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SIXTH SERIES.

(1907-1920)

PART 2.

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TITLES OF PAPERS.

(Continued from Series VI.)

PART 2.

CCLXXXVIII. The Lumleian Lectures on Angina Pectoris. The Lancet, 1910.

CCLXXXIX. The Pupil Symptoms in Thoracis Aneurysm. The Practitioner, 1910.

CCXC. Certain Vasomotor, Sensory, and Muscular Phenomena Associated with Cervical Rib. American Jour. of Med. Sc., 1910.

CCXCI. Stokes-Adams Disease (With A. Keith M.D.)

CCXCIA. Aneurysm. Allbutt and Rolleston, System of Medicine, 1910.

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Oxford Univ.Press, 1915.

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International Clinics,1915,vol.IV.

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CCCXV. Creators,Transmuters,and Transmitters. Remarks at Bodley Shakespeare Exhibition, April 24th, 1916.
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CCCXVII. The Anti-Venereal Campaign.
Trans.Med.Soc.London, 1917,vol.XL.

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Veterinary Review,1918,vol.II,No.1.

CCCXX. The First Printed Documents Relating to Modern Surgical Anaesthesia.
Proc.Roy.Soc.Med.1918,Vol.XI.

CCCXXI. Typhoid Spine.
Canad.Med.Assoc.Jour. 1919,June.

CCCXXII. Observations on the Severe Anaemias of Pregnancy and the Post-Partum State.
Brit.Med.Jour.1919,Jan.4th.

CCCXXIII. The Old Humanities and the New Science. Presidential Address before the Classical Association.
London,1919, John Murray.

CCCXXIV. Review of "Sir Victor Horsley: A study of his Life and Work."(Stephen Paget).
Oxford Magazine, 1920, Jan.23rd.
Written Autumn 1919.

The Lumleian Lectures

ON

ANGINA PECTORIS

Delivered before the Royal College of Physicians of London

BY

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

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ANGINA PECTORIS

LECTURE I.

Delivered on March 10th.

INTRODUCTION.

MR. PRESIDENT AND FELLOWS,—Twenty-five years have passed since I stood here, a much embarrassed junior, as Goulstonian lecturer. I have always had a keen sense of gratitude to the College for according recognition to a colonial worker at the time of life when such an action counts for so much, and I recall the intense pleasure of my colleagues at Montreal that one of their number had been selected for the honour. The subject of those lectures came within the ken of the younger Fellows, whose work is, or should be, largely in the post-mortem room and laboratory. And now kindly time has moved me among the seniors, and I have to thank you, Sir, for the opportunity to deliver the course distinguished among all others in the College, since in these Lumleian lectures the incomparable Harvey laid the sure foundations of modern experimental medicine.

I make no apology for the subject I have chosen—Angina Pectoris. In a very special way it is *our* disease, having been first fully described at this College by the English Celsus, William Heberden, and in a manner so graphic and complete as to compel the admiration and envy of all subsequent writers.

Like books, diseases have their destiny. Could Heberden return for a month's busy practice his surprise would be not less at the new cohorts of disease than at the disappearance of familiar enemies. How staggered he would be at the *Nomenclature* of the College! And he would be keen to write new commentaries upon old diseases with new names. How the word appendicitis would jar his critical ear, but how rejoiced he would be to see light on that dark malady, "inflammation of the bowels." Living through a century of theory, he died at the outset of the great awakening in clinical medicine, bequeathing a precious legacy of experience greatly appreciated by several generations of students, and leaving in this College a precious memory which it is our delight to cherish.

Looking through the famous *Commentaries*, one is impressed with the value, with the rarity too, of the old-fashioned, plain, objective description of disease; and one is impressed also with the great gulf which separates the clinical medicine of to-day from that of our great-grandfathers. Page after page of the Commentaries are as arid as those of Cullen or of Boerhaave, and then we light upon an imperishable gem in the brilliant setting of a master workman, whose kinship we recognise with the great of old—with Hippocrates, with Aretæus, and Sydenham. Such a clinical gem is the account which Heberden read at the College, July 21st, 1768, "of a Disorder of the Breast," to which he gave the name "Angina Pectoris," based on the study of 20 cases. When he incorporated the description in his *Commentaries* (written in 1782) his experience had extended to 100 cases.

Historical details I have dealt with at length elsewhere, but in passing one must just mention the predecessors of Heberden, particularly Rougnon, the old Besançon professor. There is no question as to the nature of the case which he describes; you can read for yourselves, as through the kindness of Professor Roland, a distinguished successor of Rougnon at Besançon, I am enabled to show, for the first time, I believe, in this country the rare "Lettre," published in March, 1768. As Rougnon antedated Heberden a few months, so did Morgagni precede Rougnon, and in his excellent report the symptoms are even more fully described, including for the first time the brachial numbness and the aortic lesion; and we get back to classical days if Seneca's disease, which he calls *meditatio mortis*, and the "paradoxon" of Erasistratus, are regarded as angina.

For more than a century the chief contributions to the pathology of the disease have been made by members of this society, and to-day our Fellows number many of its best known students, among whom, Sir, you rank *primus inter pares*. And yet so far as I can ascertain angina pectoris has never been formally considered in one of the College courses. It is, too, a disease for a senior to discuss, since juniors see it but rarely; indeed, I had reached the Fellowship before I saw a case in hospital or private practice. And then I take it that in this course the College wishes an expression of opinion on some affection to which the lecturer has paid special attention. Circumstances have given me a somewhat unusual experience. The lectures published in 1897 were based on a study of the literature and 60 cases; since then I have seen 208 additional cases, and I propose to present very largely my own impressions of the disease.

Let me ask at the outset, What is angina pectoris? Who will give an answer to satisfy all of us? The subject is full of knotty problems, which lend themselves to speculation. I could wish for a more active scientific imagination that amid webs of fancy I might entangle and darken the maturer counsels of some of my distinguished auditors. But with neither the brains nor the inclination for such a task, in a more modest flight I shall consider it as—*A disease, characterised by paroxysmal attacks of pain, pectoral or extra-pectoral, associated with changes in the vascular walls, organic or functional.*

Primarily an affection of the arterial system—of the pump and the pipes, of the system in which are literally the issues of life and death—its protean features cannot be understood unless we remember that between the chief parts of this system, the heart and the arteries, there is no essential difference, since the arteries are only a long-drawn-out heart and the heart but a bulbous expansion of an artery. A physical unit, and worked as such, it is controlled at every moment by an outside mechanism, an elaborate system of nerves which penetrate every part, and even lose themselves in its structures.

The problem before us is the anginal paroxysm in all its grades, from the trifling sense of substernal distress to the vascular *ictus* by which a man is felled as with a club. After a few etiological details I shall discuss briefly the clinical types and certain extra-cardiac features of the disease. In the second lecture I shall consider the pathology, and in the concluding one speak of prognosis and treatment.

General Etiology.

Has angina pectoris increased in the community? Has the high-pressure life of modern days made the disease more common? There is an impression among consultants in the United States that there has been an increase of late years, a view not borne out for this country by the figures available. In 1908 there were 929 fatal cases in England and Wales—617 men and 312 women. For the 20 years, 1888 to 1907, the average number of deaths was about 700; in 1905 the number rose above 800; and in 1907 to 942; but the average number of deaths per 1,000,000 living has not materially increased, ranging from 20 to 25, but in 1907 it reached 28. In England the population of the registration districts of England and Wales is about 35,000,000. The statistics for the United States in a registration area, embracing 45,000,000 of people, show a decidedly greater prevalence of the disease. The total deaths in 1908 were just under 3000. But the average number of deaths per 1,000,000 of population have not varied much within the past ten years, but it is more than double that of England and Wales, ranging from 66 to 70 per 1,000,000 of inhabitants.

It is not a disease for which hospital figures are of much service, and yet it is interesting to compare the large institutions on the two sides of the Atlantic. At the Montreal General Hospital in 10,934 admissions for the ten years 1900 to 1909 there were 6 cases diagnosed as angina pectoris. At the Royal Victoria Hospital, Montreal, among 10,510 admissions in ten years in the medical ward there were 9 cases. At St. Bartholomew's Hospital in 1907 there were 2 cases in 2602 medical admissions; in the same year at St. Thomas's Hospital in 2261 medical admissions there was only 1 case. This gives an average of 1 case a year in the wards of the large general hospitals. The figures at the Johns Hopkins Hospital are scarcely available for comparison, since they embrace a very large number of patients admitted to the private wards, and even into the public wards many of the farmer class are admitted from the country at large.

These figures bear out a remarkable fact with which we are all familiar—that angina pectoris is an affection of the better classes, and not often seen except in private practice. During 10 years I did not see a case at the Montreal General Hospital, and only one case at the University Hospital, Philadelphia; and I have no notes of a case seen at the large Philadelphia hospital. It is only as the consultant's work increases that he begins to see the disease, and then a man in active practice may see 10, 15, or more cases in the course of a year. This was about my average, and I see from the statements of our President, and of the late George Balfour of Edinburgh, that this is about the figure reached in this country by the consultant with recognised cardio-vascular leanings. Once there was the unusual experience of eight cases in a month (May, 1899), three of which died in the same street within a short distance of each other, or, to be more accurate, one died on the steps of the cathedral, the other two in adjacent houses not far away.

