom Parlamentsgericht hinter verschlossenen Türen verhandelt.

Die „Apologetica disceptatio pro astrologia", die seltenste der Schriften des Servetus, deren einziges bekanntes Exemplar sich in der Pariser Nationalbibliothek befindet, ist ein acht Blätter umfassendes Pamphlet ohne Titelblatt, Seitenzahlen und Druckernamen. Die Freunde der Fakultät müssen bei der Beschlagnahme der Schrift sehr erfolgreich gewesen sein. Tollin, der das Original entdeckte, hat einen Neudruck veranstaltet (Berlin 1880). Es war für Servetus nicht schwierig, mächtige Autoritäten für seine Sache zu zitieren, und er beruft sich in seiner Verteidigung auf das große Quartett Plato, Aristoteles, Hippokrates

und Galenus. Als praktischer Astronom machte er seine eignen Beobachtungen, und das Pamphlet spricht von einer Verfinsterung des Mars durch den Mond. Er muß sich auch mit Wetterbeobachtungen beschäftigt haben, da er davon spricht, daß er in seinen Vorlesungen öffentliche Vorhersagungen gemacht habe, die großes Erstaunen hervorriefen. Der Einfluß des Mondes auf den Eintritt der kritischen Tage bei Krankheiten, eine Lieblingstheorie des Galenus, wird ausführlich behandelt, und er sagt, daß die Ansicht des Galenus in goldnen Buchstaben geschrieben werden sollte. Er begnügt sich mit diesen großen Autoritäten und nimmt nur kurz Bezug auf ein oder zwei geringere Geisteslichter. Er spottet über den wohlbekannten erbitterten Angriff des Picus auf das Weissagen.

Es brauchte mehrere Generationen, um in der medizinischen Welt den Glauben an die Astrologie völlig auszurotten, der sich ziemlich weit bis ins siebzehnte Jahrhundert hineinzog. Sir Thomas Browne gibt in seinen „Vulgar Errors" bei der Besprechung der „Canicular Days", der Hundstage, seiner Meinung über die Astrologie in höchst charakteristischer Sprache Ausdruck. „Auch wollen wir hiermit eine maßvolle und geregelte Astrologie nicht verwerfen oder verdammen; wir glauben, daß mehr Wahrheit in ihr liegt als in den Astrologen; in einigen mehr, als viele zugeben, aber in keinem so viel, wie einige behaupten. Wir leugnen den Einfluß der Sterne nicht, aber wir bezweifeln oft seine richtige Auslegung; denn wenn wir auch zugeben sollten, daß alle Dinge in allen Dingen seien; daß der Himmel nur zum Himmel gewordene Erde und die Erde zur Erde gewordener Himmel sei, oder daß alle Teile dort oben einen Einfluß auf ihre getrennten verwandten Elemente auf Erden hätten; so ist doch, diese Beziehungen herauszufinden und ihre Wirkungen richtig in Verbindung zu bringen, ein Werk, das des öftern mehr durch irgendeine Offenbarung und Kabbala von oben als durch irgendeine Philosophie oder Spekulation hier unten vollbracht werden muß."

Unter den Zuhörern des Servetus war ein junger Mann, Pierre Paumier, der Erzbischof von Vienne, der sich in Paris mit ihm befreundet zu haben scheint, und der ein paar Jahre später ihn ersuchte, sein Leibarzt zu werden. Der astrologische Prozeß wurde im März 1537 entschieden.

Servetus kann nicht sehr lange Medizin studiert haben, aber da es ihm niemals an Selbstvertrauen fehlte, trat er mit der kleinen Abhandlung „Sirupe und ihr Gebrauch" als medizinischer Schriftsteller vor die Welt. Durch die Verbindung mit Champier, dem er bei der Herausgabe seiner französischen „Pharmacopoeia" geholfen hatte, war er mit diesem Gegenstand vertraut geworden. Die ersten drei Kapitel sind angefüllt mit den Ansichten über „Konfoktionen" oder „Digestionen", von denen damals eine Reihenfolge, von der ersten bis zur vierten, anerkannt war. Er tritt für Einheitlichkeit des Prozesses ein, und wie Willis hervorhebt, macht er die für jene Zeit sehr scharfsinnige Bemerkung, daß „Krankheiten nur Störungen der natürlichen Funktionen und nicht neue in den Körper eingeführte Elemente sind". Den größeren Teil der Abhandlung nehmen theoretische Erörterungen über die Ansichten des Galenus,

des Hippokrates und des Avicenna ein. Die „Zusammensetzung und der Gebrauch der Sirupe" ist im fünften und in dem sechsten (Schluß-)Kapitel behandelt.

Das kleine Buch scheint populär gewesen zu sein und wurde zweimal, 1545 und 1548, in Venedig und zweimal in Lyon, 1546 und 1547, neugedruckt.

III

Mag ihm nun die ungünstige Entscheidung des Parlamentsgerichts Paris verleidet oder durch Vermittlung irgendeines Freundes sich ihm die Gelegenheit geboten haben, sich als praktischer Arzt niederzulassen — wir hören zunächst von Villeneuve wieder aus Charlieu, einer kleinen Stadt, ungefähr 12 Meilen von Lyon entfernt, wo er ein Jahr oder einen Teil des Jahres 1538 bis 1539 zubrachte. Hier suchte ihn sein alter Pariser Freund Paumier auf und veranlaßte ihn, sich in Vienne niederzulassen, wo er ihm im Schloß eine Wohnung und ein Gehalt als sein Leibarzt anbot. Nach beinahe zehn Wanderjahren hatte Servetus endlich ein friedliches Heim gefunden und verlebte nun in der schönen alten Römerstadt mit ihrer guten Gesellschaft unter dem Schutz des Primas von ganz Frankreich die folgenden vierzehn Jahre als praktizierender Arzt.

Ueber sein Leben dort sind nur wenige Einzelheiten bekannt. Er blieb in Verbindung mit den Trechsels, den Buchdruckern, die in Vienne ein Zweiggeschäft eingerichtet hatten. Im Jahre 1541 gab er eine neue Auflage des Ptolemäus mit einer Widmung an den Erzbischof heraus. Die Vorrede eröffnet uns einen Blick auf eine Gruppe von geistig regen Genossen, die alle Interesse für die neuen Studien haben. Mehrere kritische Bemerkungen, die in der Ausgabe von 1535 enthalten sind, verschwinden in der neuen von 1541, z. B. die spöttischen Bemerkungen über Palästina; und bei Erwähnung der königlichen Berührung heißt es nicht mehr: „Ich habe selbst den König gesehen, wie er viele mit dieser Krankheit (d. h. Skrofeln) Behaftete berührte, aber ich habe nicht gesehen, daß sie geheilt wurden", sondern: „Ich habe gehört, daß viele geheilt wurden." Vielleicht fand er es für ein Mitglied eines geistlichen Kreises, das unter dem Schutze des Erzbischofs lebte, unschicklich, irgend etwas zu sagen, was Anstoß hätte erregen können.

Im Jahre darauf ließ er eine Ausgabe von Pagninis Bibel in einem schönen Folioband erscheinen. Für uns ist daran hauptsächlich der Beweis interessant, daß Servetus noch tief in theologischen Studien steckte, denn die Kommentare in dem Werk geben ihm einen Platz unter den frühesten und kühnsten Vertretern der höheren Kritik. Die prophetischen Psalmen und die zahlreichen Weissagungen bei Jesaias und Daniel werden im Licht der zeitgenössischen Ereignisse gedeutet, doch scheinen diese zahlreichen, äußerst freien und höchst heterodoxen Auslegungen, wie Willis bemerkt, Villeneuve in Vienne weder um Ansehen noch um Gunst gebracht zu haben.

Für einen andern Verleger in Lyon, Frelon, gab er eine Anzahl pädagogischer Werke heraus, und durch ihn kam der Arzt in Vienne in Briefwechsel mit dem Genfer Reformator.

Der Träumer, Enthusiast und Mystiker Servetus war von dem Gedanken beherrscht, daß, wenn nur die Lehren der Kirche reformiert werden könnten, die Welt sich für ein ursprüngliches, einfaches Christentum gewinnen ließe. Wir haben schon von seinem Versuch gehört, die Schweizer Reformatoren zu den nach seinem Dafürhalten richtigen Ansichten über die Dreieinigkeit zu bringen. Er begann jetzt einen Briefwechsel mit Calvin über diesen Gegenstand und über die Frage der Sakramente. Die Briefe, die noch vorhanden sind, erregten ihrem Ton und ihrem Inhalt nach bei Calvin in solchem Maße Widerwillen und Empörung, daß er in einer vom Februar 1546 datierten Mitteilung an Farel, nachdem er berichtet hat, daß Servetus sich erboten habe, nach Genf zu kommen, hinzufügt: „Ich will mein Wort nicht dafür verpfänden; denn käme er, so würde ich, sofern ich nur irgendeine Macht hier habe, ihn niemals lebendig von hinnen gehen lassen."

Seit Jahren hatte Servetus das Werk in Vorbereitung, von dem er innig hoffte, daß es das ursprüngliche Christentum wieder herstellen werde. Einen Teil des Manuskripts davon hatte er an Calvin geschickt. Nachdem er vergebens versucht hatte, einen Verleger dafür zu finden, entschloß er sich, es in Vienne auf eigne Kosten drucken zu lassen. Er traf ein Abkommen mit einem dortigen Drucker, der in einem kleinen Hause eine besondere Presse aufstellte, und in einigen Monaten waren tausend Exemplare gedruckt. Das Titelblatt trägt das Datum 1553, und auf der letzten Seite stehen die Anfangsbuchstaben seines Namens, „M. S. V."

Er muß gewußt haben, daß das Werk dazu angetan war, große Entrüstung in den kirchlichen Kreisen hervorzurufen, aber er hoffte, daß man die Persönlichkeit des Verfassers ebensowenig mutmaßen würde, wie daß der Arzt Michael Villeneuve in Vienne der Michael Servetus des ketzerischen „De Trinitatis Erroribus" war. Zur Verbreitung in Deutschland, der Schweiz und Italien bestimmt, wurde das Werk in Ballen von je hundert Exemplaren verpackt. Calvin erhielt wahrscheinlich von ihrem beiderseitigen Freunde Frelon ein paar Exemplare. Gewöhnlich wird erzählt, daß Calvin durch die Vermittlung eines gewissen Guillaume de Trie Villeneuve der Inquisition in Vienne denunziert habe. Dies war auch die Ansicht von Servetus selbst, die von Willis, Tollin u. a. geteilt wird; aber die Verteidiger Calvins stellen noch immer in Abrede, daß ein ausreichender Beweis für seine aktive Beteiligung an dem Verlauf der Dinge vorliege.

Zu dieser Zeit befand sich in Lyon der wohlbekannte Inquisitor Orry, der zehn Jahre vorher Etienne Dolet auf den Scheiterhaufen gebracht hatte. Kaum hatte er Witterung von der Angelegenheit bekommen, so unternahm er mit seinem gewohnten Eifer die Verfolgung, und Servetus wurde zur Verantwortung gezogen. Die Voruntersuchung in Vienne ist hauptsächlich von Interesse wegen der autobiographischen Details, die Servetus gibt. Das Beweismaterial gegen ihn war so überwältigend, daß er verhaftet wurde. Doch es fehlte ihm nicht an Freunden, die sehr betroffen und betrübt gewesen sein müssen, ihren Lieblingsarzt in einer so schrecklichen Lage zu sehen; mit Geld war er reichlich versehen, auch war die

Aufsicht im Gefängnis nicht sehr streng, da der Kerkermeister sein Freund war, und so ist es nicht überraschend, daß Servetus am Tage nach seiner Einkerkerung entkam, ohne Zweifel sehr zur Erleichterung des Erzbischofs und der Behörden. Der Inquisitor mußte sich mit dem Verbrennen eines Bildnisses des Ketzers und einiger fünfhundert Exemplare seines Werkes begnügen.

Vom 7. April bis Mitte Juli bleibt Servetus verschwunden, und wir begegnen ihm erst wieder in Genf. Warum er sich der damit verbundenen Gefahr ausgesetzt haben mag, ist vielfach erörtert worden, aber die von Guizot gegebene Erklärung ist wahrscheinlich die richtige. Zu jener Zeit erhofften sich die Freidenker oder „Libertiner", wie sie wegen ihrer Feindschaft gegen Calvin genannt wurden, einen vollen Sieg. „Einer ihrer Führer, Amied Perrin, war erster Syndic; ein Mann von ihrer Partei, Gueroult, der aus Genf verbannt worden war, war Korrektor gewesen zu der Zeit, wo die ‚Wiederherstellung des Christentums' veröffentlicht wurde, und dank dem Einfluß seiner Beschützer, der Libertiner, war er nach Genf zurückgekehrt und war natürlich bereit, das Bindeglied zwischen ihnen und Servetus zu sein. Wenn ich den ganzen Fall und die Antezedenzien aller daran Beteiligten im Zusammenhang betrachte, so bin ich überzeugt, daß Servetus, nachdem er in seinen Erwartungen enttäuscht worden war, sich im Vertrauen auf die Unterstützung der Libertiner nach Genf begab, während sie ihrerseits von ihm wirksame Hilfe gegen Calvin erwarteten." Er scheint fast einen Monat in Genf gewesen zu sein, ehe er am Morgen des 14. August verhaftet wurde.