Let me give as briefly as possible my personal statistics. I have notes of 268 cases in all—231 men, 37 women. If we recognise, as was my custom, mild neurotic or pseudo, and a grave organic or true form, there were of the former 225, and of the latter 43. I have not counted *les formes frustes* unless a case had subsequent severe attacks. As Heberden remarked, women are rarely affected, only 3 of his 100 cases. Of the severer form of 225 cases there were only 14 women. On the other hand, of the minor type, of 43 cases there were 23 women. It is somewhat surprising to see that in this country in the registered fatal cases of angina for the past 20 years the ratio of women to men was 1 to 1·8—5133 women to 9303 men.

The age incidence is late, the largest number of cases occurring in persons over 50. Of the 612 deaths in England and Wales, only 36 occurred between the ages of 35 and 45; while between 45 and 65 there were 291 deaths. In my list the age was much the same. There were under 30 years of age, 9; between 30 and 40, 41; between 40 and 50, 59; between 50 and 60, 81; between 60 and 70, 62; between 70 and 80, 13; above 80, 3. In women the age incidence is, on the whole, a little lower than in men.

An interesting point in my series relates to the race incidence. Of 268 cases 37 were in Jews. Nowhere in the world are members of this gifted race seen to greater advantage than in the United States, where the opportunities of a rapidly growing country give scope to their exceptional genius for business. Living an intense life, absorbed in his work, devoted to his pleasures, passionately devoted to his home, the nervous energy of the Jew is taxed to the uttermost, and his system subjected to that stress and strain which seems a basic factor of so many cases of angina pectoris. It is only fair to state that this high percentage scarcely represents a true state of affairs, since certain circumstances gave me an exceptional *clientèle* among the Hebrews.

Angina in doctors.—A point that stands out prominently in my experience is the frequency of the disease in our profession. For the same reason doubtless that Sydenham gives for the incidence of gout "more wise men than fools are afflicted," angina may almost be called "morbus medicorum." 33 of my cases were in physicians, a larger number than all the other professions put together. Curtin [1] in his study of 60 fatal cases notes that a fourth were in physicians. This large percentage in my list may in part be attributed to the circumstance of the publication of lectures on the subject in 1897. But the frequency with which doctors die from the disease has become the subject of common remark. From John Hunter onwards a long list of most distinguished men have been its victims. Not to mention the older physicians, among our contemporaries was Nothnagel, himself one of the ablest students of the disease, whose last act in life was to describe his own fatal attack. A tragic interest relates to this incident in the career of the great Vienna clinician. I do not know that the note has ever been transcribed in English; it reads as follows: "Anginal attacks with very severe pains. Pulse in the attack very variable, at one time slow, 56 to 60, quite regular, high tension, and then again rapid, 80 to 90, tolerably even and regular; then again quite unrhythmic, unequal at one time, rapid another, slow with changed tension. The first sensation of this attack dates three or four years back, at first slight, gradually becoming more pronounced. Very severe attacks with great pain have only come on within the last five or six days. Written on July 6th late in the evening, after three very severe attacks." Within a few

[1] Transactions of the American Climatological Society, vol. xxiii.

hours after this note the end came. Charcot, the founder of modern neurology, died in an attack in the arms of his friend Straus, who himself succumbed to the same disease not long after. The distinguished neurologist Joffroy died from it in Paris last winter. Our much-beloved friend and Fellow, Cullingworth, was its victim, and the list could be much extended. The most brilliant and devoted physician of his generation in the United States, the late William Pepper, died with coronary arteries like pipe-stems. The Provost, indeed the maker, of a great University, the very head and front of every important public movement in a city of a million inhabitants, a universally sought consultant, an enthusiastic teacher, a prolific author, in him was incarnate the restless American spirit, which drove him into a premature grave at the height of his career at the comparatively early age of 55.

I have looked over carefully the notes of the 33 cases to see if any factors could be said to favour. Only 7 were above 60 years of age, one a man of 80 with aortic valve disease. The only comparatively young man in the list, 35, was seen nearly 20 years ago in an attack of the greatest severity. Worry and tobacco seem to have been the cause. He has had no attack now for years. Two cases were in the fourth decade, 13 were in the fifth, and 11 in the sixth.

For the purpose of this analysis we may exclude the cases above the age of 60, after which age no man, much less a doctor, need apologise for an attack of angina pectoris. Neither alcohol nor syphilis was a factor in any case; of the 26 cases under 60, 18 had pronounced arterio-sclerosis and 5 had valvular disease. In a group of 20 men, every one of whom I knew personally, the outstanding feature was the incessant treadmill of practice; and yet if hard work—that "badge of all our tribe"—was alone responsible would there not be a great many more cases? Every one of these men had an added factor—worry; in not a single case under 50 years of age was this feature absent, except in Dr. G., who had aortic insufficiency, and who had had severe attacks of angina years before, probably in connexion with his aortitis. Listen to some of the comments which I jotted down of the circumstances connected with the onset of attacks: "A man of great mental and bodily energy, working early and late in a practice, involved in speculations in land"; "domestic infelicities"; "worries in the Faculty of Medicine"; "troubles with the trustees of his institution"; "law-suits"; "domestic worries"; and so through the list. At least six or seven men of the sixth decade were carrying loads light enough for the fifth but too much for a machine with an ever-lessening reserve.

It is a significant fact that in Ogle's well-known study [2]

[2] Transactions of the Royal Medical and Chirurgical Society, vol. lxix.

"Statistics of Mortality in the Medical Profession," among 3865 deaths 444 were undefined diseases of the heart and circulatory system, though only 34 deaths were specified as due to angina pectoris. The same dominance of cardio-vascular disease is indicated in the Registrar-General's Report.[3]

CLINICAL TYPES.

It is interesting to look over a long series of some one affection with a view to classification. Angina pectoris offers notorious difficulties, and I do not suppose there are any two of us who would agree.

As far as symptoms are concerned my cases fall into three groups: (1) Les formes frustes; (2) mild; and (3) severe.

1. *The mildest form, "les formes frustes" of the French.*—Substernal tension, uneasiness, distress, rising gradually to positive pain, a not infrequent complaint, one, indeed, from which few of us escape, is associated with three conditions. Emotion is the most common and the least serious cause. How often does it happen on getting up to speak, or when beginning to read a paper, that a man experiences a sense of tension just beneath the breast bone, a curious indescribable feeling, not of pain, yet sometimes working to a degree of uneasiness that is only relieved by firm pressure? The slight associated pallor indicates a vaso-motor disturbance which may increase, and a man may have to stop speaking; indeed, I have known instances in which fainting has occurred. In one of my physician-patients, a well-known author, the attacks of true angina began in this way; while lecturing he would experience a feeling of substernal tension and for years had nothing else and had it under no other circumstances. He could play golf and ride, and do an extraordinary amount of work without any uneasiness. Only a single action may bring it on. Dr B. could lecture and hold his clinic without experiencing any difficulty, but if he read a paper before the Medical Society, or if he gave an address in public, the substernal tension was certain to come on. In this form the condition is very transient; while sometimes a danger signal, in many cases it may be disregarded altogether. Not so the second form, in which this substernal distress is associated only with muscular effort—the slightest ascent, the extra round of golf, a sudden hurrying, as to catch a train. Much more frequently the precursor of angina, it is remarkable for how long a person may have slight attacks without aggravation. In a tranquil life the individual is perfectly comfortable. As old Dr. K—— of Philadelphia used to say to me, "I can stand anything in life but a hill or a stair." A Mr. W—— could walk a mile

[3] Decennial Supplement, Part II., 1908.

from his home to his office, but for several years he could not walk back on account of the slight up-grade. He never had an attack of angina, though he died from myocarditis and a dilated heart. In these emotional and muscular types of the "formes frustes" the condition is usually transient. But there is a third variety, the *high-pressure form*, in which day after day, for weeks or months, the individual may never be free from a sense of tension beneath the breast-bone. It is not pain; it has no accurate localisation except that it is directly substernal; there is no radiation; it is not increased by emotion or by exertion, but obtruding itself into consciousness as an unpleasant reminder it means just one thing—that the machine is being driven at too high a speed. The general manager of one of the railways of the Southern States used to call it his "hot box"—i.e., his "hot axle." It is met with in men who are burning the candle at both ends—working hard at business or in a profession and at the same time treading the "primrose path." It is not always of sufficient severity to cause the patient to consult a physician. The Sunday rest may cause its disappearance. Not always a high-pressure affair alone, it is aggravated by worries, particularly the possibility of not carrying through some big scheme or the onset of a financial crisis. With the harness off it may disappear completely. One man writes: "The second day out on the steamer from New York I am free, not the slightest sensation of my enemy." In looking up the history of these cases, in three only did severe angina follow. I have not included "les formes frustes" in my list unless there were other features, such as definite paroxysmal attacks. It is only occasionally severe enough to make a patient seek advice. It is significant that of five cases of which I have notes of the blood pressure, in all it was above 180 and in one 250.

2. *The mild form.*—Under the mild form, *angina minor*, come 43 cases of my series. I have grouped under these the neurotic, vaso-motor, and toxic forms, the varieties which we used to speak of as false or pseudo-angina, a term which I agree with Gibson and others is best given up, since, as I hope to show in the next lecture, the basic features of all forms are identical. Still, it is a very useful exoteric term, a comfort to the patient and his friends. The special features of this variety are—the greater frequency in women, the milder character of the attacks, and the hopeful outlook.

3. *Severe angina, angina major.*—This group is represented in my series by 225 cases, of which 211 were in men. The two special features here are the existence in a large proportion of all cases of organic change in the arteries and the liability to sudden death. It is not easy, nor is it wise, to class cases by symptoms alone, but all the same there is

an interest in so doing, and my list may be divided into four groups.

A. Cases in which death occurred in the first or second attack, or in connexion with a series of rapidly recurring attacks—the so-called *status anginosus*. We do not know how many instances of sudden death in the street or in bed at night are due to angina pectoris, but only three cases in my series died in the first attack. The mode of death is not always the same. In certain cases it is the most rapid we see—without warning, or after a few minutes of unpleasant substernal sensation, or possibly in some act, combining intense emotion with muscular effort, there is a rapid change, a sudden unconsciousness, a stony stare, a slight change in the facial expression, and then with two or three gasps all is over; no pulse is to be felt at the wrist; the respiration stops, but even when the patient is apparently dead a feeble heart impulse may be felt or faint heart sounds heard.

B. The patients have had a series of characteristic attacks ranging from two or three to scores during the course of a few months or a year or more, and in a severe paroxysm or in a series death occurs. The final event has not the same suddenness, nor is there the rapid loss of consciousness; the patient may indeed be moribund and quite conscious, though this is unusual. The mode of dying in these cases is very remarkable. In a number of instances I have made careful notes. Two are worth quoting:—

On Thursday, May 25th, 1899, while at work in the ward, Dr. Knox called me to see a patient in an attack of angina. I found a man, aged 41, who had been admitted the previous day complaining of pain in the heart. He had been a heavy worker, a large eater, had not had syphilis. Five years ago while rowing he had an attack of pain and shortness of breath, which lasted for a few minutes. On and off since then similar attacks have occurred, always brought on by exertion, now even by very slight effort. He had aortic insufficiency, and a very soft low tension pulse. About 9.30 A.M. his hands and feet had become cold and a little cyanosed, and he had a slight attack. It continued on and off all the morning. I saw him at five minutes past 12; he was propped up in bed moaning with pain, but was not sweating; the pulse was soft, regular, and feeble—100 to the minute, the left smaller than the right. Everywhere over the chest in front and back were medium-sized râles; the pulmonary resonance reached almost to the costal border on the right side, and the superficial cardiac flatness was completely obliterated; there was a soft apex systolic murmur, and a soft diastolic aortic heard along the sternal border. At 12.15 he had a sudden collapse, became pulseless, the features set, and he gave one or two gasping respirations, which recurred at intervals of about five minutes. No pulse could be felt in carotids or brachials. Remembering the remarkable case reported by Sloan, I performed cardio puncture, thrusting a long thin aspirator needle into the heart through the fourth right interspace. This was followed at once by one or two faint inspirations; the needle showed a cardiac impulse very plainly, beating 52 to the minute. At 12.25 the needle was moving much more slowly and more feebly—44 to the minute. A saline injection was made directly into a vein. At 12.28 the cardiac beats as shown by the needle were still regular—32 to the minute, without any tremor in the interval, such as might be given by fibrillation. At 12.37 the excursion of the needle was a little stronger. No heart sounds could be heard; no pulsation in the veins of the neck. At 12.44 I injected a tenth of a grain of strychnine directly into the wall of the left ventricle. The needle in the right fourth interspace continued to show definite movements, gradually getting feebler, and stopped at five minutes past one, 50 minutes from the onset of the collapse, and exactly 45 minutes from the last inspiratory gasp.

Nov. 4th, 1901.—I was sent for hurriedly this morning to see a stout, healthy-looking man, aged 57, whom I had known for some years, and had seen at intervals. As I entered the room at 8.15 the patient apparently was *in articulo mortis*; indeed, I thought he was dead. The eyes were fixed, the pupils dilated, the face of an ashy colour, and he was not breathing. Seeing my startled look, Dr. Atkinson, who was just preparing a hypodermic injection of ether, said: "It is all right; he will come to; he has had four such attacks in the night." There was no pulse in either radial, but listening over the heart one could hear feeble distant heart sounds. In about a minute (it seemed to me longer) the patient began to breathe; inspiration and expiration were somewhat noisy and deep, and accompanied everywhere with loud bronchial râles. He did not recover consciousness. He became more livid in the hands and face, and the pupils became contracted. The pulse could be felt, small at first, but it then became of much better volume and ranged from 56 to 68. In the course of ten minutes the breathing became less laboured; his colour improved and lost the ashy look, but he did not regain consciousness. The heart sounds could be well heard; the pulse was full and soft, 62. At 11.15 the patient died in another attack. He had not regained consciousness. He had had his first attack of angina on Nov. 2nd.

C. A chronic form, represented in my series by 10 cases, all of which were characterised by frequent recurring attacks over a period of more than 10 years. John Hunter, you remember, had had his first seizure in 1773, 20 years before his death, and he had many in the intervals. One special feature of this form is the frequency with which certain special actions are associated with the attacks. A patient may be perfectly comfortable and remain free if he leads a tranquil life with little or no muscular effort: a slight hill, the act of dressing himself, may be sufficient to bring on an attack; or in another patient an indiscretion in diet. This is a form with which the patient may feel comfortable for a great many years. I have had several friends, two of them medical men, who have managed very comfortably for more than 10 years, in spite of the liability to attacks. On the other hand, they may be among the most distressing cases we see. A Mr. D. of Wilmington lived a life of martyrdom for more than 10 years; emotion, cold, exercise, eating, would bring on the attacks, and his existence was a burden—not a week passed without an attack. He was thought to be neurotic and hysterical, though a man of 60. He had remarkable quivering of the fingers in the attacks, and on several occasions became unconscious. He threw himself about and was in intense distress during the paroxysm. I saw him in an attack and felt sure the condition was serious. The left radial pulse became very much smaller than the right. He died suddenly after nearly 11 years of suffering. Both coronary arteries were calcified.

D. A group of cases, not large, I am sorry to say, in which after attacks of great severity, recurring for months, or for as long as two years, complete recovery takes place. These are cases I shall deal with more fully in speaking of prognosis.

Extra-pectoral Forms.

Angina pectoris is an affection of the arteries. The studies of Nothnagel in 1867 on the vaso-motor phenomena of the attacks widened enormously our conception of the nature of the disease, and we have come more and more to regard the symptoms of the attack as an expression of a *vascular crisis*, to use the apt term introduced by James Collier. I shall try in the next lecture to discuss the disease from this point of view. Meanwhile here may most conveniently be considered certain extra-pectoral, or, more properly speaking, extra-cardiac features, which have a direct bearing upon our conception of its pathology. Following this wider conception it is interesting to note in the literature the use of such terms as "angina abdominis," "angina cruris," "angina brachialis." In looking over my list I find a considerable number of instances in which prominent features of the disease were extra-pectoral or there were symptoms suggestive of vascular disturbance in distant parts. It is difficult to make a classification of the symptoms, and certainly one cannot take for granted that they were always due to vascular crises. But I may roughly group the cases into those with (A) peripheral, (B) abdominal, (C) pulmonary, and (D) cerebral features.

A. *Peripheral angina*.—Heberden first recognised that the patient could die from angina pectoris without any pain in his chest. In his *Commentaries* he describes the case of a man, aged 60, who began to feel, while walking, an uneasy sensation in the left arm, never while in a carriage. After continuing for ten years it would come upon him two or three times a week at night, and he would have to sit up for an hour or two. In all other respects he was healthy and strong, and he never had a pain in the chest. Then he added: "This disorder, its seat excepted, perfectly resembled the angina pectoris, gradually increasing in the same manner, and being both excited and relieved by all the same causes. He died suddenly without a groan at the age of 75 years." In the case of Lord Clarendon's father, as noted by Blackall in his famous book on *Dropsies*, the pain was brachial, even in the fatal attack.

Four cases in my series presented in some degree this brachial peculiarity. In L. N. H., aged 58, the pain began in the middle of both forearms; when walking he would be warned at once of the onset by sharp pains appearing simultaneously about the middle of both arms; if he stopped to look at a window the pain would disappear, if he attempted to proceed it would increase in severity, and he would begin to feel faint; sometimes then the pain would extend to the chest. The first occasion on which I saw him the pain was entirely in the arms; there was no cramp, and he pointed to a position about the centre of each forearm. There was moderate sclerosis of the brachial and radial arteries. In Mr. D., aged 42, the pain always began in the left elbow where it would sometimes stay, though more frequently it extended up the arm to the heart. Dr. M. C. G., aged 69, insisted that the pain which "pulled him up short" on exertion was in the elbow, or rather at a point 2 inches above it, in the biceps muscle itself. So severe would it sometimes be that he would turn pale and sweat. He subsequently died in an attack.

In three instances the chief symptom was at first in the legs. My distinguished friend, Dr. W. W. J., for many years the leading physician of Washington, D.C., at the onset of the attacks had remarkable pains, with numbness in the left leg; there were no cramps, but the pains were sometimes intense, and he called it his "signal symptom." In a letter containing a very accurate analysis of his attacks he says that the painful sensations in the left leg seemed to initiate the outburst, though sometimes the pains remained limited to the leg. In F. L., aged 58, whom I saw in many attacks, some of maximum severity, they began with pains in the legs. I never saw a patient so drenched with sweat in the paroxysm, he was literally dripping, and could not have been more soaked had a hose been turned upon him. As he expressed it, he did not know which caused him the greater trouble, the painful cramps in the legs or the pain in the chest. He had indeed typical features of intermittent claudication, as the pain, sometimes with, sometimes without, actual cramp in the muscle, would pull him up short in the street.