Der ausführliche Bericht über diesen berühmten Ketzerprozeß hat, soweit die dogmatischen Details in Frage kommen, viel von seinem Interesse verloren. Aus unsrer Entfernung, mit unsern modernen Ideen, müssen wir das Verfahren gegen Servetus höchst barbarisch finden. Er wurde im Gefängnis grausam behandelt, und es existiert ein Brief von ihm, der von seiner entwürdigenden Lage spricht und berichtet, daß er ohne ordentliche Kleidung und eine Beute des Ungeziefers sei. Fräulein Roch hat diese Phase seiner Märtyrerlaufbahn in ihrer schönen Statue des Servetus, die zu seinem Gedächtnis errichtet worden ist, vortrefflich geschildert. Der vollständige Bericht über die Verhandlung kann in der von Willis gegebenen Darstellung nachgelesen werden, und das Protokoll war in Genf im Manuskript vorhanden.

Das eine scheint klar zu sein, daß, während sich die Anklage zuerst hauptsächlich gegen die ketzerischen Ansichten des Servetus richtete, der öffentliche Ankläger später mehr Gewicht auf die politische Seite des Falles legte, indem er ihn beschuldigte, mit den Libertinern konspiriert zu haben. Der Prozeß teilte Genf in zwei feindliche Lager, und es sah manchmal aus, als ob Calvin ebenso gut wie Servetus als Angeklagter vor Gericht stände. Um ihre Macht zu verstärken, appellierte die klerikale Partei an die Schweizer Kirchen. Die Antwort verdammte zwar die Ketzerei und Gotteslästerung mit aller Strenge, enthielt sich aber einer bestimmten Aeußerung über die Art der Strafe.

Servetus, der es in Frankreich gewohnt gewesen war, die Schweizer Refor-

matoren als die schlimmste Klasse von Ketzern brandmarken zu hören, scheint niemals verstanden zu haben, warum er nicht von den Protestanten mit offenen Armen hätte aufgenommen werden sollen, deren einziger Wunsch derselbe wie sein eigner war: die Wiederherstellung des ursprünglichen Glaubens und Gottesdienstes. Er kämpfte tapfer und brachte scharfe Gegenklagen gegen Calvin vor, den er besonders beschuldigte, seine Verhaftung in Vienne veranlaßt zu haben. Er erbot sich zu einer öffentlichen Diskussion der streitigen Fragen, ein Anerbieten, das Calvin angenommen haben würde, wenn es die Syndics zugelassen hätten. Die ganze Stadt war in Gärung, und Sonntag um Sonntag donnerten Calvin und die andern Prediger von ihren Kanzeln herab gegen die Gotteslästerungen des Spaniers. Nachdem der Prozeß in ermüdender Länge sich beinahe zwei Monate hingeschleppt hatte, fühlte sich das Publikum stark auf die Seite Calvins gezogen, und am 26. Oktober beschloß der Rat mit Stimmenmehrheit, daß der Gefangene in Anbetracht seiner großen Irrtümer und Gotteslästerungen lebendig verbrannt werden solle.

Servetus scheint ein merkwürdiges Gemisch von Kühnheit und Arglosigkeit gewesen zu sein. Ueber die Verkündigung des Urteils scheint er vollständig bestürzt gewesen zu sein, denn er scheint dessen Möglichkeit niemals in Betracht gezogen zu haben. Er ließ Calvin zu sich rufen und bat ihn um Verzeihung, aber das Herz des großen Reformators war von grausamer Strenge verhärtet, und sein Bericht über die Unterredung ist nicht sehr erbaulich zu lesen.

Am Morgen des 27. versammelte sich der Gerichtshof vor dem Tor des Rathauses, um dem Gefangenen seine formelle Verurteilung bekannt zu geben. Die beiden wichtigsten der fünfzehn verschiedenen Paragraphen, die das Urteil enthielt, bezogen sich auf die Dreieinigkeit und auf die Kindertaufe. Merkwürdig ist, daß er in dem einen Paragraphen als ein anmaßender Neuerer und als ein Erfinder von Ketzereien gegen das Papsttum denunziert wurde! Die inständige Bitte des Verurteilten um eine mildere Todesart (für die auch Calvin — zu seiner Ehre sei es gesagt — eintrat) war vergebens. Der Zug setzte sich sogleich in Bewegung nach dem Richtplatz.

Nichts in seinem Leben, kann man sagen, kam an Würde der Art und Weise gleich, wie er es verließ. Guizot sagt: „Die Würde des Philosophen triumphierte über die Schwachheit des Menschen, und Servetus starb heldenmütig und seelenruhig an jenem Pfahl, an den er zuerst nicht einmal hatte denken können, ohne mit Entsetzen erfüllt zu werden."

Nächstes Jahr wird in Vienne ein Denkmal errichtet werden zum Gedächtnis an die Dienste, die Servetus der Theologie als unabhängiger Geist und der Physiologie als Pionier erwiesen hat. Man hat gesagt, daß Sappho noch lebe, weil wir ihre Lieder singen, und Aeschylus, weil wir seine Stücke lesen, aber es wäre schwer, das weitverbreitete Interesse für Servetus mit irgendwelcher Kenntnis, die die Menschen von seinen Schriften haben, zu erklären. Das Ergreifende seines Geschickes, das Gibbon tiefer empörte als alle die Menschenhekatomben in Spanien und Portugal, erklärt jenes Interesse zum Teil. Dann ist da der beschränkte

Kreis jener, die ihn als einen Märtyrer des unitarischen Bekenntnisses ansehen, und die Männer der Wissenschaft haben ein sehr bestimmtes Interesse für ihn als einen der ersten, die einen wesentlichen Beitrag zu unserm Wissen über die Blutzirkulation geliefert haben. Seine theologischen und physiologischen Anschauungen erfordern kurze erläuternde Bemerkungen.

IV

Nächst der Theologie selbst hat das Studium der Medizin die meiste Ketzerei erzeugt. Seit den Tagen des Arnoldus Villanovanus und des Pietro d'Abano hat es berühmte Ketzer in den Reihen der Mediziner gegeben. Bossuet definiert einen Ketzer als „Einen, der Meinungen hat". Servetus scheint mit Meinungen geladen gewesen zu sein wie eine Leydener Flasche. Seine bemerkenswertesten betreffen die Dreieinigkeit und die Kindertaufe. Die endgültige Besiegung des Arianismus, der im dritten und vierten Jahrhundert an der Frage der Dreieinigkeit einen nahezu vernichtenden Schiffbruch erlitten hatte, fand ihren Ausdruck in jenem herrlichen menschlichen Dokument des Athanasianischen Glaubensbekenntnisses, durch das die katholische Kirche für alle Zeiten die Frage gelöst hat, in einer Sprache, die Ketzern einen kalten Schauer den Rücken hinunterjagt. Aber es hat immer aufrührerische Seelen gegeben, die sich nicht zufriedengeben konnten und das unbequeme Stellen aus der Bibel zur Sprache brachten — Menschen, die nicht imstande waren, Dantes weisen Rat zu befolgen:

> „Tor, der da hofft, unendliche Regionen
> Mit irdischem Verstande zu durchlaufen,
> Wo eins ist die Substanz in drei Personen.
> ‚So ist's!' Das, Menschheit, muß dir Trost gewähren."

Das Dogma ist eine große Brutstätte von Ketzern gewesen, deren Brandgeruch für die Nasen der Katholiken wie der Protestanten ein süßer Duft war. Selbst heutigestags ist das katholische Glaubensbekenntnis so tief eingewurzelt, daß beinahe jeder dogmatische Seitensprung verziehen wird, nur nicht das Leugnen der Dreieinigkeit, mit dem ein Mensch sich nach der allgemeinen Anschauung außerhalb der Grenzen des normalen Christentums stellt. Wenn das schon die heutige Ansicht ist, so kann man sich vorstellen, wie es in der Mitte des sechzehnten Jahrhunderts gewesen sein mag.

Servetus schrieb zwei theologische Werke. Von dem ersten derselben „De Trinitatis erroribus", das er im Jahre 1531 veröffentlichte und dem er im Jahre 1532 einen Nachtrag folgen ließ, habe ich bereits gesprochen. In Vienne lebte er ein Doppelleben: für die Einwohner der Stadt war er der sorgsame und gütige Arzt, dem sie zugetan geworden waren, aber währenddessen hatte er, von dem Traum seiner Jugend erfüllt, ein Werk in Arbeit, das, wie er glaubte, dem Heiland durch die Reinigung der Kirche von schweren Irrtümern in ihrer Lehre die Welt gewinnen würde.

Auch von der „Christianismi Restitutio" habe ich schon gesprochen. Dieses Werk, das sich hauptsächlich mit höchst verwickelten Fragen über die Dreieinig-

keit und die Kindertaufe befaßt, ist sehr schwer zu lesen und, wie die Theologen bekennen, noch schwerer zu verstehen. Professor Emerton gibt in seinem Artikel, aus dem ich bereits eine Stelle zitiert habe, mit einigen Sätzen den wesentlichen Inhalt seiner Anschauungen wieder. „Er findet den Mittelpunkt des christlichen Dogmas nicht in der Lehre von der Dreieinigkeit, wie sie von der Scholastik formuliert war, sondern in der Tatsache der göttlichen Fleischwerdung in der Person Jesu. Er glaubt an die göttliche Geburt, indem er sie als im Einklang mit einem allgemeinen Gesetz göttlicher Manifestation stehend erklärt, nach dem das Geistige im Körperlichen offenbart wird. Die Idee einer ewigen Sohnschaft wollte er nicht akzeptieren, ausgenommen in dem Sinne, daß das göttliche Wort, der Logos, immer als der Ausdruck der göttlichen Kraft in äußerer Form wirksam gewesen ist. So brachte derselbe Logos, als die Zeit erfüllt war, ein Wesen aus einer menschlichen Mutter hervor, auf das im Augenblick seiner Geburt der göttliche Geist gehaucht ward. Augenscheinlich ist dies nicht der ‚ewige Sohn‘ der Glaubensbekenntnisse, und darin lag das besondere theologische Verbrechen des Servetus. In seiner Kritik der Kirchenordnung, der päpstlichen Herrschaft, des sakramentalen Systems unterscheidet er sich nicht wesentlich von der radikaleren der Reformatoren. In den wesentlichen Materien der Taufe und des Abendmahls geht er weit über die offiziellen reformierten Kirchen hinaus. In beiden Fällen stellt er das Prinzip der reinen Vernunft auf. Er verwirft die Kindertaufe, weil das Kind keinen Glauben haben kann und weil die Taufhandlung deshalb für ihn Teufelswerk ist. Er leugnet die Transsubstantiation mit der rationellen Begründung, daß Stoffe und Ereignisse nicht getrennt werden können und kritisiert die Führer der Reformation unnachsichtlich wegen ihrer nach seiner Ansicht flauen Haltung in diesem Punkt. Seine Sprache ist durchwegs scharf und heftig, ausgenommen da, wo er, wie am Ende seiner Kapitel, in die Formen frommer Gottesverehrung übergeht und seine Ausfälle mit außerordentlich schönen und seelenvollen Gebeten schließt.“

Die christliche Kirche fand bald heraus, daß es nur e i n e n sicheren Weg gab, mit der Ketzerei fertig zu werden. Vom Ende des vierten Jahrhunderts an, wo der Brauch anfing, bis zu seinem Höhepunkt am St. Bartholomäustag war es allgemein anerkannt, daß nur tote Ketzer aufhörten, aufrührerisch zu sein. Die Geschichte liefert reichliche Beweise für die Wirksamkeit von Repressivmaßregeln, die oft in weitgehendem Maße durchgeführt wurden. Frankreich ist katholisch infolge einer mit Stumpf und Stiel ausrottenden Politik; Englands Protestantismus ist ein dauerndes Zeugnis für die Gründlichkeit, mit der Heinrich VIII. seine Maßregeln durchführte. Wie De Foe in seinem berühmten Pamphlet „The shortest way with the Dissenters“ sagt: wenn jemand eigensinnig ist und auf seiner eignen Ansicht besteht, im Gegensatz zu derjenigen, die die Mehrheit seiner Mitmenschen hat, und wenn die Ansicht verderblich ist und sein Seelenheil in Gefahr bringt, so ist es viel sicherer, ihn zu verbrennen, als seine Lehren sich verbreiten zu lassen! Zwölfhundert Jahre lang hielt diese Politik die Ketzerei in engen Schranken bis zu der großen Auflehnung. Die

allerbesten Männer der Zeit waren mit dem Tod der Ketzer einverstanden. Der Geist des Protestantismus war dagegen; vor allem von Luther ist zu rühmen, daß er sich in diesem Sinne aussprach. In den Augen seiner Zeit war Servetus ein Erzketzer und verdiente den Tod wie nur irgendeiner, der an den Marterpfahl gebunden wurde. Wir können ihn kaum einen Märtyrer der Kirche nennen. Welche Kirche würde ihn als den ihrigen anerkennen? Dagegen ehren wir sein Gedächtnis als das eines Märtyrers der Wahrheit, wie er sie sah.

Servetus studierte Medizin in Paris mit Sylvius und Günther, zweien der eifrigsten Wiederbeleber der Galenischen Anatomie. Noch bedeutungsvoller ist es, daß er ein Mitarbeiter des Vesalius war. Er schrieb ein einziges kleines Buch über Medizin von keinem besonderen Wert. Die Arbeiten, die er herausgab und die ihm mehr Geld als Ruhm eintrugen, deuten auf einen unabhängigen und kritischen Geist. Vienne war eine kleine Stadt, von der wir nicht annehmen können, daß sie irgendeine wissenschaftliche Anregung bot, obwohl sie in einer Gegend liegt, die wegen ihrer geistigen Regsamkeit bekannt ist.

Eine von ihm gefundene physiologische Tatsache von der allergrößten Wichtigkeit beschrieb er mit außerordentlicher Klarheit und Genauigkeit. Doch so gering dachte er von dieser Entdeckung, von so geringer Bedeutung erschien sie ihm im Vergleich zu dem großen Wert, an dem er arbeitete, der Wiederherstellung des Christentums, daß er sie lediglich als eine Illustration benutzte, als er in seinem Werk „Christianismi Restitutio" über das Wesen des Heiligen Geistes sprach. Die Entdeckung war keine geringere als die Tatsache, daß das Blut aus der rechten Herzkammer durch die Lungen nach der linken fließt — der sog. Lungenoder kleinere Kreislauf.

Im Jahre 1553 galten überall die Ansichten Galens als maßgebend. Der große Meister hatte in der Tat eine fast ebenso gewaltige Revolution in dem Wissen vom Kreislauf hervorgerufen, wie sie Harvey im siebzehnten Jahrhundert bewirkt hat. Nach seiner Lehre gibt es, kurz gesagt, zwei Arten von Blut, das natürliche und das vitale, in zwei praktisch geschlossenen Systemen, den Venen und den Arterien. Die Leber ist das Zentralorgan des Venensystems, die „Werkstatt", wie Burton sagt, in der der Chylus in Blut verwandelt wird und von der aus es durch die Venen nach allen Teilen des Körpers zur Ernährung verteilt wird. Die Venen sind mehr Gefäße, die das Blut enthalten, als Röhren zu seiner Fortleitung — Bewässerungskanäle nannte sie Galen. Galen kannte die Struktur des Herzens, die Anordnung seiner Klappen und die Richtung, in der das Blut durchströmt, aber seine Hauptfunktion ist für ihn nicht, wie wir annehmen, mechanisch, sondern nach ihm werden in der linken Kammer, dem Sitz des Lebens, die Lebensgeister erzeugt, die eine Mischung von eingeatmeter Luft und Blut sind. Durch abwechselnde Ausdehnung und Zusammenziehung der Arterien wird das Blut mit den Lebensgeistern in ständiger Bewegung gehalten. [1])

---

[1]) So fest war die Galenische Physiologie eingewurzelt, daß die neuen Ideen Harveys anfangs sehr langsame Fortschritte machten. Burtons „Anatomy of Melancholy", die eine

Galen hat dargetan, daß die Arterien und die Venen an der Peripherie miteinander in Verbindung stehen. Eine kleine Menge Blut geht, so glaubte er, von der rechten Seite des Herzens in die Lungen zu ihrer Ernährung, und strömt von dort nach der linken Seite des Herzens; aber die Hauptverbindung zwischen den beiden Systemen vollzieht sich durch Poren in dem ventrikularen Saeptum, der dicken, muskulösen Wand, die die zwei Hauptkammern des Herzens voneinander scheidet.

Man wird in der Literatur bis zum Jahre 1553 umsonst nach irgendeiner andern Ansicht als der Galenischen suchen. Sogar Vesalius, der nach der Struktur der Scheidewand zwischen den beiden Herzkammern nicht verstehen konnte, wie auch nur die kleinste Menge Blut durch sie hindurchdringen könnte, wußte keine andre Erklärung zu geben. Je mehr man von der Galenischen Physiologie weiß, um so weniger ist man erstaunt, daß sie die Geister der Menschen so gefangengenommen hatte. Die Beschreibung des neuen Weges, die Servetus gibt, ist im fünften Buch der „Christianismi Restitutio" zu finden, worin er über die Natur des Heiligen Geistes spricht. Nachdem er den dreifachen Geist des menschlichen Leibes, den natürlichen, den animalischen und den Lebensgeist erwähnt hat, spricht er eingehender über den Lebensgeist und beschreibt in wenigen Abschnitten den Lungenkreislauf. „Um die Frage hier richtig zu verstehen: das erste, was man zu beachten hat, ist die substantielle Erzeugung des Lebensgeistes — eine Mischung der eingeatmeten Luft mit dem feinsten Teil des Blutes. Der Lebensgeist hat daher seinen Ursprung in der linken Herzkammer, da die Lungen sehr wesentlich zu seiner Erzeugung beitragen. Es ist ein feiner, flüchtiger Geist, hervorgebracht durch die Macht der Hitze, von hochroter Farbe und feuriger Kraft — sozusagen der durchsichtige Dampf des Blutes, substantiell aus Wasser, Luft und Feuer zusammengesetzt; denn er wird, wie gesagt, durch die Vermischung der eingeatmeten Luft mit dem feineren Teile des Blutes erzeugt, das die rechte Herzkammer der linken übermittelt. Diese Uebermittlung jedoch findet nicht durch das Saeptum, die Scheide- oder Mittelwand des Herzens, statt, wie gewöhnlich angenommen wird, sondern durch eine andre wunderbare Einrichtung, indem das Blut aus der Lungenarterie in die Lungenvene mittels eines verlängerten Wegs durch die Lungen befördert wird, in dessen Verlauf es durchgearbeitet wird und eine hochrote Farbe annimmt. Auf diesem Wege mit der eingeatmeten Luft vermischt und durch den Akt des Ausatmens von schwärzlichen Dämpfen befreit, wird es, da die Mischung nun in jeder Hinsicht vollständig ist, und das Blut ein tauglicher Aufenthaltsort für den Lebensgeist geworden ist, schließlich durch die Diastole angezogen und erreicht die linke Herzkammer.

Art Abriß der medizinischen Wissenschaft des siebzehnten Jahrhunderts ist, enthält u. a. folgende Beschreibung: „Die linke Kammer hat die Form eines Kegels und ist der Sitz des Lebens, der, wie eine Lampe das Oel, das Blut an sich zieht, Geister und Feuer aus ihm erzeugend, und wie ein Feuer in einer Lampe, so sind Geister im Blut; und durch jene große Arterie, die Aorta genannt wird, sendet es Lebensgeister durch den Körper und nimmt Luft aus den Lungen."

„Die Sicherheit nun, daß die Uebermittlung und Durcharbeitung in der beschriebenen Art in den Lungen stattfindet, erhalten wir durch die Verbindungen und den Zusammenhang der Lungenarterie mit der Lungenvene. Die beträchtliche Größe der Lungenarterie scheint von selbst zu erklären, wie die Sache steht; denn dieses Gefäß wäre weder von einer solchen Größe, wie es ist, noch würde eine solche Menge des reinsten Blutes durch es hindurch zu den Lungen allein zu ihrer Ernährung gesandt worden sein; auch würde nicht das Herz die Lungen in solcher Weise versorgt haben, denn wir sehen ja, daß die Lungen im Fötus aus einer andern Quelle gespeist werden — da diese Membranen oder Klappen des Herzens bis zur Stunde der Geburt nicht ins Spiel kommen, wie Galen lehrt. Das Blut muß folglich in so starkem Maße im Augenblick der Geburt vom Herzen in die Lungen zu einem andern Zweck als zur Ernährung dieser Organe getrieben werden. Ueberdies ist es nicht einfach Luft, sondern Luft, gemischt mit Blut, das durch die Lungenvenen von den Lungen in das Herz zurückgeschickt wird.

„Folglich findet in den Lungen die Vermischung (der eingeatmeten Luft mit dem Blut) statt, und das Blut nimmt auch in den Lungen, nicht im Herzen die hochrote Farbe an. Es ist in der Tat nicht genügend Raum in der linken Herzkammer für eine so große und wichtige Durcharbeitung vorhanden, noch erscheint sie tauglich, die rote Farbe hervorzubringen. Endlich ist das Saeptum oder die Mittelwand des Herzens, in Anbetracht, daß sie ohne Gefäße und besondere Eigenschaften ist, nicht geeignet, die in Frage stehende Uebermittlung und Durcharbeitung zu vollbringen, obwohl es sein kann, daß in gewissem Maße eine Durchschwitzung durch sie stattfindet. Durch einen Mechanismus, ähnlich dem, durch den die Transfusion des Blutes aus der Vena portae zu der Vena cava in der Leber vor sich geht, findet auch in der Lunge die Transfusion des Lebensgeistes von der Lungenarterie in die Lungenvene statt."

Die wichtigen Tatsachen hier sind: erstens die klare Beschreibung der Funktion der Lungenarterie; zweitens die Transmission des unreinen oder venösen Blutes von der rechten Herzkammer durch die Lungen zur linken; drittens die Erkenntnis einer Durcharbeitung und Umbildung des Blutes in den Lungen derart, daß mit der Befreiung des Blutes von „schwärzlichen Dämpfen" zu gleicher Zeit eine Umwandlung zu der hochroten Färbung des arteriellen Bluts vor sich geht; viertens die direkte Leugnung einer Verbindung zwischen den beiden Blutarten durch Oeffnungen in der Wand zwischen den Kammern.

Er hatte keine Vorstellung von dem allgemeinen oder systematischen Blutkreislauf, und von der linken Herzkammer und den Arterien glaubte er, daß sie der Sitz des Lebensblutes und des Lebensgeistes seien.

Es ist nicht schwer, sich vorzustellen, wie Servetus sich von den alten Ansichten emanzipiert hatte. Während seiner Studienjahre in Paris, die in eine sehr günstige Zeit fielen, in der das Sezieren allgemein üblich geworden war, hatte er als Prosektor Günthers eine außergewöhnlich günstige Gelegenheit, Kenntnisse zu sammeln. Aber noch wichtiger ist es, daß er den anatomischen Erzketzer Andreas Vesalius zum Studiengenossen hatte, der bereits von der

Ueberzeugung durchdrungen war, daß seine Lehrer sich im Irrtum befanden, wenn sie den Galenus für unfehlbar hielten. Gerade in jener Zeit hatte Vesalius seinem Lehrer Sylvius den Irrtum des Galenus über die Aortaklappen dargetan; und wenn man bedenkt, wie außerordentlich rasch Vesalius die menschliche Anatomie reformierte, ehe er sein achtundzwanzigstes Jahr vollendet hatte, so ist es nicht überraschend, daß sein Kollege und Mitarbeiter eine der großen physiologischen Wahrheiten entdecken konnte.

Die „Christianismi Restitutio" gelangte niemals in die Oeffentlichkeit und die Entdeckung des Servetus blieb unbeachtet, bis Charles Bernard, ein Chirurg an St. Bartholomews Hospital, Wottons[1]) Aufmerksamkeit darauf lenkte. Inzwischen war sie wieder entdeckt worden, und unter den vielen Seltsamkeiten, die die Geschichte der Lehre vom Blutkreislauf aufzuweisen hat, ist der Versuch, dem Servetus seinen Ruhm zu rauben, nicht der am wenigsten überraschende. Im Jahre 1559 wurde von Realdus Colombo,[2]) einem Schüler des Vesalius und dem Nachfolger desselben in Padua, ein Buch veröffentlicht, in dem der Blutkreislauf von der rechten Seite des Herzens zur linken klar beschrieben ist. Es ist unmöglich zu sagen, daß er zu der oben wiedergegebenen Schilderung irgend etwas hinzugefügt hatte, und es ist die sehr gesuchte Behauptung aufgestellt worden, daß italienische Studenten in Paris Servetus mit den Ansichten Colombos bekannt gemacht hätten. Es wird auch zugunsten Colombos geltend gemacht, daß er eine bessere Vorstellung von der Funktion der Atmung bei der Reinigung des Blutes durch seine Vermischung mit der Luft gehabt habe, aber Servetus erklärt deutlich, daß die Vermischung in den Lungen stattfinde, nicht, wie gewöhnlich in jener Zeit angenommen wurde, im Herzen selbst.

Caesalpinus (1569), für den von manchen das Hauptverdienst an der Entdeckung in Anspruch genommen wird, wußte ebenfalls vom Lungenkreislauf, aber er dachte, daß ein Teil des Blutes durch die Scheidewand zwischen den Herzkammern ströme. Manche erheben sogar den noch bedeutenderen Anspruch für ihn, daß er den großen Kreislauf entdeckt habe, aber es ist bemerkenswert, daß jeder, der die Geschichte der Sache kennt, in seine Physiologie nichts weiter hineinlesen kann als die alten Galenischen Ansichten.

Die Geschichte des Blutkreislaufes strotzt von Kontroversen, und über die Verdienste der verschiedenen Forscher sind weit voneinander abweichende Ansichten ausgesprochen worden. Daß Servetus zuerst einen Schritt über Galen hinausging, daß Colombo und Caesalpinus unabhängig zu demselben Schluß gelangten, daß alle drei den kleinen Kreislauf kannten, ist ebenso sicher, wie daß es Harvey vorbehalten blieb, ein vollständig neues Kapitel in der Physiologie zu eröffnen und moderne Experimentalmethoden einzuführen, durch die der vollständige Kreislauf des Blutes zuerst klar demonstriert wurde.[3])

---

[1]) William Wotton, „Reflections upon ancient and modern learning", 1697, S. 229.

[2]) De re Anatomica Venetiis.

[3]) John C. Daltons „History of the Circulation", 1884, gibt die bei weitem beste und vollständigste englische Darstellung des ganzen Themas.

Ein paar Worte noch über das Buch „Christianismi Restitutio“, „liber inter rariores longe rarissimus“. Nur zwei vollständige Exemplare davon sind bekannt, das eine befindet sich in der Pariser Nationalbibliothek, das andre in der kaiserlichen Hofbibliothek in Wien. Ein drittes, unvollständiges Exemplar, dessen erste sechzehn Seiten mit der Hand geschrieben sind, befindet sich in der Universitätsbibliothek in Edinburg. Das Pariser Exemplar ist von besonderem Interesse, da es Dr. Richard Mead, dem hervorragenden Arzt und Büchersammler, gehörte, der es im Tausch für eine Serie Medaillen Herrn de Boze überließ. Im Jahre 1784 wurde es für die königliche Bibliothek erworben. Es ist jetzt in einem der Schaukästen der Nationalbibliothek zu sehen, zu deren kostbarsten Schätzen es gehört. Ein weiteres Interesse bietet das Exemplar durch den Umstand, daß auf dem Titelblatt der Name „Germain Colladon“ steht. So hieß der Genfer Advokat, der die Klage gegen Servetus führte, und es ist im höchsten Grade wahrscheinlich, daß dies das Exemplar ist, das bei der Verhandlung benutzt wurde. An einer Stelle hat das Buch Flecken, manche nehmen an, infolge von Feuchtigkeit, andre halten es für möglich, daß dieses Exemplar kein andres ist als das, das auf dem Opfer selbst bei der Verbrennung festgebunden wurde, und daß es von irgend jemand, der ein so interessantes Andenken an den großen Ketzer vor der Vernichtung bewahren wollte, den Flammen entrissen worden ist. Die Frage ist von dem verstorbenen Professor Laboulbene und Dr. Hahn, dem ausgezeichneten Bibliothekar der Pariser medizinischen Fakultät, sorgfältig geprüft worden, und beide sind zu der Ueberzeugung gelangt, daß die Flecken nicht durch Feuchtigkeit, sondern durch Feuer verursacht worden sind.