It is a noteworthy circumstance that all the vaso-motor phenomena, even to fainting, may be associated with extra-pectoral pain. Colonel E., aged 66, had agonising attacks of pain without cramp in the left leg, in the first of which he turned pale and fainted. The true nature of the attacks was not recognised until he began to have substernal pain and angina pectoris, in an attack of which he died.

I witnessed a remarkable attack in which the pain was limited to the right pectoral muscle. The man, aged 55, when shown into my consulting-room had an ashen grey colour and looked faint. He said at once: "Doctor, I am in an attack." Though his pulse was 172, and he looked faint and was sweating, he preferred to walk about. I was apprehensive lest he should drop dead on the spot. He pointed to and grasped the right pectoral fold, repeating the words, "Here is all my trouble." He had had attacks of great severity for four years. The pain always began in the right pectoral muscle, and sometimes stayed there, but if very severe it went down the right arm. In the attack in which I saw him the skin was not hypersensitive, there were no tender spots anywhere, but the muscle itself was very sensitive; he winced at once when it was touched. It would remain sore sometimes for hours after the attack had passed off.

In only one of these cases were the features those of intermittent claudication, angina cruris, as Walton terms it, which has close analogies with angina pectoris, particularly its paroxysmal character, the pain, which is not necessarily associated with cramp, and the cessation when the patient comes to rest. In a syphilitic woman, aged 37, admitted on March 7th, 1900, with severe angina, in two attacks in December the left foot and leg became œdematous and painful. The arteries and veins of the limb were normal.

Pain in the *testicle*, sometimes with swelling, is mentioned by one or two writers as an occasional feature during the attack. In the case of our late colleague, Dr. C., the pain was sometimes very severe in this region, and the attack would even begin there. It is possible that the pain may be limited to the testis; at any rate, the following is a very suspicious case. A man, aged 56, while speaking at a meeting, was seized with an agonising pain in the left testis, and became pale and faint; there was no swelling, no tenderness, no radiation of the pain, but his condition must have been very serious, since the doctor did not think he would survive. He had attacks at intervals of every two or three months. Four days before I saw him he had a very severe paroxysm, in which he became faint and sweated, and for the first time had a sense of tension and distress just below the ensiform cartilage. He was extremely feeble and collapsed, and the attack lasted for 12 hours. He had slight arterio-sclerosis, with accentuation of the aortic second sound.

B. *Angina abdominis.*—That angina attacks may begin in the abdomen has long been recognised. Several writers have called attention to the similarity of the gastric crisis of locomotor ataxia to angina. In my series there have been three groups of cases with abdominal symptoms. An important form is met with in nervous and hysterical patients with the combination of throbbing, tender, and mobile abdominal aorta and recurring crises of gastric pain. The pains may radiate to the chest, or gastric and thoracic crises may alternate, as in an extraordinary case in a lad aged 17—"a bundle of nerves"!—who nearly died in the paroxysms. The extreme tenderness of the aorta in some of these cases led Potain to suggest the existence of aortitis, while the radiation of the pain, &c., has given the term *syndrome solaire* to the group of symptoms. In some 10 or 12 cases in men of middle age the anginal symptoms at first were abdominal, and the true nature was not suspected. In many cases the attack starts in the upper abdomen. As Mr. C. expressed it, "a wave starts here"—pointing to his stomach—"and passes up with a feeling of fright, and when it gets beneath the breast-bone it cuts me short as though the machinery of life had stopped." In my "Lectures" I have reported several cases of the pseudo-gastralgic type, as Huchard calls it, but in reality Leared in 1867 first called attention to these disguised cases. The difficulties in diagnosis may be very great, particularly in the form which resembles the tabetic crisis. A Mr. P., aged 58, seen on Feb. 11th, 1897, had attacks of cramp-like pains in the upper abdomen passing to the back, in which he became completely prostrated and sweated and vomited, and only morphia gave relief. The pains began just under the ensiform cartilage but never ascended. He had not had syphilis, the knee-jerks were present, the pupils were normal. He had aortic insufficiency and sclerotic arteries. There was no lead-line. He was a very healthy, robust man, only every month or few weeks he would be prostrated in an attack, in one of which, Dec. 20th, 1899, he died. In three other instances in the series gastralgia had been diagnosed, in one the malarial form, but the character of the attacks altered and left no doubt as to the nature of the trouble. And lastly, I have a group of three cases in which attacks of typical angina pectoris were complicated with abdominal pains, like gall-stone colic and jaundice. The combination may be quite accidental, but abstracts of the cases are worth recording.

Captain M——, aged 60, seen Jan. 15th, 1897, had had in 1890 attacks of angina pectoris of the most characteristic type. In 1893 he had pains in the region of the liver with jaundice; these recurred at intervals, and he was operated upon by Mr. Mayo Robson at Leeds, May, 1895, but no gall-stones were found. He consulted me for pain in the abdomen, crossing from one side of the costal arch to the other, like a band or constriction; at times it became very aggravated. Food made no difference, and there was no tenderness on pressure and no enlargement of the liver. While more or less constant the abdominal pain comes on in spells, and sometimes makes him feel faint and sick at the stomach.

Mr. A. W.——, seen April 4th, 1903, aged 59, in the first attack of angina four years ago had pains in the abdomen of great severity, and he was jaundiced after the attack. It was supposed to be gall-stones. Four months ago he had a very bad night, with attacks of pain in the chest and much discomfort in the epigastrium; on the following day he was jaundiced. The curious thing was that he could not differentiate the pain in this epigastric attack from the furious seizures of definite angina, in many of which I saw him during the six weeks that he was in hospital. He died in an attack of angina some months later.

Dr. J. C. T., aged 64. After a day or two of indigestion and irregular pains had on Oct. 27th a severe attack of pain in the chest, with extension into the arm, evidently of great severity. On the 30th the pain was more abdominal, and he was very sensitive over the region of the gall-bladder; on Nov. 1st and 2nd the pain was abdominal, and tenderness marked over the gall-bladder, and he had become jaundiced. This relieved our minds, as we were afraid from the character of the early attacks that it was angina. By Nov. 9th he was very much better, and the pains had almost disappeared, and at 6 o'clock when I saw him he seemed nearly well; but at 8 o'clock, while his son and the nurse were in the room, he gave one or two short, quick, sighing inspirations, his head dropped on his chest, and he died instantly.

C. *Respiratory features of angina.*—The pulmonary symptoms of the attack have been carefully studied by many observers. A man may die from angina without any change in the respiratory function other than abrupt cessation; indeed, the death may be at the medulla, so suddenly does respiration cease, even for nearly an hour before the heart ceases to beat. Ordinary cardiac asthma is a common symptom—the orthopnœa, the light cyanosis, and the feeble pulse of myocardial weakness. Cheyne-Stoke breathing is not infrequent, and in the status anginosus may be present for weeks. But there is another type much more characteristic and quite unlike the ordinary cardiac asthma: it is paroxysmal, occurring abruptly, often at night; it is not associated necessarily with signs of myocardial weakness; it is accompanied with very high tension; it may alternate with attacks of angina or come on in one, and sometimes bears the stamp of an acute œdema of the lungs. There are four special features.

First, the universal distension of the lungs in an acute emphysema as Goodhard described it; the inspiratory excursion is limited; expiration is prolonged; in one patient the chest even looked larger; and the increase in the volume of the lungs may be demonstrated by percussion. The condition is what von Basch has called "lungenschwellung" and "lungenstarrheit," a state which he believed to be due to distension of the capillary network, with swelling of the alveolar walls.

Secondly, the rapid onset of the physical signs, like those of an acute attack of bronchial asthma, wheezing, fine bubbling râles, and prolonged expiration. Within ten minutes the attack may be in full swing.

Thirdly, acute œdema of the lungs may follow, indicated by a great increase in the bubbling râles and the rapid expectoration of large quantities of a thin, frothy, sometimes blood-tinged, liquid. The attacks may be transient, lasting only for a few hours, and give a very special pulmonary stamp to the attack.

Fourthly, increased blood pressure, rising to 250 millimetres and over (Riva-Rocci). In one case (Dr. J. H. K.) the record was 340 millimetres during an attack, in the intervals it was 250. On three occasions he brought up large quantities of a clear fluid, with blood.

In May, 1899, I saw on several occasions with Dr. Atkinson Mr. G., aged 65, who had had his first and very characteristic attack while walking up a hill on April 27th. It was probably an attack associated with acute infarct of the ventricle, as a pericardial rub was detected the next day. On the first occasion I saw him he was propped up in bed, wheezing audibly, expiration was prolonged, and cardiac flatness was obliterated. The pulmonary resonance on the right side extended to the costal margin. He was coughing and bringing up a considerable quantity of frothy, liquid expectoration. The pulse was full, regular, 100, and of high tension; the heart sounds were muffled and obscure; he had at the time no pain, but this acute condition of emphysema had followed the attack in the morning; within a few hours it had disappeared and Dr. Atkinson thought that there was a definite reduction of the lower limits of the lungs.

The condition may be associated, as just mentioned, with extraordinarily high tension. A man, aged 43, was admitted to Ward C, Nov. 17th, 1900, complaining of shortness of breath and attacks of substernal pain. He weighed 190 pounds, was a very heavy eater, and had not had syphilis; the blood-vessels were sclerotic; he had loud aortic second sound; the blood pressure was very high. I saw him in an attack of pain on Dec. 11th; he was not cyanotic, the pulse was regular; very high tension; the heart sounds were clear, loud, and sharp; he then turned pale and sweated, and the pulse at the wrist became almost imperceptible. He began to wheeze, and in a few minutes one heard on auscultation high-pitched sibilant râles mixed with fine crepitations. These were very intense and sounded close to the ear, suggesting at first a friction rub; the percussion note over the lungs became hyper-resonant and on the right side reached almost to the sternal margin. A hypodermic of morphia relieved his pain. The hyper-resonant condition of the lungs persisted for two days; a remarkable change in his facial expression occurred, as after the attack he had for days retraction of the upper eyelids. A Mr. C., aged 62, who had very characteristic attacks of angina pectoris, had several severe but transient pulmonary attacks, in one of which he had hæmoptysis.

One of the most remarkable cases was that of a coloured woman, aged 54 years, who was in the hospital for several weeks, and who died in an attack on Jan. 28th, 1897. She would wake at night from a sound sleep with pain in the region of the heart, and in five minutes she would have urgent dyspnœa, noisy respiration, with coarse râles everywhere over the chest. A hypodermic of morphia with atropine would quiet her within an hour or two. She was under observation on and off for more than a year, and she had scores of the pulmonary attacks, sometimes with pain but very frequently without. In the severer attacks she would have strong tonic contractions of her fingers and hands. We often discussed the character of this paroxysm, as it was suggested that she might have had asthma previously. In the suddenness of the onset and the rapidity with which the attacks came on, the limited duration and prolonged expiration suggested bronchial asthma. She did not always have a cough and rarely had expectoration.

One case in the series had indications of consolidation of the lower lobe of one lung in connexion with an attack, and curiously enough, while preparing this lecture, Dr. T. McCrae, knowing my interest in the subject, sent notes of the case of a man, aged 35 years, who died from angina. The attacks yielded promptly to amyl nitrite, but in the last one there were acute pulmonary symptoms for 24 hours, oppression, cough, &c., and scattered areas of consolidation with tubular breathing and râles.

A case with extraordinary respiratory features was that of Captain H., whom I frequently saw with Dr. McCormick. A man of extraordinary vigour and health, aged 71 years, and of great intelligence, he had, as is not uncommon, studied his case most closely. For years he had had to be very careful in doing all the small actions which necessitated stooping, as in tying his shoes or in getting into his bath-tub, as he would experience such intense pressure in the chest which would render him immobile for a moment or two. Then he had a second variety, which corresponded to ordinary severe attacks of angina, terrible paroxysms of great severity. And thirdly, he had respiratory attacks, in which, waking from a sound sleep, he would gasp as if every breath would be his last, and then he would choke and begin to cough; the respiration became wheezing and the piping râles came everywhere over the whole chest just as in a severe attack of asthma. In from 10 to 15 minutes he would bring up large quantities of frothy, sometimes blood-stained, expectoration, as much as a large teacupful. He died in an attack of angina.

D. *Cerebral features of angina.*—Unconsciousness may occur during an attack. Epilepsy, believed by Trousseau to be closely related to angina, occurred in two cases, in neither in direct connexion with the paroxysm. Certain of the reported cases may have been the Stokes-Adams disease, in which the epileptiform attacks are sometimes preceded by pain about the heart. In only three cases transient cerebral symptoms occurred during attacks. T. S., aged 51 years, had had for three years occasional paroxysms. On Sept. 20th, 1901, while in a seizure, he had transient numbness of the left hand and foot and side of the face. The left leg dragged. These symptoms disappeared in the course of the day, but he complained of his eyesight and was found to have lateral hemianopia. The condition resembled closely the transient cerebral attacks so common in arterio-sclerosis.

Aphasia is a rare complication. I. B., aged 63 years, seen Jan. 14th, 1900, had had angina on and off for five years. In four attacks he had had transient aphasia without losing consciousness. In a recent attack he was speechless for an hour, and once eight hours passed before he could say a word. Dr. McKnew said that there was no trace of paralysis and that he could understand everything and write. He had widespread sclerosis of the vessels. He died in an attack.

A remarkable feature existed in the case of Mr. M., who in the attacks had an intense pain at the back of the head, inside he insisted, and he would hold his head between the hands to avoid pain on movement.

L. S., aged 31 years, was admitted on Feb. 21st, 1898, with paroxysms of severe angina, which had recurred for several years, usually following exertion. Five attacks occurred in the month before admission, one with unconsciousness. He had not had syphilis, nor was there heart disease. He had had on several occasions temporary loss of power in the left hand with numbness. In the paroxysm just before admission, which was of great intensity, the left arm and leg were paralysed for two days. The face was not involved.

I have dwelt upon these extra-cardial features with a special object, as they throw light upon the essential nature of the disease, which I propose to discuss in the next lecture.

LECTURE II.

Delivered on March 15th.

Pathology.

Had Heberden listened to my first lecture he could have remarked very justly: "Well! they have not got much ahead since my day." In descriptive symptomatology we have not, and among 100 cases of angina pectoris there is no reason why Heberden should not have met all the important anomalies and complications. He had the good sense not to say much about the cause of the disease, and the good fortune to get very close to the truth in what he did say. I do not propose to weary you in a vain repetition of the scores of explanations which have been offered since his day. The older ones are to be found in the monographs of Parry and Jurine, the more recent in the Traité of Huchard, in the writings of our President, and in those of Allbutt, Bramwell, Gibson, Morrison, MacKenzie, and others. At the outset let us frankly face certain obscurities which have not yet been cleared up. Why is it more common in the upper classes? Why do we not see it more often in hospital practice? Worry and work are the lot and portion of the poor, among whom vascular degeneration is more widespread. It is as though only a special strain of tissue reacted *anginally*, so to speak, a type evolved amid special surroundings or which existed in certain families. Or there may be a perverted internal secretion which favours spasm of the arteries, as Harvey at Cambridge has shown to be the case with pituitary extract and the coronary vessels. And a case of aortic valve disease is reported in which the use of this extract caused anginal attacks. This suggestion is supported by the fact that in myxœdema anginal attacks may be caused by thyroid extract. I saw last year a patient of Dr. Lafleur's of Montreal with this most distressing peculiarity, which was mentioned to me also by Dr. Allan Starr of New York. The disease may occur in three generations, as in the Arnolds, and a father and four children have been affected. In three instances of my series father and son were attacked; in two, brothers; and in one, a brother and sister. It is not the delicate neurotic person who is prone to angina, but the robust, the vigorous in mind and body, the keen and ambitious man, the indicator of whose engines is always at "full speed ahead." There is, indeed, a frame and facies at once suggestive of angina—the well "set" man of from 45 to 55 years of age, with military bearing, iron-grey hair, and florid complexion. More than once as such a man entered my consulting-room the suggested diagnosis of angina has flashed through my mind. Still more extraordinary and inexplicable is an imitative feature, if one may so speak of it, by which the repeated witnessing of attacks may induce one in the observer. The case of Senator Sumner attracted widespread interest on account of his distinguished public position. Two weeks after his death Dr. Hitchcock, his physician, died in an attack with coronary artery disease and acute infarct of the myocardium. Tabor Johnson, his other physician, at that time a young man, had two attacks, diagnosed by Brown-Sequard as angina, and he had seen some twenty cases of what may be called the manufactured variety. Straus died not long after his friend Charcot. A young man, aged 28, whose father, a very vigorous planter, had through the spring and summer of 1900 severe attacks and died in one Sept. 28th, consulted me the following January for angina. I had seen the father, and had been a witness to the devotion of the son during the terrible paroxysms. Within a month of the death of the father he began to have severe pain in the chest, with pallor, sweating, the pains down the left arm, which became numb and tingled. The sister said the paroxysms were identical with those of the father, and naturally the family were greatly distressed. The patient was a healthy, robust fellow, very neurotic, and almost frightened to death. A reassuring prognosis was all the treatment he required. He has had no further attacks. A woman, aged 38, after her father's death from angina, had severe pains about the heart, and attacks which she insisted were of the same character, but she, too, got quite well. A still more remarkable illustration of the imitative, emotional influence was seen in the outbreak of angina-like attacks among the sailors of the French corvette *L'Embuscade* reported by Gelineau.

There are two primary features of the disease, pain and sudden death—pain, paroxysmal, intense, peculiar, usually pectoral, and with the well-known lines of radiation—death in a higher percentage than any known disorder, and usually sudden. Often, indeed, it is, as the poet says, "Life struck sharp on death." The problems for solution are: What is the cause of the pain? Why the sudden death? The secondary features of the attack, the vaso-motor phenomena, the radiation of the pain, the cardiac, respiratory, and gastric symptoms are of subsidiary interest.

Morbid Anatomy.

Naturally, in the presence of a disease with such startling characters, men have sought an explanation in the bodies of its victims. And angina pectoris has a very definite morbid anatomy, few affections more so, since in practically all cases vascular disease exists. With Morgagni, Jenner, Fothergill, and Parry, a majority of authors have correlated the fatal symptoms with the arterial disease; others have reached the less satisfactory, if more philosophical, position of Rougnon, who, taking all the circumstances into consideration, concluded, "Monsieur Charles est mort parce qu'il est mort." Not a hospital disease, one naturally does not see many necropsies. I have notes of 17 post-mortem examinations, all in men, 8 of them in men under 40 and 4 of them with a history of syphilis, and dying at the ages of 34, 38, 37, 39. They fall in three groups—aortitis, coronary artery disease, and a negative case.