Im Jahre 1791 wurde das Wiener Exemplar in Nürnberg im Faksimile, Seite für Seite, nachgedruckt, aber Dr. de Murr, der für diesen Neudruck verantwortlich war, setzte sehr vernünftigerweise die Jahreszahl 1791 ans Ende der letzten Seite. Exemplare dieser Ausgabe sind in den größeren Bibliotheken nichts Ungewöhnliches. Im Jahre 1723 unternahm Mead die Veranstaltung eines Neudrucks nach seinem Exemplar, aber als die Drucke beinahe fertig waren, ließ der Bischof von London sie unterdrücken, und sie wurden angeblich verbrannt. Ein paar Exemplare indessen entgingen diesem Schicksal, und Willis sagt, daß er eines in der Bibliothek der London Medical Society gesehen habe. Leider habe ich von dem Bibliothekar gehört, daß es nicht mehr zu finden ist. Ein Exemplar des unvollständigen Meadschen Neudrucks befindet sich in der Pariser Nationalbibliothek, zwei andre im Britischen Museum.

Zum Schluß noch ein paar Worte über die Haltung Calvins gegen Servetus. Es ist viel Haß auf den großen Reformator gehäuft worden, und man kann nur bedauern, daß ein Mann, der so Großartiges vollbracht, sich in eine nichtswürdige Ketzerjagd hat hineinziehen lassen, wie ein gewöhnlicher Inquisitor. Beurteilen wir ihn nicht nach seinem Jahrhundert, wie seine Freunde es verlangen, sondern frei und offen nach seinem Leben und als einen Menschen mit denselben Leidenschaften, wie wir sie haben. Er war scharf gereizt worden. Ist es ver-

wunderlich, daß, nachdem er jahrelang den fortwährenden Angriffen des Servetus ausgesetzt gewesen und durch dessen Gotteslästerungen alles Mitgefühls beraubt worden war, der alte Adam den Sieg über die christliche Liebe davontrug? Es ist nicht nur unmöglich, Calvin von der aktiven Mitschuld an dieser unglücklichen Angelegenheit freizusprechen — es war dabei auch persönlicher Haß und eine einem so großen Manne schlecht anstehende und, können wir sagen, ihm fremde Rachsucht im Spiel. Doch der langjährige Ruf eines selbstverleugnenden Lebens, das in einer schlimmen Zeit dem Höchsten und Besten gewidmet war, vermag für alle vernünftig denkenden Menschen diesen einen Makel zu verwischen. Wir wollen ihn, wenn wir überhaupt über ihn zu Gericht sitzen dürfen, als einen Menschen, nicht als einen Halbgott beurteilen. Wir können ihn nicht verteidigen, aber wir wollen ihn auch nicht verdammen; lassen wir seinen einzigen schweren Fehler, wenn wir auch fürchten müssen, daß er ihn nie bereut hat, den Schatten sein, der den herrlichen Umrissen eines edeln Lebens ein kräftigeres Relief gibt. In seiner Verteidigungsschrift,[1] in der er sich ausführlich mit dogmatischen Fragen beschäftigt, finden sich nicht nur keine Ausdrücke der Reue über die Rolle, die er in der Tragödie gespielt hat, sondern das Werk ist voll von Beleidigungen gegen seinen toten Feind, die in einem höchst rachsüchtigen Ton gehalten sind.

Auf der Stelle, wo Servetus verbrannt wurde, steht heute ein Sühnedenkmal, das den Geist des modernen Protestantismus zum Ausdruck bringt. Auf der einen Seite stehen die Angaben über die Geburt und den Tod des Servetus, auf der andern eine Inschrift, die in der Uebersetzung folgendermaßen lautet: „Getreue und dankbare Anhänger Calvins, unsers großen Reformators, doch einen Irrtum verdammend, der der seiner Zeit war, und nach den wahren Grundsätzen der Reformation und des Evangeliums fest an der Gewissensfreiheit haltend, haben wir dieses Sühnedenkmal errichtet. Den 27. Oktober 1903.“

Durch die für nächstes Jahr geplante Errichtung eines Gedächtnisdenkmals in Vienne vervollständigt die moderne Welt die Anerkennung der Verdienste eines der merkwürdigsten Menschen, die uns in dem ereignisreichen sechzehnten Jahrhundert entgegentreten. Der wandernde spanische Gelehrte, der ungestüme Disputant, der anatomische Prosektor, der von einem wiederhergestellten Christentum träumende Mystiker, der Entdecker einer der fundamentalsten physiologischen Tatsachen ist endlich zu seinem Recht gekommen. Ich weiß, es gibt Leute, die der Ansicht sind, daß vielleicht mehr getan worden ist, als recht und billig ist; aber Servetus spielte in einer tragischen Zeit eine außergewöhnlich tragische Rolle, und die Tragik seines Geschickes spricht stark zu uns.

Die Gegenwart ist eben auch eine Zeit der Vergeltung, der Erneuerung aller Dinge, eine Zeit der Eröffnung des fünften Siegels, da wir „sehen unter dem Altar die Seelen“ derer, und in das weiße Kleid der Nächstenliebe hüllen jene, „die erwürget waren um des Wortes Gottes willen und um des Zeugnisses

[1] Defensio Orthodoxae, 1554.

willen, das sie hatten", ohne danach zu fragen, ob der Märtyrer Katholik oder Protestant war, nur darauf bedacht, einen jener großen Schar zu ehren, die kein Mensch zählen kann, „deren heroische Leiden," wie Carlyle sagt, „melodisch zusammen aus allen Landen und allen Zeiten als ein heiliges Miserere zum Himmel aufsteigen, ·ihre heroischen Taten als ein unendlicher, ewigwährender Siegespsalm." [1])

---

[1]) Die gesamte Servetus=Bibliographie bis zum Jahre 1890 ist in Professor A. von der Lindes „Michael Servetus" (Groningen 1891) enthalten. Mein persönliches Interesse für Servetus datiert aus der viele Jahre zurückliegenden Zeit, wo Pastor Tollins köstliche Arbeiten die Hefte von Virchows „Archiv" belebten. Niemand hat je einen begeisterteren Biographen gefunden als Servetus in Pastor Tollin, und wir verdanken den Schriften des Magdeburger Geistlichen den größten Teil unsers heutigen Wissens über Servetus. Die beste englische Arbeit ist von Willis, „Servetus and Calvin", 1877. — Eine deutsche Ueber-setzung der „Christianismi Restitutio" von Dr. Bernhard Spieß erschien im Jahre 1895 (2. Auflage, Wiesbaden, Chr. Limbarth). Herrn Professor Harper in Princeton bin ich für ein historisches Drama „The Reformer of Geneva" von Professor Shields (Privatdruck der Princeton University Preß, 1897), das ein herrliches Bild von Genf zur Zeit des Prozesses gibt, zu Dank verpflichtet. Aus Chéreaus „Histoire d'un Livre" (1879) habe ich den Ge-danken der Einleitung „gestohlen". — Erwähnt muß noch der Name Mosheim werden, da die Schriften dieses Gelehrten viele Jahre lang die allgemeine Quelle waren, aus der alles Wissen über Servetus geschöpft wurde. Das Bildnis des Servetus, von dem Mosheim spricht, ist verschwunden.

THE MEDICAL LIBRARY
IN POST-GRADUATE WORK.

BY

WILLIAM OSLER, M.D., F.R.S.,
President of the Medical Library Association.

Remarks

ON

THE MEDICAL LIBRARY IN POST-GRADUATE WORK.[*]

BY

WILLIAM OSLER, M.D., F.R.S.,

PRESIDENT OF THE MEDICAL LIBRARY ASSOCIATION.

WITH collectivism the order of the day it is very natural that those interested should associate themselves in an organization which has for its object the welfare of the Medical Library. As stated in the circular, the Provisional Committee has given the new society a wide basis. The objects are:

(a) To bring together those engaged in or interested in medical libraries and medical literature, and for the discussion of matters associated with their fostering and care;

(b) To maintain an exchange for the distribution of duplicate books and periodicals;

(c) To increase the facilities for reference work;

(d) To encourage the study of the history of medicine;

(e) To issue publications dealing with medical library work;

(f) To form a library union amongst those of the medical libraries between which the exchange of books can be arranged—

all unexceptionable objects, and with the additional merit of being within reach of accomplishment.

Let me say at the outset that this is not to be simply a society for those whose work is more or less officially concerned with libraries, but it is for all interested in the book as a living factor in the education of the members of a learned and consequently of a very bookish profession. Whether the British doctor has been a better book-lover or book-maker is an open question, but from the first Oxford movements in the thirteenth and in the early fifteenth centuries we find him ever in the ranks of the keenest bibliophiles. He has never been a great student of the book as such, and it is strange not to find in the long line of splendid bibliographers, from the lovable Conrad

---

Gesner to the encyclopaedic Billings, an Englishman of the first rank. I do not forget the useful books of Douglas, of Young, and of Forbes, nor the Rabelaisian (in the mirth-loving sense) two-letter bibliography of Atkinson † ; but they are feeble efforts in comparison with the works of our foreign and American brethren. But the Englishman has made up by being a great book-lover. Some of the best known of collections have been made in this country by physicians. It would be impossible to parallel elsewhere the libraries of Mead, Askew, and William Hunter. The sale catalogues of the former tell of treasures (and of prices) that send a thrill of regret through the book-lover that his lot was not cast in those happy days. The William Hunter Library met a better fate, and in the University of Glasgow is an enduring and worthy monument to the elder of the two great brothers, so unlike in mind and manners, so like in the capacity to see the true value of collections. It is to be hoped that a complete catalogue of this library may be issued before long, in companion volumes to the splendid catalogue of the manuscripts recently edited as a memorial to the late Professor Young.

It is safe to say that in proportion to population there are more medical libraries in these islands than in any other country in the world. We hope before long to have a proper census of them, and meanwhile I base the statement on casual observation. One of the first questions I ask on visiting a new town is, " Where is your medical library?" and I have been astonished at their extent and value. Usually in connexion with the county hospital or the medical society, or both, many of them go back to the middle or later part of the eighteenth century, and bear witness to the culture and intelligence of the provincial physicians of those days.

There are three groups :

First, in the national libraries of the capitals and of the universities, such as the British Museum and the Bodleian, are large collections of medical books—that of the British Museum the largest in the country. Upon these public storehouses of bibliographical knowledge we all draw freely. In many of the small libraries there are special collections of great intrinsic or historical value. The college libraries of Oxford and Cambridge contain manuscripts and old books of exceptional interest. Diel's topographical catalogue shows how rich some of the colleges are in the Greek medical manuscripts, particularly Balliol, New, Merton, All Souls, and Caius. Stowed away on their shelves are many fine folios, the gift of old members. Gulston's books are at Merton ; New College has a very choice collection, including some of Walter Bayley ; Floyer's books are at Queen's, Paddy's at St. John's, Coggan's at Oriel—indeed there is scarcely a college library without interesting medical associations.

† The only man, so far as I know, who has had the courage to write a diverting bibliography, but unfortunately he only got through A and B.

Secondly, the medical libraries proper, among which those of the Royal Colleges of the three capitals are the most important. Easily first in extent and in the wide sphere of its influence is that of the Royal College of Surgeons of England, which is a model of good management. The library of the Royal Society of Medicine is the largest, I believe, connected with any medical society, and with the new organization is rapidly growing. The libraries of the Faculty of Physicians and Surgeons of Glasgow, of the Medical Institution of Liverpool, of the Birmingham Institute, of University College, Bristol, the Worth Library of the Steevens Hospital, and the Manchester Medical Society, form collections of the first rank. One of the most valuable of professional libraries is that of the British Medical Association, under whose auspices, so to speak, we meet to-day. Founded in 1889, it now possesses more than 20,000 volumes, with a card catalogue. The books are chiefly modern, with a large proportion of monographs and valuable sets of foreign periodicals. It receives also, and this is a very important point for borrowers, the theses of the French universities. Through it the Association has already done good work by aiding in the formation of local libraries, and between 6,000 and 7,000 duplicates have already been distributed. An important step has recently been taken to make this a lending library for members of the Association, who will be able to borrow expensive works and periodicals such as are only occasionally required for consultation. Having frequently visited the library in the old building, I very gladly bear testimony to its usefulness and to the admirable way in which it is managed by the librarian, Mr. Honeyman. I am not surprised to hear that the annual number of readers is very large, more than 6,000 in 1906. In the new building the arrangements are excellent, and I have no doubt that provincial members visiting London will more and more resort to this library. In all matters of management and detail these large libraries will be able to guide and assist us with their experience. Certainly we shall get much more from them than they from us, but theirs will be the richer blessing of the giver. With a well-managed exchange we may be able to help them fill the lacunae on their shelves, and it should be our aim to make these national collections more and more complete.