A. Aortitis.—From the publication of Morgagni's famous case writers have recognised the importance of aortic changes at its root. The special importance of this has been dwelt upon by my brother regius of Cambridge, whose many publications upon the subject, dating from his remarkable study of syphilitic arteritis [2] in 1868, have edified his colleague and students. For our purposes here there is but one aortitis—the syphilitic. Occasionally a fairly acute process occurs at the root of the aorta in the specific fevers, but this is very uncommon, except in connexion with endocarditis. Chronic atheromatous changes in the aorta of the aged are very rarely associated with angina unless the coronary arteries are involved. Syphilitic aortitis is a most distinctive lesion. I pass round the beautiful plate of Corrigan's paper, in which he brings out for the first time I think, and with great clearness, the connexion of the disease with this lesion. The frontispiece of Balfour's book on "The Senile Heart" gives an equally good representation. Upon its anatomical features I need not dwell further than to refer to its predilection for the supra-sigmoidal region, the sectional limitation, and the great frequency of its association with aneurysm.

Of the post mortem examinations of my series only one offered a good illustration of the supra-sigmoidal type; a negro, aged 38, who had had syphilis about a year before. The attacks of angina began in December, 1904; they lasted for from 15 minutes to half an hour, with very characteristic distribution of the pain; in severer paroxysms he had fallen unconscious. The attacks recurred even when he was in bed and quiet. There was diffuse cardiac impulse, the area of

[2] St. George's Hospital Reports, 1868.

flatness was increased, but there were no murmurs; the blood pressure was 188 mm. Hg. On the evening of admission he had a very sharp attack, and another at 1.30 A.M., in which the pain was chiefly epigastric; he sweated profusely and became very weak, and at 2.30 was found unconscious, and died at 4 A.M. The heart weighed 490 grammes; the free edges of the valves were a little thickened; the only important lesion was an extensive fresh-looking aortitis, involving the root of the vessel and narrowing the orifice of the left coronary. The right coronary orifice was normal; the coronary arteries themselves were not affected.

Another syphilitic patient, W. A. M., aged 38, admitted Feb. 20th, 1895, had very severe paroxysms of angina, with aortic insufficiency. The aortic segments were thickened and curled; the coronary arteries were small but healthy; there was the characteristic sclerotic aortitis not confined to the root. The smaller arteries of the body, particularly the splanchnic, were tortuous and thickened.

In a third syphilitic case, J. W., negro, aged 34, admitted May 25th, 1897, the paroxysms were most characteristic, and had recurred since March; in several attacks he had become unconscious, and following them he had transient weakness of the left arm. During the fortnight he was in hospital he had several severe attacks; the left arm was distinctly weaker than the right, particularly the grasp of the hand; the heart appeared to be normal. On June 8th he complained of a great deal of coldness of the hands and feet; at 6.10 in the evening he threw up his hands suddenly and died within a few minutes. Widespread aortitis of the sclerotic type, with here and there plaques of atheroma, were the only lesions. The coronary arteries were not involved; they looked small, the walls thin, but there was no occlusion.

B. *Coronary arteries.*—We are all united in the acceptance of the Jennerian view of the close connexion of lesions of the coronary arteries with the disease. As shown in the extensive analysis by Huchard, a very large proportion of all the cases show changes in these vessels. Of the 17 necropsies of my list, 13 illustrated all the varieties of the lesions.

(*a*) Narrowing of the orifices is a very common occurrence, particularly in the syphilitic aortitis, but not often met with without some involvement of the branches. In the case of a man who died suddenly in my wards after recurring attacks the sclerosis of the ascending part of the arch was marked and the orifices of the coronary arteries were extensively contracted; as the post-mortem report states, "they admitted only a bristle." The arteries beyond were nearly normal, showing only slight sclerotic change.

(*b*) Blocking of a branch with a fresh thrombus is very common in cases of sudden death in angina. In my post-mortem experience this has been more frequent in the medico-legal cases of sudden death without symptoms of angina. One of the main stems or a small branch may be plugged with the formation of fresh infarct. In patients who live some time the infarct may soften and pericarditis may be excited. A specimen in McGill College, from a man who died suddenly the day after an attack, shows the left coronary artery blocked by the thrombus and perforation of the softened anterior wall of the ventricle.

(*c*) Obliterative endarteritis, if we may judge from the reports of fatal cases collected by Huchard and others, is *the* lesion of the disease; it was present in nine cases of my series. The most remarkable peculiarity is the variation in the extent of involvement. The angina may be associated with obliteration of a comparatively small branch, or with a most widespread involvement of all the vessels. In the younger subjects the process is a gradual endarteritis with narrowing, and even complete occlusion of the vessel. In older subjects, the arteries may be converted, as in John Hunter and in William Pepper, into "open bony tubes." In one instance of my series the vessels were calcified to their smallest branches. Four cases showed disease of the coronary arteries alone; five in connexion with aortitis. In looking over these notes one is astonished at the comparatively small extent of coronary tubing which is sufficient to carry on the myocardial circulation. Mr. G., aged 39 years, an extraordinarily vigorous muscular man, after a day full of effort and strain, had read an important paper at a college society and died the following night in an attack. Not more than a third of his coronary vessels were in use. It has long been known that advanced coronary artery disease may be present without much disturbance of the function of the heart. There is not a clinician among us who could not furnish from his notes a dozen cases of this kind. A man may get on very comfortably with only the main branch of one coronary, practically a fourth of the whole system. A heart once in my possession showed almost complete obliteration of the left coronary, only a pin-point channel could be traced for a short distance. Of the right branch, the main division passing between the auricle and the ventricle was completely obliterated, so that the only one of full size passed in the posterior interventricular groove. The heart came from a large, very muscular imbecile, aged 36, an inmate of the Institution for the Feeble-Minded, at Elwin. I knew him well; a good-natured, helpful fellow, constantly employed in carrying about, and attending to, the more helpless children. He died suddenly one day in a fit. The coronaries are not endarteries in the sense of Cohnheim, and disease of their branches is not necessarily associated with angina.

(*d*) And in a few fatal cases no lesions whatever are found;

we must accept the fact that angina pectoris may kill without signs of obvious disease in heart or blood-vessels. Such an instance has been reported by Dr. Bullard and myself.[3] The case was regarded by all who saw it as one of so-called functional angina. The patient, aged 26, was very strong and robust, devoted to athletics, and a heavy smoker. He had served in the United States Army, but was discharged in the spring of 1896 for attacks of angina. The chief feature was pain in the heart, and "awful cramps," as he described them, in his arms. The attacks were so severe that at times he became unconscious, and after one he was thought to be dead, and was about to be removed to the dead-house! The attacks were brought on by cold and exertion. The pain was evidently very severe, and in the major paroxsyms respiration would cease, and his pulse would become so feeble that he seemed to be dead. Only chloroform and morphia were of of any avail in the attacks. He had an extraordinary number of attacks in 1896–7; Dr. Bullard had notes of 105. In 1898 he was better and had not nearly so many attacks, and was able to be at work. On Nov. 27th at 11.30 he had an attack of great severity; at 12.55 the doctor gave him chloroform; the attack was very prolonged, and the muscles of the chest became fixed, and remained so; he had a series of paroxysms and died at 6.40 in the morning. Except a few pleural adhesions, there was nothing special to be noted. The heart weighed 14 ounces; the muscle and the valves were normal. Just above the ring the aorta measured not quite 6 centimetres, a small vessel for a man of 5 feet 10 inches, weighing just over 13 stones. There was no disease except a flake here and there of atheroma. There was no thickening about the pericardium, and the sections showed no changes in the cardiac nerves.

Pump and Pipes.

The circulation as a whole may be compared to a vast irrigation system, with innumerable sub-districts of varied extent, under the control of local officers, but all under one central bureau, with which they are connected by telephone and an automatic signalling apparatus. The engine, pumping night and day, keeps a steady, uniform supply in the mains. The efficiency of the system depends upon the care with which the managers of the sub-stations regulate the flow to different plantations as occasion demands; the slightest disturbance in the most distant district is at once indicated by telephone to the central office, or in some instances automatically to the pump itself. Into certain vast irrigation areas with large sluice-ways all the water of the system can be diverted; and through carelessness of the men in control

[3] Medical News, vol. lxxvii., p. 974.

or through misinterpretation of a message from the head office, it sometimes happens that these sluice-ways are left wide open and the whole system is wrecked. Or strikes arise in local, outlying districts, the distributing mains are closed, and the pumping reservoir is flooded and permanently disabled. Or things go wrong in the central bureau—supplies are not forthcoming to keep up the plant, or there is litigation with neighbours, and the works are shut down, sometimes abruptly and without warning. What happens in a great irrigation plant happens also in the vascular system of the animal body, the mechanism of which, pump (heart), mains (aorta), sluices (arteries), and lakes (capillaries), is very much the same. Take two illustrations of its working. In Hill's experiment—hold a tame rabbit up with the forelimbs spread, and the gates of its splanchnic sluices will open so wide that the head office, pumping station, and whole irrigation system are wrecked in a few minutes. Try the same with the wild rabbit, whose splanchnic dam is under the control of trained officials—nothing happens. The pumping-engine itself is as sensitive as a galvanometer and has a marvellous mechanism for relieving and preventing any strain or tension on its machinery. Irritate with a probe, as in Stewart's experiment, the inner surface of the left ventricle, just enough to suggest or imitate tension, and automatically messages are sent, opening wide the most distant sluice-gates to prevent any strain on the pump itself. Or damage the main valve of the pump so that there is a leak with increased central strain, as in aortic insufficiency, and all the outlying territories open their sluice-ways to relieve the pressure. The circulation is maintained, equalised, and regulated by one working element—the muscle in the walls of its system, a peculiar, indeed a unique, type in the pump, ordinary unstriped fibre in the distributing channels. Both constituents, heart and arteries, are elaborately "wired" with nerves, which end about possibly in the muscle fibres, and there are peculiar end organs widely distributed (Paccinian bodies). Just as in the irrigation fields, pump and channels are connected by wires with the local and central offices of control, so the arteries and the heart are connected with centres, local and general, which act directly upon their muscular elements, by which the whole system is worked and regulated—an automatic set of fibres which keeps the head office constantly informed as to pressure conditions in the engine, a set which slows, and a set which hastens its action. Moreover, a complicated, subsidiary system coördinates the different parts of the heart ministered to by a tissue of special type, unlike the fibres of the heart itself or of the arteries. Not only does the muscular element maintain the circulation, but it keeps the vascular walls in a state of tension, a tonus or tautness which has an all-important influence in relieving the strain on the non-muscular elements. As Harry Campbell remarks in his recent Study of the Circulation,[4] "The greater the tonus of the muscular elements the more exclusively does the vascular strain caused by the blood pressure fall on them."