By far the best work we can do is in the organization, preservation and extension of the smaller libraries already existing in the provincial cities and towns. Many of these are already well housed and well arranged, as for example the Reading, York and Norwich libraries, to speak of those which I know personally. There are scores of hospitals with good collections, some of the greatest value, as those of Exeter and Bath and the Brackenbury Library, Preston. Some of them have associations of exceptional interest. I have always been an admirer of Caleb Hillier Parry of Bath, type of the old naturalist-physician, more common a few generations ago than now.

His library in the Royal Hospital remains a fitting monument to a scholarly man of wide sympathies, and who left a deep impression on that part of the West Country which has given us such men as Jenner, Pritchard and Symonds. In those days life was not so full, and competition was less keen, so that men had more time to read and to think. Many of the best of these smaller libraries date from the latter part of the eighteenth century and the beginning of the nineteenth century. Some of them have died into cupboards and barrels, and sadly need the kind care of a Philip de Bury, one of the founders of Oxford libraries, who, in the fourteenth century, complained bitterly that he found precious volumes defiled and injured by mice, worms and moths. A collection of this sort, offered me a few years ago, I was able to buy through a friend, for the Johns Hopkins Medical School. It had associations with Joseph Priestley, with John Aikin, Thomas Percival and James Kendrick, well-known names in the North. As illustrating how valuable may be some of these out-of-the-way collections, there were in this one scores of seventeenth and eighteenth century pamphlets which were not in the London libraries.

Our best work will be in stimulating an interest in these smaller libraries, either in connexion with the medical society or with the hospital, and in helping to organize them; and from every one of them we hope to have in our society a representative.

And, lastly, there is the private library of the practitioner, the scope of which will depend on his training, his tastes, and his purse; and this brings me to the subject of my remarks, "the value of the library in post-graduate study."

Some of the best of men have used books the least, and there is good authority for the statement that shallowness of mind may go with much book-learning. Descartes, one of the most brilliant of thinkers and observers, had no library. At Egmond, asked by a friend the books he most read and valued, he took him into his dissecting room and showed him a calf—"There is my library." An identical anecdote is told of John Hunter. But these were exceptional men; and few will be found to doubt the importance of books as a means to what the same author called the end of all study—the capacity to make a good judgement.

It cannot be denied that many men practise, and do so successfully, with few journals and still fewer books. Radcliffe, whose memory is enshrined in two of the finest library buildings in the kingdom, and whose travelling Fellows are supposed to have at least a triennial thirst for new knowledge, neither read nor wrote books; and he is credited with the famous *mot* that he could set down the whole art of medicine on a sheet of paper. But conditions have changed, and medicine is now a rapidly progressive science, as well as an exceedingly complicated art, of which, at qualification, a man has only laid the foundation; and if he is to develop his intelligence— that is, get an education—it must be by systematic post-

graduate study. Out of leading-strings he must himself be at once teacher and pupil, and make and keep certain self-made laws. Whether he will get this education, whether, indeed, he will be able to keep what he has, will depend in part upon the sort of training he has received, and in part upon the type of mind with which he has been endowed. Unless as a student he has got that " relish of knowledge " of which Locke speaks ; unless he has got far enough to have his senses well trained to make accurate observations ; unless he has been taught how to use his intelligence so as to form a good judgement, the teacher will have more or less of a fool for a pupil, and between them make a sad mess of an education. After a few years such a man gives up in despair, and without mental exercise grows stale and is fit to do only the ordinary reflex practice, in which cough means an expectorant mixture, and heart disease digitalis, just as surely as a tap on the patellar tendon brings out the knee-jerk. A glance at the consulting-room suffices for the diagnosis of this type : the BRITISH MEDICAL JOURNAL or *Lancet* lies uncut in heaps on the table, and not a book is in sight ! Some of the men of this type play a good game of tennis, others shoot and ride well, more play a good game of bridge, but they are lost souls, usually very dissatisfied with the profession—the kickers, the knockers, the grumblers, without a glimmer of consciousness that the fault is in themselves.

Post-graduate study is a habit of mind only to be acquired, as are other habits, in the slow repetition of the practice of looking at everything with an inquiring spirit. A patient with pneumonia has grass green sputum. " Have I ever seen it before ? Have I a note of it ? Where can I get a good description of it ? What does it signify ? " These are questions preliminary to getting a bit of clinical education, trifling in itself apparently, but when stored up and correlated with other facts may become the basis for an intelligent judgement on an important case.

There are many factors in this training—note-taking, reading, the medical society, and the quinquennial brain-dusting at a hospital or a post-graduate school. But I am only here concerned with one—books. I would like to speak of the value of notes, however brief, collected through long years as the sole means whereby a man gets his experience codified and really helpful; but I cannot wander to-day from the book, in which I include the JOURNAL.

But how can a busy man read, driven early and late, tired out and worried ? He cannot. It is useless to try, unless he has got into the habit when he was not so busy; then it comes easy enough, and the hardest-worked man in the land may read his journals every week, even if he has to do it in his carriage. My old teacher and colleague at McGill, Palmer Howard, was the busiest practitioner in Montreal, but the weeklies and the monthlies, English and French, the good old Quarterly, the hospital reports, the new monographs—nothing escaped him, and I have

often heard him say that he did his best reading as he drove from patient to patient.

It is not so much a question of *when* but of *what* and of *how*. What sort of reading will best help a man in his education, will help him to keep up with the times and to develop into a thinking, reasoning practitioner? Let him get rid of the notion that much has to be read; one or two journals, a good weekly—the *Lancet* or the BRITISH MEDICAL JOURNAL—a good monthly—the *Practitioner* or the *American Journal of the Medical Sciences*—suffice; but let them be read thoroughly. Then each week strip the husk of advertising sheets, and keep on the desk a file of reasonable proportions, and to the articles which have been of interest refer again and again. At the end of the half-year bind your journals and insert slips where you have found articles bearing directly on your cases.

Carefully studied, a couple of journals are the very basis of post-graduate work, and year by year the files on the shelves become not simply the nucleus of, but actually a good working library, and, well marked in his mind, he has in them volumes on every special disease and a complete summary of the progress of medicine.

Let him follow the same practice with books. Buy with discrimination, and not too many, as here again it is a question of reading. If, as is said, the man of one book is dangerous, the man of a few books is more useful and more apt to keep the open, plastic mind. A good " System " of medicine and of surgery, an occasional monograph or work on special diseases, a new edition of a favourite textbook (when you can trust that it is really an editor's, not a publisher's, edition !), should suffice, and do not mean a large annual expenditure.

It is much simpler to buy books than to read them, and easier to read them than to absorb their contents. Too many men slip early out of the habit of studious reading, and yet this is essential to a man if he is to get an education. To be worth anything it must be associated with concentration—with that mental application which means real effort. Of the new Allbutt and Rolleston " System " I can read comfortably about twenty pages in an hour —sometimes of a tough author not more than fifteen. Half an hour a day would finish the six volumes already published within a year.

More than once I have referred to the three essentials in the house of the general practitioner—the library, the laboratory, and the nursery—and of these the first is much the easiest to get, as he starts with a nucleus in his students' textbooks. Effort and system gradually train a man's capacity to read intelligently and profitably, but only while the green years are on his head is the habit to be acquired, and in a desultory life, without fixed hours, and with his time at the beck and call of everybody, a man needs a good deal of reserve and determination to maintain it. Once the machinery is started, the effort is not felt in the keen interest in a subject. As Aristotle remarks, " In the case of our habits we are only masters of the

beginning, their growth by gradual stages being imperceptible, like the growth of a disease"; and so it is with this habit of reading, of which you are only master at the beginning—once acquired, you are its slave.

So far as the library is a factor, the greater part of a man's post graduate education must be at home. In this country no man practises very far from a county town in which there is a medical society or a general hospital with a library attached. A notebook for special points to look up, or for certain books of reference, will get him into the habit of frequenting it, and he should become a subscriber, as in this way not only does the library widen its influence, but finds means for its support. The county library, wherever situated, should be the much-esteemed consultant of the general practitioner.

But it is in the towns of 20,000 in population and upwards that the library is of the greatest value, and where it becomes a factor of the first importance in the development of the progressive man. These are days of great opportunities, when we have discovered other ways to the top, toilsome all the same, than up the old rungs of the academic ladder, or the weary climb of the stairs of a London hospital. We are waking up to the fact that the man may make his own environment, and may make it just what and where he pleases; he may even perform a miracle—the mountain may come to Mahomet. Let me give you a notable illustration.

A few years ago when two young Irish-Americans called Mayo began to frequent the surgical clinics of Europe, no one knew where they came from; no one had ever heard of Rochester, Minnesota, and when informed that it was on the "Prairies," about 1,000 miles north-west of Chicago, there was a shrug of the shoulders and "Oh!" Self education, post-graduate study, books, journals, laboratory work, have enabled these remarkable men to build up one of the largest and in some respects the most important surgical clinic in the world, and a town of less than 20,000 inhabitants has become the Mecca of all surgeons.

To the man who is ambitious to use his opportunities in a town or city, a well selected library is essential, and whether he be surgeon, physician, or specialist, he needs as a rule more than his own shelves supply, often indeed a good deal more than the library can offer. As I have already stated, the library of the British Medical Association is offering great facilities to its members. In England, too, he can and should join the Royal Medical Society, from which monographs and special journals may be had, but he cannot always wait, and there is no reason why in the larger towns there should not be a library which ministers to the ordinary wants of all ranks. The journals at once become a serious consideration—French, German, and American—but a few of the best suffice when supplemented by the admirable German *Centralblätte*. By means of an exchange this association can render great assistance, while in the thickly populated districts a system of exchanges between libraries would cut in half

the cost of the more expensive journals. In this matter, too, a central library like that of the British Medical Association may be most helpful.

In large cities the profession should have its own home in connexion with the leading medical society, and of such an organization the library forms an important part. Belfast has set a good example, and through the munificence of Sir William Whitla you have a splendid building for the Medical Institute. About such rooms or buildings should centre the life of the profession, present and past. Portraits of the old worthies, memorials of friends, and to our heroes (such as the beautiful stained-glass window in the Institute here to Dr. William Smyth), show-cases full of the interesting relics of the profession, with manuscripts and books illustrative of local history—all these memorials make the past live again. At York you may see in the medical library the actual forceps with which Dr. Slop broke the bridge of Tristram Shandy's nose, and in every county there are relics of the profession well worth preserving.

It should be the ambition of the men in each county to have well-equipped rooms, such as those I have visited with much pleasure at York and Norwich. If, as at Reading, Exeter, Preston, and Dublin (Steevens' Hospital), rooms have been furnished in the hospital, see that the equipment is attractive; many libraries have deservedly fallen into disuse because men will not seek books or journals in dull, dark, cold, dusty, uninviting rooms.

Like everything else that is worth having, a library costs money. Do not try to do too much, strive to have a large membership, which enables the fees to be low; and when the library is in connexion with a hospital, the current English journals should be furnished by the governors to the staff. In towns with a tax for the upkeep of a public library, a grant should be made for the medical library. But the financial and other questions of organization and support will be discussed, I hope, at an early meeting.

Were there time I should like to say a few words on the subject of *how* to read, but the essence of the whole matter I found the other day in the Bibliotheca Lancisiana, Rome (founded in 1711, and containing the books of the famous Lancisi). In the opening address, 1714, *De recto usu Bibliothecae*, the Abbé Carsughi discusses the subject in three sections, and gives some good rules. The first section, *Librorum scilicet delectum*, need not detain us, but in the second, *Legendi methodum*, he urges two important points—to read in a certain order and with a definite object, and *lente festinans*, "unhasting but unresting." In the third section, *Adnotandi modum*, he urges the necessity of careful note-taking, quoting the praise of Clement of Alexandria, "Oblivionis medicamentum, monumentum senectutis et adjumentum memoriae." He dwells upon the importance of study in the morning, which was all very well in those days, but is not one hour after six in the evening worth now two before

eight in the morning? (I am sure it is to me!) With
half an hour's reading in bed every night as a steady
practice, the busiest man can get a fair education before
the plasma sets in the periganglionic spaces of his grey
cortex.

But there is another side of the question of books and
libraries—man does not live by bread alone, and while
getting his medical education and making his calling and
election sure by hard work, the young doctor should look
about early for an avocation, a pastime, that will take him
away from patients, pills and potions. One of the best
features I find in my "old country" colleagues is the
frequency with which they have hobbies. No man is
really happy or safe without one, and it makes precious
little difference what the outside interest may be—botany,
beetles or butterflies, roses, tulips or irises, fishing, moun-
taineering or antiquities—anything will do so long as he
straddles a hobby and rides it hard. I would like to make
a plea for the book, for the pleasant paths of bibliography,
in which many of us stray to our great delight. Upon
this how charming is old Burton (really one of us, "by
profession a divine, by inclination a physician," he says),
whose *Anatomy of Melancholy* is the only great medical
work ever written by a layman. "For what a world of
books offers itself, in all subjects, arts, and sciences, to the
sweet content and capacity of the reader! In arithmetic,
geometry, perspective, optics, astronomy, architecture,
sculpture, painting, of which so many and such elaborate
treatises are written; in mechanics and their mysteries,
military matters, navigation, riding of horses, fencing,
swimming, gardening, planting, great tomes of husbandry,
cookery, falconry, hunting, fishing, fowling, etc., with ex-
quisite pictures of all sports, games, and what not! In
music, metaphysics, natural and moral philosophy, phil-
ology, in policy, heraldry, genealogy, chronology, etc., they
afford great tomes, or those studies of antiquity, etc.,
*et quid subtilius Arithmeticis inventionibus, quid ju-
cundius Musicis rationibus, quid divinius Astronomicis,
quid rectius Geometricis demonstrationibus!* What so
sure, what so pleasant?"

Our society will, I am sure, be very helpful to men who
take up this study. We hope to have two groups, mutually
helpful—the professional bibliographers, the men in charge
of our libraries, who have to do with the book, as such, and
who care little or nothing about its contents; and amateurs,
like myself. As Professor Ferguson says in his charming
essay[1]:

He (the bibliographer) has to do with editions and their
peculiarities, with places, printers, and dates, with types and
illustrations, with sizes and collation, with binding and owners,
with classifications, collections and catalogues.

There are scores of book collectors whose hobby also
takes them in this direction, but we should have a large
amateur group who will be happier in following other
lines. Personally, I collect on two principles—first, in-
terest in an author, which is a good guide, as the book

illustrates the biography, a principle which has the advantage of helping at least to keep you within the limits of purse and shelves, more the latter than the former. Take, for example, the two small groups of books I have placed in our exhibition, the one illustrating Servetus, the other Ulrich von Hutten. Valuable as they are from the standpoint of the professional bibliographer, this is nothing to the interest awakened in the men themselves, in their aspirations, their labour, and their tragic fates. For the amateur this personal note clothes the dry bones of bibliography and makes them live. And my other principle is this: a student of the history of medicine, I look out for books which have left their impress on it in some special way. If one is particular to examine carefully into the claims of a book before admitting it to the select company on your shelves, you here again cultivate a due regard for purse and space. For example, five or six books illustrate the whole subject of auscultation and percussion, only the masterpieces are chosen. I confess there may be a certain satisfaction in tracing out the biography of a book, but it is cold work unless you love the author.

Judiciously cultivated, bibliography has many advantages as a pastime for the doctor; a little patient care, a very small expenditure of money, and a constant look-out for the books wanted are the essential requisites. Nor is there ever any difficulty in the choice of a subject—anything he may be interested in has its bibliographical side. One friend (Dr. Turrell), a very busy man, is a keen fisherman, and has found the time to collect a library on this subject, and has written the article on it for the *County History of Oxfordshire*. Another man has kept up his classics, and collected everything relating to Horace. Another has a library relating to the order of St. John. Another friend in large general practice has found time to make a collection of the masterpieces of English literature, which has not only been a diversion and an education, as it has brought him into the best company of the past four centuries, but he tells us there is another side—it has been a better investment than life insurance. A member of our profession, the late Professor Corfield, made one of the best modern collections of bindings, the sale of which at Sotheby's in 1904 was one of the bibliographical features of the year. Once in a subject it is extraordinary how it grows and develops. As Atkinson says, "It is an art of itself, which is not easily sought into or acquired, but which, if so acquired, may stand both his pleasure and profit in very great stead in a very long or a short life." And the busiest general practitioner may find the time for first-class work. Many of you may have seen a book issued two years ago from the Oxford Press on Greek and Roman medical and surgical instruments, the only separate treatise on the subject which has appeared in English. It illustrates the hobby of a very hard-worked practitioner in the town of Hartlepool—John Milne, whose spare time and whose vacation have been spent in studying this aspect of Greek and Roman archaeology.

We shall hope to have in our society both the professional and the amateur—the man whose life-work is in libraries, and those of us who are fond of books, either from a biographical or a bibliographical standpoint. We should be able to encourage library organization, and once established as a common meeting ground for all interested, the society should be of great value to the profession. We look for a large membership, and many will join who do not belong to either of the above-mentioned groups, the men who feel that, as a matter of policy, such a society should be supported. *Non sibi sed toti*—let us work in the spirit of this motto, and our future is assured.

In starting an organization of this sort the work always falls on one or two men. We have to thank Dr. Stanley Hall, of Bristol, and Mr. C. E. A. Clayton, of the Manchester Medical Library, to whom is due entirely the success of this preliminary meeting. We have also to thank the university authorities for allowing us to meet here, and furnishing us with rooms for the exhibit.

REFERENCE.
[1] *Some Aspects of Bibliography*, Edinburgh.

THE NATION
AND THE TROPICS

ADDRESS DELIVERED IN THE LONDON
SCHOOL OF TROPICAL MEDICINE
OCTOBER 26, 1909

BY

WILLIAM OSLER, M.D., F.R.S.

REGIUS PROFESSOR OF MEDICINE
UNIVERSITY OF OXFORD

THE NATION
AND THE TROPICS

ADDRESS DELIVERED IN THE LONDON
SCHOOL OF TROPICAL MEDICINE
OCTOBER 26, 1909

BY

WILLIAM OSLER, M.D., F.R.S.

REGIUS PROFESSOR OF MEDICINE
UNIVERSITY OF OXFORD

T[...]

GE[...]

T[...]
tha[...]
clo[...]
—t[...]
hav[...]
pro[...]
bio[...]
out[...]
up [...]
tio[...]
cen[...]
cen[...]
rac[...]
tra[...]
rur[...]
ide[...]
of [...]
ori[...]
pov[...]
san[...]
a r[...]
suc[...]
bur[...]
pla[...]
nev[...]
is t[...]
wh[...]
unc[...]
giv[...]
rem[...]

THE NATION AND THE TROPICS

Gentlemen,

The evolution of our present hopeful condition, like that of organic life, looks uniform; but examined more closely this uniformity disappears in a deeper parallel —the sudden intrusion of apparently new forces which have changed the broad surface of humanity quite as profoundly as did, for example, the glacial period the biology of the northern portions of the globe. Three outstanding events have loosened as a spring the pent-up energies of the modern world—the Greek civilization, the geographic renaissance of the sixteenth century, and the scientific awakening of the nineteenth century. Greek thought not only stripped man for the race, but Greek methods gave him correct principles of training and clear ideas of the nature of the race to be run. Collectively we follow to-day occidental, Greek ideals, and what makes Western civilization such a tissue of inconsistencies is the injection, Anno Domini, of an oriental morality which controls the individual, while powerless to sway the nations. The geographic renaissance has given to the progressive peoples of Europe a new pinnacle of outlook. To the lust of conquest succeeded the lust of commerce, to be followed by the burning zeal to evangelize; and then a steady, sober plan of settlement which has encircled the earth with new nations. And the third great outburst of energy is the scientific awakening of the nineteenth century, which has not only placed in his hands a heretofore undreamed of capacity for material progress, but has given to man such a control of nature that at a stroke is removed the chief obstacle to a world-wide dominion.

A

The expansion of modern Europe, the completion of which was one of the great features of the latter part of the nineteenth century, has opened a broader vista than ever before looked on by humanity. The ascent of man began in the tropics, where the conditions of nature made life easy, and at least four of the six great ancient civilizations—the Egyptian, Phoenician, Assyrian, and Babylonian—rose and fell within, or close to the tropics. Once only in modern times has a tropical people, reaching a high grade of civilization, spread far and wide, in the magic outburst with which the Arabians shook the very foundations of Christianity. In the last four centuries the expansion of Europe has changed the map of the world, and in conflict with the old civilizations in North and South America, and by wholesale appropriations in Asia and Africa, the children of Japhet have gone forth with the Bible in one hand and the sword in the other conquering and to conquer, taking the uttermost parts of the earth for their possession. In the course of this period they have partitioned among them one hemisphere, two continents, and a large part of a third. A glance at the map shows that as a result of this expansion many independent nations have sprung up; but a very large portion of the conquered earth is still in control of Europe, and linked to it by strong political ties. Practically these countries come in two divisions—the self-governing colonies and the dependencies. A majority of the former are in the temperate regions, and have reached a stage of maturity, and one of them has become the great nation whose representative honours us to-day with his presence.

Scarcely less important, and vastly greater in extent and population, are the dependencies, nearly all of which fall within the tropics, and with their destiny the problem of the twentieth century is bound up. If we take two lines, 30 degrees north latitude and 30 degrees south latitude, the part of the earth between represents the great heat belt of the tropics, within which lie the

whole of Africa, Arabia, India, Burma, the Malay States,
Polynesia, the Philippines, Mexico, and the Central
American Republics, with the West Indies. Mr. H. O.
Becket of the Department of Geography, Oxford, has
prepared for me four maps (which I have much pleasure
in presenting to the school) showing at a glance the
tropical possessions of the four Western nations—
England, France, Germany, and the United States.
The following table gives the figures in population and
in square miles of territory :—

—	Tropical territory in—				Total tropical.	Home country.
	America.	Africa.	Asia.	Pacific.		
France . . . {	440,000 35,000	17,700,000 4,032,000	18,500,000 310,000	80,000 9,000	36,720,000 4,386,000	39,000,000 207,000
German Empire . {	Nil.	11,700,000 931,500	Nil.	400,000 96,000	12,100,000 1,027,500	60,000,000 209,000
United Kingdom . {	2,000,000 109,000	30,500,000 1,600,000	296,600,000 1,900,000	1,150,000 1,400,000	330,250,000 5,009,000	44,500,000 121,000
United States . {	305,000 47,500	Nil.	Nil.	7,707,000 134,500	8,012,000 182,000	76,000,000 2,970,000

Heavy figures give population.   Lighter figures give area (in square miles).

The tropical world has been appropriated, and this
country has a burden of tropical population six times
greater than the other three combined. A few com-
paratively small districts remain either independent, or
as yet unexplored, as Abyssinia and parts of Polynesia.

THE DOUBLE BURDEN OF THE WHITE MAN.

It is no light burden for the white man to administer
this vast trust. It is, indeed, a heavy task, but the
responsibility of Empire has been the making of the
race. In dealing with subject nations there are only two
problems of the first rank—order and health. The first
of these may be said to be a speciality of the Anglo-
Saxon. Scarlet sins may be laid at his door—there are
many pages in the story of his world-exodus which we
would fain blot out ; too often he has gone forth in the
spirit of the Old Testament crying 'The sword of the

Lord, and of Gideon'. But heap in one pan of the balance all the grievous tragedies of America and of Australasia, the wholesale destruction of native races, all the bloodshed of India, and the calamities of South Africa, and in the other pan put just the one little word 'order', which has everywhere followed the flag, and it alone makes the other kick the beam. Everywhere this has been the special and most successful feature of British rule. We are entering upon a phase in which the natural results of this stable government upon the subject races are shown. Just as at home the fate of the rich is indissolubly bound up with that of the poor, so in the dependencies the fate of the strong and the weak cannot be dissevered; and whether he will bear or whether he will forbear, the brother's keeper doctrine of the strong, helpful brother must be preached to the white man. The responsibility is upon the nation to maintain certain standards which our civilization recognizes as indispensable on the supposition that our Western ideas are right; but we have to meet the fact that the ways of the natives are not our ways, nor their thoughts our thoughts; and yet we place them in such a position that sooner or later they become joint heritors with us of certain civil and social traditions and aspirations. It is in India and the Philippines that the political problem looms large, but no matter how large or how formidable it must not be allowed to interfere with the great primary function of the Anglo-Saxon as a policeman. There may be a doubt as to the grafting of our manners, and still greater doubt as to the possibility of inculcating our morals; a doubt also as to the wisdom of trying everywhere to force upon them our religion; but you will, I think, agree that the second great function of the nation is to give to the inhabitants of the dependencies, Europeans or natives, good health —a freedom from plague, pestilence, and famine. And this brings me to the main subject of my address, the control of the tropics by sanitation.

THE NEW CRUSADE.

When the historian gets far enough away from the nineteenth century to see it as a whole, perhaps one feature above all others will attract his attention, since amid all the movements of that wonderful period it has been most directly beneficent to the race. Political, social, religious, intellectual revolutions will demand his comments, but if I am not greatly mistaken the movement upon which he will dwell longest will be the introduction of modern sanitation. It is not possible to ascribe the credit of this to any one man or group of men in any country. The movement arose with the recognition of the true nature of the large division of what we call the infectious diseases, which are responsible for more than one-half of the deaths in the community. This country may claim the merit of having first carried into practical effect sanitary laws, which have resulted in a steadily diminishing mortality from this class. The cholera epidemic in the 'fifties' did a great deal to arouse public opinion, and that remarkable group of men, comprising Southwood Smith, Chadwick, Budd, Murchison, Simon, Acland, Buchanan, Russell, and B. W. Richardson, and among laymen Charles Kingsley, put practical sanitation on a scientific basis. They had grasped the conception that the battle had to be fought against a living contagion, which found in poverty, filth, and wretched homes the conditions for its existence; and an immense impetus was given when in rapid succession, in the last third of the century, the germs of a large number of the most serious of epidemic diseases were discovered. The sum total has been the abolition of many infections, such as typhus fever; an extraordinary reduction in others, as in typhoid; the almost complete abolition of post-operative sepsis through Lister's work; and the perfecting of a sanitary organization which gives confidence to the public and prevents commercial panics. Think of the shudder that

would have passed over this country thirty years ago at the announcement of an outbreak of cholera in Rotterdam, yet in August last the presence of ten cases in that city was simply commented upon, but none felt the slightest anxiety. Altogether we may say that the home defences are in a fairly satisfactory condition, but there remain the complete victory over typhoid fever, the progressive reduction in the mortality from tuberculosis, and the limitation of the still very fatal diseases of childhood, and we have not arranged yet even a truce with that subtle and very progressive foe, cancer.