INVOLUNTARY MUSCLE PAIN.

Involuntary muscle pain has its peculiarities, and whether in artery, bowel, ureter, gall-duct, or uterus, comes in crises, storms, and outbursts. I have recently taken advantage of an unpleasant experience in my own person to observe the phenomena of these paroxysms in a ureter struggling with a calculus. Periods of complete freedom, extending from two to three, to eight or ten hours, attenuated with three types of disturbance of sensation—a dull, steady, localised pain, the situation of which could be covered with a penny. It could be imitated exactly by firm pressure with the handle of a knife, or, indeed, with a finger upon a bone, particularly upon that tender spot on the sternum just a little above the ensiform cartilage. Lasting for hours and unmoved it was fairly bearable. Now and then, when free from pain, there were remarkable flashes, an explosive sort of sensation, not actually unpleasant, and accompanied by a glow-like wave along the course of the ureter and out through the flank, as it were through the muscles. And then abruptly, or working out of the steady pain, came the paroxysm, like a twisting, tearing hurricane, with its well-known radiation, followed by the vaso-vagal features, the pallor, cold extremities, feeble pulse, sweating, nausea, vomiting, and in two attacks, a final, not altogether unpleasant period, when unconsciousness and the pain seemed wrestling for a victory reached only with the help of God's own medicine—morphia.

Any portion of the arterial system taken as a unit may present the phenomenon of involuntary muscle pain, and herein, I think, lies the key to the explanation of the anginal attack. The intermittency, the suddenness of onset, the steady, dull, enduring pain, and then the paroxysm, with its associated vaso-motor features, sometimes unconsciousness, and the radiations are paralleled in other involuntary muscle crises. Paralleled, but not equalled, and not often associated with the dangerous collapse symptoms, and rarely causing sudden death. And yet a man may die in renal or biliary colic, borne down in a vaso-motor storm, as happened in the only case of the kind I have seen.

CARDIO-VASCULAR PAIN.

What do we know about cardio-vascular involuntary muscle pain, and under what circumstances do we meet it? Like

[4] THE LANCET, Jan. 15th, 1910, p. 193.

other viscera, the heart itself is insensitive to ordinary stimuli. You remember how this so amazed Harvey when handling the apex of the heart of the young Viscount Montgomery. Even his Most excellent Majesty, who studied the case with him, "acknowledged that the heart was without the sense of touch; for the youth never knew when we touched his heart except by a sight or the sensation he had through the external integument."

In most affections of the heart pain is conspicuous by its absence, particularly in the more serious maladies, so that it has almost become an axiom that "not much is the matter when a patient complains of his heart." Pericarditis may pass through all its phases without pain. Occasionally it is present in a marked degree, and it may be a special feature in the chronic mediastino-pericarditis.

In acute endocarditis pain is rarely present, and ulceration of valves or of the wall may proceed to a most extreme degree without any sensory disturbances. Of valvular lesions mitral disease is often associated with slight pain, particularly in children with greatly enlarged heart. And sometimes in women the pain is of great severity and persistence, but it rarely has the characters of true angina. There are a number of cases on my list with mitral lesion, stenotic or regurgitant, but, curiously enough, the only instance of attacks which I could call genuine angina pectoris in the stage of cardiac insufficiency occurred in a young girl of 11. And in this point I see that my experience coincides exactly with that of Nothnagel. On the other hand, lesions of the aortic ring are often painful, and attacks of true angina are common, particularly when the root of the aorta is involved.

Arterial pain is met with under many different circumstances, and may present all the features of angina. In the first place, external pressure directly upon the wall is associated with agonising pain. Those of us who as students took our turn in digital compression of the femoral artery for popliteal aneurysm have a lively recollection of the misery suffered by the poor patient.

Secondly, pressure from within; the pain caused by an embolus may be of the most terrific character. A man admitted to the Radcliffe Infirmary under Dr. Brooks—an old examination case of aortic insufficiency, with a loud, musical, diastolic murmur—had a sudden pain in his right leg, just below the popliteal space, and for days was in such agony that he had to have repeated hypodermics of morphia. As the swelling and pain subsided signs of an aneurysm became evident, and it was noted that the loud, musical murmur had disappeared. A calcified fragment whipped off from the aortic valve had torn the wall of the artery. Not only sharp emboli but the soft ones of ulcerative endocarditis cause intense pain. As I was going up the steps of the house of a patient, the diagnosis of whose trouble had wavered between typhoid fever and ulcerative endocarditis, I heard loud screams and found a young fellow in great agony, and he pointed to a spot below Poupart's ligament which he would not allow us to touch. He had embolism of the femoral artery, with subsequent gangrene of the leg. The intense colic of mesenteric embolism, such as we see in aneurysm, and occasionally in endocarditis, is of the same character, and it is diagnostic point between thrombosis and embolism of the cerebral arteries.

Thirdly, spontaneous tear of the arterial coats is associated with atrocious pain, with symptoms, indeed, in the case of the aorta of angina pectoris, and many instances have been mistaken for it. In this remarkable drawing which I pass round, of a split, fissured, and healed rupture of the internal coats of the aorta just above the valve, the patient was thought to have angina pectoris, and in the second attack, from which he died a year or more subsequently, a fresh split of the internal coats was found, which had ruptured into the pericardium.

Fourthly, as a result of extreme dilatation, distension, and stretching. Following the application of an Esmarch bandage, the arteries of the limbs dilate and throb, and there may be pain of a very intense character. In chilblains and in erythromelalgia the pain is probably arterial, and may be greatly aggravated with each systolic distension. In the excessive dilatation of the vessels following frost-bite the more rapid the dilatation the more intense the pain. As boys we had to give practical recognition to this point; if after a snowball fight anyone was foolish enough to put his cold hands into warm water he would be sure to suffer agonies of pain. An every-day cause of arterial pain is met with in aneurysm. In 132 cases of thoracic aneurysm the histories of which were carefully revised for this symptom pain was present in 104, and in 62 the trouble began with it. A feature of special interest to which attention has been called by many writers is the occurrence of attacks of angina pectoris as the first symptom. This happened in four cases in my series, and in every one of them the anginal attacks disappeared with the increase in the size of the aneurysm. There are other mechanical causes of pain in aneurysm, but I think we all accept the fact that pain is a very constant feature in the early formation and growth of the sac. Stretching of the aorta without disease of its coats, as seen in the dynamic dilatation of aortic insufficiency and certain neurotic states, is not necessarily painful.

Fifthly, spasm of the arteries may cause severe pain. Slow, gradual contraction of the peripheral vessels due to cold is associated with a sense of numbness but not of actual pain. Scores of everyday vascular actions illustrate the same thing, and the radials may be contracted to obliteration of the pulse without any abnormal local sensations. On the other hand, there are types of arterial spasm accompanied with acute pain. Dubois, you may remember, referred the pain of hemicrania to angio-spasm. And our distinguished emeritus registrar, in his classical monograph on the disease, notes a number of instances and discusses this theory very fully. One does occasionally meet with an extraordinary degree of contraction of the temporal arteries during a paroxysm, but I have never seen an arterial distribution of the pain, nor are the vessels themselves sensitive.

The painful extremities in the various pathological states described as Raynaud's disease afford the best illustrations of disturbance of sensation as a direct result of angio-spasm. In a great many of the cases there is either obliterative endarteritis or the thrombo-angiitis of Buerger. But numerous observations show that spasm alone may account for all the symptoms. The paroxysmal character of the attacks, the intensity of the pain, the direct association with angio-spasm, suggest its vascular origin. It is an interesting point, too, that angina pectoris has been met as a complication of Raynaud's disease. In the case reported by Cleeman, a man, aged 62 years, had from his fiftieth year severe attacks of Raynaud's disease, chiefly in the hands, and usually in the winter season. Following several pronounced attacks of local asphyxia, and local syncope in the hands, he had one day a very severe paroxysm of angina pectoris; the pain lasted for two hours and was of such intensity that he was greatly prostrated. The association of migraine with angina pectoris, particularly the vasomotor type, has long been recognised, and is discussed by Dr. E. Liveing; two of my patients had been great sufferers with typical migraine.

Arterial Spasm.