This flowery and flattering picture is true of the little island which forms the centre, and it is true, fortunately, to a great extent of the Confederated States, but when we take a glance at the empire at large, at the huge area which we see represented on the map, we find a totally different state of affairs. Out of the total population 60,000,000 perhaps live under good and constantly improving sanitary conditions, but of the vast dependencies with their teeming millions there is a very different story to be told. With an awakening of an interest in the tropics men have learned to recognize the primary importance of good health and the possibility of mitigating conditions which favour the persistence of widespread and destructive epidemics. Of tropical diseases of the first importance may be mentioned malaria, plague, cholera, yellow fever, dysentery, beri-beri, and relapsing fever, and certain parasitic disorders as ankylostomiasis. They vary in their prevalence in different localities, but together they make the tropics' great enemies. It is interesting to note that of all but one we know the germs, the conditions of their growth, and in nearly all the mode of propagation. Quietly but surely this great work has been accomplished by a group of patient investigators, many of whom have sacrificed health and life in their endeavours. Let us pause a moment to pay a tribute of gratitude to these saviours of humanity who have made the new mission

possible—to Pasteur, to Koch, to Laveran, to Reed and his fellows, to Ross, Manson, and Bruce. And let us not forget that they built upon foundations laid by thousands of silent workers whose names we have forgotten. A great literature exists in the contributions published during the past century by the members of the medical department of the old East India Company service and of the army in both the East and West Indies. I should like to awaken in your memories the names of Lind, Annesley, Moorehead, Pringle, Ballingall, MacGregor, Hillary, Waring, Cheevers, Parkes, Malcolmson, and Fayrer. Many did work of the very first quality with very little recognition at home or abroad. I sometimes think of the pathetic letters received from that splendid investigator Vandyke Carter of Bombay, the first in India to confirm the modern studies upon malaria in the early days when we were both working at the subject, how he spoke of his isolation, the difficulties under which he struggled, the impossibility of arousing the apathy of the officials, and the scepticism as to the utility of science.

No one has expressed more deeply this sentiment of lonely isolation in the tropics than Ronald Ross in his poem *In Exile*:—

> Long, long the barren years;
> Long, long, O God, hast Thou
> Appointed for our tears
> This term of exile.

Few have been able to sing with him the paean of victory when he discovered the mode of dissemination of malaria through the mosquito—

> Seeking His secret deeds
> With tears and toiling breath,
> I find thy cunning seeds,
> O million-murdering death.

And the pathway of victory is strewn with the bodies of men who have cheerfully laid down their lives in the search for the secrets of these deadly diseases—true

martyrs of science, such as were Myers, my friend and former assistant, Lazear (both of whom died from yellow fever), Dutton, and young Manson. Of them may fitly be sung in words from the noblest of all American poems, that in which Lowell pays a tribute to the young Harvard men who fell in the war of secession :—

> Many in sad faith sought for her,
> Many with crossed hands sighed for her;
> But these, our brothers, fought for her,
> At life's dear peril wrought for her,
> So loved her that they died for her.

As a result of twenty-five years' work we have an extra-ordinary volume of knowledge concerning the causes of most of the tropical diseases and the nature of the measures required for their prevention. And yet when one considers the existing conditions it is safe to say that our task has scarcely begun. When we read in *The Lancet* of October 23 that during the last four months of 1908 400,000 deaths from fever were reported in the Punjab, and that it is estimated that a fourth of the total population of the province suffered from malaria, one realizes the truth of such a statement. And yet the situation is one full of encouragement, particularly in connexion with the practical prevention of insect-borne diseases. For centuries there has been a popular belief in the transmission of disease through mosquitoes and flies, and in the middle of the nineteenth century that remarkable clinician and anthropologist, Nott of Mobile, suggested the association between the mosquito and yellow fever and malaria. A more scientific presentation of the question was made by the French physician Beauperthuy, an enthusiastic student of the epidemics in the Spanish Main. But the first clear demonstration of a mosquito-borne disease was made by Manson in the case of filariasis. The whole story is told in a fascinating way in Sir Rubert Boyce's just issued work, *The Mosquito or Man: the Conquest of the Tropical World*. The discovery by Laveran in

1880 of the parasite of malaria, the demonstration by
Ross in 1897 of the part played by the mosquito in
its transmission, have a greater significance for a
greater number of persons than any single observations
ever made in connexion with disease. Then followed
in 1900 the demonstration by the American Army Com-
missioners, Reed, Carroll, Agramonte, and Lazear, of
the transmission of yellow fever by the mosquito. Many
scientific discoveries have afforded brilliant illustrations
of the course to be followed in a modern research; but
one is at a loss to know which to admire most, the
extraordinary accuracy and precision of the experi-
ments, or the heroism of the men, officers and rank and
file, who carried them out, all the time playing with
death and some of them paying the penalty. The con-
ditions were favourable to the demonstration on a large
scale of the practical value of the discovery. It was
a fortunate thing that the head of the American occupa-
tion of Cuba was General Leonard Wood, himself
a well-trained physician, and deeply interested in
problems of sanitation. Backed by the military arm
it took Dr. Gorgas and his colleagues nine months to
clear Havana, which had been for centuries a strong-
hold of the disease. With the exception of a slight
outbreak after the withdrawal of the American troops
the city has remained free from yellow fever. What is
even more important, in the great centres in South
America, particularly in Rio, similar measures have
been carried out with signal success; indeed, we may
say that the possibility is in sight of the extermination
of one of the world's greatest plagues, which has cost
millions of lives and has at intervals interrupted the
commerce of half a continent.

I mentioned yellow fever first because its history
illustrates the importance of effective organization. It
has been an added merit to Dr. Ross's great merit that,
like the fiery Peter of old, he has preached a ceaseless
crusade in favour of organized effort against malaria.

Every one knows that the control of the tropics is bound up with this disease, and it is a problem the practical solution of which will tax to the uttermost the organizing capacity of the Anglo-Saxon. A singularly happy combination of circumstances has demonstrated on a large scale the efficiency of modern sanitary measures in one of the world's greatest death-traps.

THE STORY OF THE PANAMA CANAL.

In a general way the story of the Panama Canal is well known, but as I do not think an up-to-date version has ever been presented to the British public I propose to tell you in a few words a marvellous history of sanitary organization. The narrow Isthmus, separating the two great oceans and joining the two great continents, has borne for four centuries an evil repute as the white man's grave. Silent upon the peak of Darien stout Cortez with eagle eye gazed at the Pacific. As early as 1520 Saavedra proposed to cut a canal through the Isthmus. There the first city was founded in the new world which still bears the name Panama. Spaniards, English, and French fought along its coasts; to it the founder of the Bank of England took his ill-fated colony; Raleigh, Drake, Morgan the buccaneer, and scores of adventurers seeking gold, found in fever an enemy stronger than the Spaniard. For years the plague-stricken Isthmus was abandoned to the negroes and the half-breeds, until in 1849, stimulated by the gold fever of California, a railway was begun by the American engineers, Totten and Trautwine, and completed in 1855, a railway every tie of which cost the life of a man.

The dream of navigators and practical engineers was taken in hand by Ferdinand de Lesseps in January, 1881. For twenty-three weary years the French company struggled against financial difficulties at home and insuperable sanitary obstacles on the Isthmus. Little did

the nineteen Frenchmen who reached Panama in January, 1881, think that the secret of success lay 7,000 miles away with a young countryman of theirs, an army surgeon in Algiers called Laveran, unknown, solitary, unrecognized, who was quietly studying malaria in a military hospital in Algiers, doing work which alone could make possible the completion of their plans.

From the outset the chief obstacle proved to be the fevers. It is a sad record. Within seven months from beginning work the mortality had risen to the rate of 119 per 1,000 for the month. As the number of employees rose, so in a certain measure did the death-rate, which reached the maximum in the month of September, 1885, in the appalling figures of 176·97 deaths per 1,000. This would appear to be about the maximum death-rate of the British Army in the West Indies in the nineteenth century. The average in Jamaica for the twenty years ending 1836 was 101 per 1,000. At several stations it reached as high as 178 per 1,000. But this is nothing to some of the seventeenth-century records, which show that a regiment of 800 lost two-thirds of its strength in a fortnight.[1] The maximum number of employees was in 1887 and 1888 from 15,000 to nearly 18,000. The maximum mortality in these two years was 72·48 per 1,000. Then for a period of eight or ten years the work lagged, and the total number of men employed annually was for many years under 1,000 ; a large proportion coloured and the whites chiefly immunes. Only once in these years did the mortality rise above 133 per 1,000, which was in the month of January, 1903, and this seems largely to have been due to an epidemic of small-pox. Yellow fever, malaria, and dysentery were responsible for the large proportion of deaths. From 1890 yellow fever practically disappeared, with the exception of a small epidemic in 1897. During the French occupation 6,283 of the employees died in hospital ; thousands died

[1] Maunsell, Jamaica branch of the British Medical Association, *Proceedings*, Year 3, No. 12.

along the course of the canal; many thousands were damaged permanently in health, or died after their return to their homes. In Philadelphia in 1888 I had a telegram from a contractor asking what accommodation could be given in the hospitals for two shiploads of workmen returning from the canal, the great majority of them ill with malaria and dysentery. The mortality had been very high as yellow fever had been raging. One of the ships came to Philadelphia, and I do not remember ever to have seen a more appalling sight when these victims of chronic dysentery and malaria were landed; many were anaemic, others worn to the bone, and not a man of them had escaped serious damage. Not 50 per cent. of those who had gone out returned, and a very large proportion of those who landed in New York and Philadelphia died subsequently.

When in 1904 the United States undertook to complete the canal every one felt that the success or failure was largely a matter of sanitary control. The necessary knowledge existed, but under the circumstances could it be made effective? Many were doubtful. Fortunately, there was at the time in the United States army a man who had already served an apprenticeship in Cuba, and to whom more than to any one else was due the disappearance of yellow fever from that island. I know that to a man the profession in the United States felt that could Dr. Gorgas be given full control of the sanitary affairs of the Panama zone the health problem, which meant the canal problem, would be solved. There was at first a serious difficulty relating to the necessary administrative control by a sanitary officer. In an interview which Dr. Welch and I had with President Roosevelt he keenly felt this difficulty and promised to do his best to have it rectified. It is an open secret that at first, as was perhaps only natural, matters did not go very smoothly, and it took a year or more to get properly organized. Yellow fever recurred on the Isthmus in 1904 and in the early part of 1905. It was

really a colossal task in itself to undertake the cleaning of the city of Panama, which had been for centuries a pest-house, and the mortality of which, even after the American occupation, reached one month as high as 71 per 1,000 living. There have been a great many brilliant illustrations of the practical application of science in preserving the health of a community and in saving life, but it is safe to say, considering the circumstances, the past history, and the extraordinary difficulties to be overcome, the work accomplished by the Isthmian Canal Commission is unique. 1905 largely dealt with organization, yellow fever was got rid of, and at the end of the year the total mortality among the whites had fallen to 8 per 1,000, but among the blacks it was still high, 44. For three years with a progressively increasing staff which had risen to above 40,000, of whom more than 12,000 were white, the death-rate progressively fell.

Of the six important tropical diseases, plague, which reached the Isthmus one year, was quickly held in check. Yellow fever, the most dreaded of them all, has not been present for three years. Beri-beri, which in 1906 caused 68 deaths, in 1908 caused only 38. The hook-worm disease, ankylostomiasis, has steadily decreased. From the very outset malaria has been taken as the measure of sanitary efficiency. Throughout the French occupation it was the chief enemy to be considered, not only because of its fatality, but on account of the prolonged incapacity following infection. In 1906 out of every 1,000 employees there were admitted to the hospital from malaria 821; in 1907, 424; and in 1908, 282. The mortality from the disease has fallen from 233 in 1906 to 154 in 1907, and 73 in 1908; that is to say, with a force more than a third larger in 1908 there were only a third the number of deaths that occurred in 1906. Dysentery, next to malaria the most serious of the tropical diseases in the zone, caused 69 deaths in 1906; 48 in 1907; and in 1908 with nearly 44,000 only 16 deaths. But it is when the general figures are taken

that we see the extraordinary reduction that has taken place. Out of every 1,000 engaged in 1908 only a third of the number died that died in 1906, and half the number that died in 1907.

The death-rate among white males has fallen to 3·84 per 1,000. The rate among the 2,674 American women and children connected with the Commission was only 9·72 per 1,000. But by far the most gratifying reduction is among the blacks, the rate of which had fallen to the surprisingly low figure in 1908 of 12·76 per 1,000; in 1906 it was 47 per 1,000. A remarkable result is that in 1908 the combined tropical diseases—malaria, dysentery, and beri-beri—killed fewer than the two great killing diseases of the temperate zone, pneumonia and tuberculosis—127 in one group and 137 in the other. The whole story is expressed in two words, *effective organization*, and the special value of this experiment in sanitation is that it has been made, and made successfully, in one of the great plague spots of the world.

In the great centres of trade in South America, similar measures have been carried out with signal success. Dr. Cruz has recently told the sanitary story of the city of Rio de Janeiro. Annually, since imported in 1850, yellow fever has been endemic and the cause of a fearful mortality, ranging as high sometimes as nearly 5,000. Last year there were only four deaths from the disease, this year the city is practically free. The measures which have led to this extraordinary result have been based directly upon the experimental work of the American Havana Commission, and they are practically those which were carried out by Dr. Gorgas in Cuba.

In Italy, in India, in many parts of Africa, and in the United States the anti-malarial campaigns are being pushed with the same vigour and success, but time will not permit me to dwell upon any of these, or upon the brilliant success which has followed the work of Bruce and his colleagues in clearing Malta of Malta fever, but

I must stop to refer briefly to certain dark shadows in the picture of tropical medicine. Within ten years the investigations in Africa have shown the wide prevalence of formidable diseases of animal and man, unknown or previously but imperfectly known. The knowledge of the group of diseases caused by the trypanosomes has added terror to tropical life. The dreaded sleeping sickness which now extends over some million of square miles is one of the serious problems of life in Africa. A vigorous plan of campaign has been instituted, and already in Uganda, as the Governor's report shows, there is a steady diminution, and no whites have been attacked since 1906. The public will find in Boyce's book the whole story of the relation of tropical diseases to flies and insects, and this most timely contribution should help to call attention to the medical problems of the tropics and the supreme interest to the nation of these new maladies. I wish I had time to speak of the organized campaign in various parts of the world against the ravages of the ankylostoma. Here again it has been a thorough scientific study of the life history of the parasite by Looss and by Stiles that has enabled us to frame curative and preventive measures. The work of Ashford and his colleague in Porto Rico illustrates how effective these measures may be. It is gratifying to note that Mr. John D. Rockefeller has given £200,000 to organize a campaign against the disease in the Southern States. But there is a dark spot in our story.

THE RECRUDESCENCE OF PLAGUE.

Certain epidemic diseases are very much like the fabled 'Hydra', from which so soon as one head was cut off another sprang up to take its place, or, what is just as bad, grew again. Even the eternal watchfulness which safety demands is not of any avail against the workings of Nature when we do not understand her laws, and when we are face to face with certain

mysterious phenomena, the sweep of whose orbit we have not yet measured. Geologists tell us of epochs when there must have been a wholesale destruction of certain types, possibly by disease. More than once within historic days it must have seemed as if the very existence of the race was threatened, so vast and overpowering had been an epidemic invasion. No disease had so shaken the foundations of human society as the plague, which in the second century and again in the thirteenth had shown a capacity for wholesale destruction not shared by any other. In reading Abbé Gasquet's picture of the effects of the great pandemic of the thirteenth century, one gets the impression of the loosening of an irresistible cosmic force which swept like a tornado over the earth, leaving it desolate and almost uninhabited. We have traced the orbits of the planets, and the advent again of Halley's comet shows us how fully we understand the stars in their courses, but these are mechanical things, the laws of which are plain and legible in comparison with the many and as yet insoluble problems of life. One of these relates particularly to the extraordinary reappearance or re-crudescence of certain epidemic diseases. Twenty years ago when one spoke of the plague, memories were recalled of the history of Athens in the days of Pericles, of Rome in the days of Marcus Aurelius, of the great pandemics of the Middle Ages, and then of the dwindling smaller epidemics of the sixteenth, seventeenth, and eighteenth centuries. But to the profession and to the world at large the plague was a closed book. A few knew that it lingered in certain centres, but none dreamed that it would again burst like the comet into our orbit. There was a certain fitness that it should have started on a world mission of destruction at Hong-Kong, the port which boasts the largest and most world-wide tonnage. When one considers the dynamic energy of the plague, its powers of resistance, its terrible killing capacity, exceeding all known vital forces, who

can doubt that had its advent been in the middle instead of at the end of the last century, civilization might have had to face again the prospect of destruction. With slow deliberation since in 1894 it started in Hong-Kong it has reached fifty-two countries in every district of the world (J. M. Eager).

The outbreak in India, which began in 1896, has shown that under suitable conditions the disease has lost none of its old malignancy. With the exception of a slight decrease in the years 1900 and 1906, there has been a constant annual increase in the number of deaths, the total amounting now to between 6,000,000 and 7,000,000. On the whole, in other countries it has been held in check, and for so pandemic a prevalence during fifteen years the total mortality cannot be said to be excessive. The two serious features relate to the difficulty of enforcing successful measures in India, and the extraordinary tenacity it has displayed in spite of the most vigorous measures for its total suppression. It is not without significance that at Glasgow, where there were small outbreaks in 1900 and 1901, two cases occurred in 1907 which could not be traced directly to shipping. As Lucretius says, in describing the great plague in Athens, 'Appalled and doubtful mused the healing Art'; but we have made a great step in our knowledge of the means of its dissemination, and though we may well be appalled at the virulence of the disease in India, we have no cause to doubt the efficacy of the machinery which is keeping it in check all over the world. As an offset to the dark picture, India is the very country above all others in which the health of the European has progressively improved. The army statistics show an extraordinary reduction in the death-rate from typhoid fever, dysentery, and from malaria. Lord Kitchener remarked the other day that the improvement of the English troops in India in the past ten years was equivalent to adding 2,000 men to the strength of the army.

C

Plan of Campaign.

I have indicated briefly to you the pressing necessity to take up the heavy burden of securing health in the tropics. To make our knowledge effective, to make it as effective as Dr. Gorgas has done at the Isthmus of Panama, as Ross has done at Ismailia, is the problem which to-day confronts us. Enough has already been accomplished to indicate a successful plan of campaign. Two things are necessary. First, organized centres from which the work may proceed ; a model of this sort is the 'Sleeping Sickness' Bureau under the auspices of the Royal Society. The work which it has done and which is under progress shows the value of central organization. Similar central bodies have already dealt with plague and malaria, but these organizations should be placed on a permanent basis and unified in some way under a central Tropical Institute, the different departments of which would be in touch with its workers all over the world.

How fascinating to stand at the window of the Norddeutscher Lloyd's office in Charing Cross and see the chart of the position of every ship of their great fleet as it plies the seas of commerce, and one turns away with a tribute of admiration to enterprise and organization. Given two not unattainable features, an Imperial Tropical Institute and strong affiliated schools, the health side of the burden of Empire might be undertaken with a staff of highly trained workers who could be sent hither and thither, wherever there was a disease to be investigated or a pest-hole to be cleared up. A map would show one hundred or more expeditions planted in India, Africa, and America, all, like the Lloyd's ships, a testimony to organization and enterprise. And this is no vain dream. By far the most useful work in British medicine during the past twenty years has been the result of just these carefully planned expeditions, sent out, partly by the liberality of the citizens of Liverpool,

partic
by th
only
tropic
and s
neces
their
report
Societ
the m
count
has i
awake
tropic
organi
has b
seapo
diseas
study
here
proper
the tr
pride
two g
Ronal
founde
career
and pa
and M
the Ui
investi
foreigr
mentic
one re
that th
the ex
modes
years

particularly Sir Alfred Jones, and partly as commissions by the Government and by the Royal Society. Not only have they added enormously to our knowledge of tropical diseases, particularly of plague, Malta fever, and sleeping sickness, but they have demonstrated the necessity of working at these diseases in the regions of their prevalence. It is not too much to say that the reports of the Liverpool School and of the Royal Society and the Government commissions are among the most valuable contributions made of late in this country to scientific medicine. More than this, there has in consequence taken place an extraordinary awakening of the profession to the importance of tropical disease ; societies for its study have been organized in different countries, an International Society has been formed, special journals founded, at large seaports hospital wards devoted entirely to tropical diseases have been opened, and lastly schools for the study of tropical diseases have been organized. And here I come to one of the great factors in securing proper sanitation in the tropics – suitable provision for the training of workers. The country may feel a just pride in the schools which have been started in the two great seaports of the nation. In the hands of Ronald Ross and Rubert Boyce the Liverpool School, founded ten years ago by Sir Alfred Jones, has had a career of exceptional vigour. Backed by the citizens, and particularly by those princely souls Sir Alfred Jones and Mr. William Johnston, and with the co-operation of the University of Liverpool, it has drawn students and investigators from all parts of the Empire and from foreign countries. As an indication of its vitality I may mention that the school has already dispatched twenty-one research expeditions to the tropics. And I am told that the entire 'plant' of the school and the cost of the expeditions have been less than £75,000, a very modest sum considering the results. Started just ten years ago by the wise support of Mr. Joseph Cham-

berlain, who will always be gratefully remembered as the statesman who taught us to think tropically, this school has had the great advantage of the guidance and the prestige of the name of Sir Patrick Manson, the dean of all students of tropical medicine. To him more than to any one man we owe the strong position occupied by the subject to-day in Great Britain. You have been singularly fortunate in securing a staff of teachers well known for their researches in tropical medicine, such as Sandwith, Simpson, Duncan, Cantlie, and Sambon, a director of such unusual experience as Daniels, and such well-recognized authorities as Leiper and Wenyon on helminthology and parasitology. In the heart of the Empire, in its richest and largest city, to which all the world pays tribute, one naturally expects a foundation commensurate with its advantages and responsibilities. With the aid of the Government and a few liberal friends a good start has been made and the school has taken a strong position among the educational institutions of the country. In the short time of its existence, it has trained nearly 1,000 men for work in the colonies and dependencies, it has fostered original research in tropical diseases, and it has been an important centre for the diffusion of scientific knowledge. Need I dwell upon its peculiarly fortunate situation in the very midst of the commerce of the world, where sailors from every region congregate, bringing with them the diseases peculiar to their homes. The possibilities exist for the greatest of all schools of tropical medicine if London will but rise to the occasion. Liberal and encouraging at the outset, the Government has taken the usual course and has thrown upon the public the chief responsibility for its support. After reading a statement of the finances of the school furnished by the secretary, I am astonished that so much good work has been done with so meagre an endowment. Only the self-sacrificing devotion of the staff has enabled the school to achieve its marked success. I am

sorry to have to say that neither the City of London as a corporation, nor its rich guilds, nor its citizens have contributed to the cause as might have been expected. The total expenditure on the school has been less than £40,000, a sum not more than sufficient to endow one department. As we all know, the extraordinary demands upon London are met in a way that makes it the centre for all beneficent enterprises. For church missions alone millions are contributed annually. It is not too much to ask for rich endowments for the missions of science.

I have tried to indicate the position which the new crusade occupies in the work of the nation, a work co-ordinate with, and almost of the same importance as, that of maintaining order. We cannot expect much more from the Government, which throws the onus of endowment upon private hands, but it makes the struggle hard when we come into competition with the Government-supported institutions of other countries. London, which should be the centre of the Empire, not alone commercially but in every relation, cannot be said to have kept pace in science with modern demands, and it has never realized its imperial position for post-graduate study. It is not a good thing for the Empire to find that so many of our young men who come from overseas for work slip away to the Continent, where they find conditions more favourable and better organized. It is not the sort of impression which one would like to have taken away from the Imperial capital.

This great question of tropical sanitation, in which we have only made a start, is bound to loom in larger and larger importance. Of the nations, England has the heaviest responsibility, as the figures I have quoted show; but she has the advantage of the first start and of strongly ingrained national ideas on the value of health. It is not too late to seize the opportunity. The United States, Germany, France, Holland, and Japan

are in the field. Now is the time for new enterprise and a more complete organization. That the Government is friendly and begins to realize the importance of the work is evident in the appointment of an entomological commission; but this is a vast and complicated problem which needs an organized effort on the lines I have indicated. An Imperial Institute would represent the general staff of an army of sanitation, the expeditionary forces of which could concentrate at any place and could be used for investigation, education, and supervision. Each unit would represent the staff of one of Dr. Gorgas's seventeen divisions of the Panama Canal Zone and would take hold of an insanitary district and leave it pest free. Affiliated and ancillary would be the two schools which would serve as training colleges for investigators and sanitary administrators. Take, for example, this school. If I were Minister for tropical dependencies and a friend of a Chancellor of the Exchequer with a big balance, I would first establish six professorships, two of tropical medicine with a hospital of 200 beds, a good clinical laboratory, and a system of graded associates and assistants; a professor of pathology with a separate institute —and the model of the new one at Leipsic would be thought good enough; a professor of protozoology; a professor of helminthology; a professor of entomology—all of whom would have *carte blanche* for their laboratories, museums, and libraries. I would establish subsidiary schools in the tropics, in West Africa, Uganda, and India, which would serve as centres for the mission work in those countries. By no means a visionary scheme, and well within the possibility of achievement, it would not demand an endowment of more than a couple of millions. Once get the intelligent business men to take up this as a business scheme in the interests of the whole Empire, and they will not, as they never have in the past, shirk their duty, but in slow and steady streams of a few thousands now and

then, in big rushes, let us hope, of a hundred thousand now and again, the necessary amount will be made up.

Is it likely that the white man can ever thrive in the tropics except as a sort of exotic, as he is at present in the West and East Indies? As the nations of the north and south increase and multiply, doubling every century, will he find an outlet by settlement in the tropics, or will he simply use them as Rome did Egypt, as a granary? It cannot be said that so far the European has been a success as a settler in the tropics, since no white colony has ever prospered below 30 degrees of northern latitude, but has he ever had a chance? In contact with brown and black races, which have become inured to heat, tolerant of parasites, and more or less immune to the worst of the tropical diseases, he has so far never had an opportunity to show of what he might be capable when placed in really sanitary surroundings. The 8,000 whites now at the Isthmus work eight hours a day in the burning sun, and they with their wives and children thrive and enjoy a health quite as good as dwellers in any town in the United States. Heretofore man has never met nature on equal terms; now science has taught him how to be master, but the knowledge is so new and so recently made effective that we have not the data from which to make a clear judgement. How far the introduction of tropical diseases has accounted for the decadence of Greece has been discussed by W. H. S. Jones and Ronald Ross, who seem to have made out a good case, but given a white race living in the tropics for two generations, and free from malaria and parasitic anaemia, would it show the hardy vigour at present the characteristic of the Anglo-Saxon? Time alone will tell. Personally I doubt it. Man is a lazy animal, and the best thing that ever happened in his history was when Adam's wife ate the apple and they both were turned out of a tropical Eden to earn their bread by the sweat of their brows. As Sir Charles Dilke has remarked, the banana is the curse of the tropics,

and when have ever 'the blossom-fed Lotophagi' done anything for the race? The most successful attempt has been in the English West Indies, but commercial conditions have been adverse, and to-day the negro may be said to possess the islands where the white man lives it is true, but hardly thrives. No, it has been found in the past, and it will be found in the future, that the men of mettle, the men who have made the world their Odyssey, have been reared in Ithaca's 'rugged Isle of hardy youths, a nurse of name'. It is good for man to have the 'rebuff that turns earth's smoothness rough', and this is not what he gets amid the fascination and fertility of the tropics, which, as Homer says, breeds—

> A race
> Of proud-lived loiterers that never sow
> Nor put a plant in earth, nor use a plow,
> But trust in God for all things.

When Isaiah was discussing the burden of Babylon, the burden of Tyre, and the burden of Egypt, I wonder what he would have said could his prophetic eye have glanced at the map on which is depicted the burden of the British Empire. Surely no nation in history has ever had such a load of responsibility. But fit as it has been in the past it will ever be fit so long as *salus populi* remains *suprema lex*. It only behoves us to see that we are well equipped for the second great task—the task of the future, to give to the teeming millions of our dependencies that greatest of all blessings in life, good health.