Let us now consider in what conditions we actually see spasm of the arteries; and by spasm I mean a persistent contraction leading to ischæmia, with disturbance of function of the parts supplied. Raynaud's disease is, of course, the type of an angio-spastic affection. One does not actually see the arteries contract, but one may feel the gradual reduction in volume of the pulse, even to obliteration. One may feel a full, easily palpable radial contracted to a narrow cord, followed by a gradual blanching of the skin of the hands. The spasm may affect the smallest twigs, such as those distributed to the extreme tips of the fingers, or it may be the tip of one finger only. The spasm is not always painful, but it may be associated with intense pain, and I have noted in one or two instances that there is greater pain with the local syncope, and the reactionary intense hyperæmia, than with the cyanosis. Of late in so many instances of so-called Raynaud's disease arteritis has been discovered that is well to insist upon the fact that the most advanced necrosis may occur as a consequence of spasm in vessels apparently healthy. Russian Jews are subject to a very remarkable malady studied by Buerger of the Mount Sinai Hospital, New York. While similar in some features to Raynaud's disease, it differs anatomically in having widespread obliterative endarteritis, with thrombosis of the veins; indeed, the disease may begin in the veins, so that Buerger calls it "thrombo-angiitis." The same condition has been shown by Parkes Weber in several Russian Jews at the Clinical Section of the Royal Society of Medicine. Buerger writes me that in two cases of typical Raynaud's disease in which he performed amputation of the leg the arteries were found normal; evidence of exceptional value, as this observer has made a special study of the condition of the vessels in some 30 or 40 cases of thrombo-angiitis of the leg.

There is one place in which we can actually see spasm of the arteries associated with loss of function. In numbers of instances of amaurosis spasm of the papillary arteries has been noted by Priestley Smith and others. I have seen but one case myself—a man with small contracted kidneys and the usual associated vascular changes, became blind while walking from the out-patient department to the ward, and was unable to see for some hours. The retinal arteries on both sides were strongly contracted and I had the advantage of the confirmation of the observation by my colleague, Buller, the well-known ophthalmic surgeon. In Raynaud's disease a similar contraction of these vessels has been seen, originally by Raynaud himself, since then by a number of observers, and quite recently in an interesting case reported by Friedman.[5] In none of these cases has pain been mentioned as a symptom. I know of no other conditions in which we actually see angio-spasm with disturbance of the function.

And now let us leave the solid ground of observation for a few minutes. As I mentioned in my first lecture, the term "vascular crises" was introduced by James Collier in discussing the features of erythromelalgia, and it is a most useful term which admirably expresses the state of affairs in the recurring paroxysms of Raynaud's disease. It has been used with great effect by recent authors, particularly by Pal of Vienna, in whose monograph, "Gefässkrisen" (Leipsic, 1905), the whole question is exhaustively considered, more particularly in reference to its association with high tension and arteriosclerosis. The profession is at present riding on the top of a cardio-vascular wave, and it is impossible to approach questions without considering blood pressure and sclerosis. In Pal's hand the vascular crisis is a key to unlock many of the mysteries of disease in head,

[5] Friedman: American Journal of Medical Sciences, February, 1910.

chest, and abdomen. Paroxysmal high tension we know with its remarkable phenomena—cardiac dyspnœa, cardiac pain, headache, uræmic symptoms, nausea, vomiting, and convulsions. No one who has seen much of blood pressure work can doubt that in patients with arterio-sclerosis these paroxysms play a very important part; but when we come to conditions of *local* high tension associated with contraction of the arteries, I confess that we are a little bit in the spray of the wave, and yet it may be used as a working hypothesis to explain a whole group of obscure conditions. As briefly stated, Pal's contention is: "Where the tension is produced by contraction in a definite vascular area, local consequences follow and dominate the picture. These are manifest chiefly by a peculiar painful sensation and local disturbance of function. General phenomena to a greater or less extent are manifest at the height of the tension." One is a bit staggered at the very free use which many writers make of the vascular crises, but it is a seductive theory and only the name is new. We have, I think, evidence that sclerotic arteries are specially prone to spasm. In many of Buerger's cases of thrombo-angiitis the symptoms were in part due to spastic contraction; in intermittent claudication vascular spasm plays a part, and one may actually see the foot get pale, as the patient begins to complain of pain and stops walking. We have really very little positive evidence of angio-spasm of the internal vessels. In a few remarkable cases of Raynaud's disease transient cerebral symptoms have occurred—aphasia, monoplegia, epilepsy, either at the time of or alternating with peripheral attacks. So transient has been the disturbance of function that it could be scarcely any other condition than angio-spasm. This was the view I took of the two remarkable cases which I reported some years ago. Now we have in arterio-sclerosis identical transient cerebral attacks for which it is scarcely possible to offer any other explanation. The condition, familiar to me for more than 25 years, was brought to my notice by the illness of a warm personal friend, who before his forty-fifth year was the subject of the most advanced sclerosis, with high tension. He had literally scores of attacks of transient paralysis, of monoplegia, asphasia, occasionally hemiplegia for 24 hours; and once as he got off the steamer after a trip to England he became paraplegic and remained so for nearly two days. The attacks are not always associated with very high tension. The cases are by no means uncommon, and a peculiarity is the extraordinary frequency of the attacks and their transient character. The question has recently been reopened in an interesting discussion on intermittent closure of the cerebral arteries by Lauder Brunton, William Russell, and Hobhouse in the *British Medical Journal* towards the end of last year. The correspondence shows how numerous are the cases. It will be fresh in your memory how ably Dr. A. E. Russell supported the vaso-motor or arterial-spasm view of the origin of epilepsy in the Goulstonian lectures of last year.[6]

What evidence is there of the existence of angio-spasm in angina pectoris? In many cases the attack begins directly as a peripheral vaso-constrictor storm, with cold hands and cold feet, pallor of the face, and sweating. Nor is this simply in the so-called functional type, but in the severest forms an emotional disturbance may initiate a widespread contraction of the arteries. During the paroxysm it is by no means uncommon to find the radial pulse on one side very much smaller than on the other. I have notes of six cases in which this observation was made, and there may be associated pain, numbness, and tingling. In a few instances spasm of local arteries has occurred with the features of Raynaud's disease. I have already mentioned Cleeman's case in which the diseases coexisted. And Worton[7] has reported an instance in a woman, aged 54 years, in whom after attacks of angina the tip of the left middle finger always became dead white and numb. That is as far as the facts carry us, and they indicate a widespread tendency in the disease to angio-spasm. I discussed in the last lecture with a purpose the extra-pectoral phenomena of the disease, as these receive their most suitable explanation in the spasm of the arteries. In one case the attacks of pain in the leg occurred with intermittent claudication. The sensations in the leg in Dr. W. W. J.'s case, which initiated the attack, were identical with those I have seen in the arm, with definite contraction of its blood-vessels. The three cases with transient aphasia or paralysis during the paroxysms are suggestive of intermittent closure of the vessels, particularly when one considers the similar attacks in Raynaud's disease and the frequency of such a transient paralysis in arterio-sclerosis. It is quite possible that the pain in the testis, such as I have reported, and of which there are a number of cases in the literature, may be associated with artarial spasm, and a suggestive fact is that the organ may become swollen after the attack.

A consideration of the very important group of cases in which the pain is limited to the abdomen throws light on the question. Except in distribution the symptoms may be identical. Pectoral and abdominal attacks may alternate, or one may spread into the other. Death may occur with only the abdominal pain. Special consideration of this angina abdominis may be found in the "Archiv für Verdauungs-Krankheiten," Band IX. and X., by Buch. These attacks have a striking resemblance to three well-known forms of abdominal crises—the lead, the tabetic, and that met with in purpura and angio-neurotic œdema.

[6] The Lancet, April 3rd (p. 963), 10th (p. 1031), and 17th (p. 1093), 1909.
[7] The Lancet, April 16th, 1898, p. 1053.

The whole question of visceral pain has of late years undergone revision. Haller, Mackenzie, Lennander, and others conclude that practically all organs innervated by the sympathetic and vagus are insensitive to ordinary stimuli. After having gone through a painful visceral experience, one appreciates the force of Dr. Johnson's method of refuting Bishop Berkeley's theory of the non-existence of matter. "I refute it thus," he said, kicking a stone; but of course they refer to ordinary extrinsic stimuli. It was Riegel, I believe, who first suggested that the pains of lead colic were due to spasm of the branches of the intestinal arteries, with ischæmia and œdema of the wall. Pal explains the abdominal pains in tabes as a vascular high-tension crisis, with spasm of the smaller intestinal arteries, and stretching of the nerve plexuses of the proximal arterial wall. Very high peripheral blood pressure exists during the paroxysms, as in a case recently reported by L. F. Barker,[8] in which, in a woman, the pressure rose to 210 mm. Hg. It is a reasonable inference that the crises of these two states are really vascular. We have positive evidence of it in the extraordinary abdominal crises of purpura and angio-neurotic œdema. There are now nearly a score of cases which have been operated upon for "the acute abdomen." Œdema of the wall of the stomach or bowel, or œdema with hæmorrhage, has been the usual condition found; though, as in the remarkable case reported in last week's LANCET by Collinson, intussusception may be present, and it would be very apt to follow a localised œdema. I do not know that these cases specially favour a view of angio-spasm, but they, at any rate, point to a vascular origin. We may accept the view that the bowel wall is insensitive to ordinary stimuli, but the visible peristaltic colic of any chronic obstruction, with its character of smooth muscle pain, demonstrates in blunt Johnsonian fashion the existence of nerves capable of transmitting painful sensations from intrinsic stimuli, whether they exist in the arteries alone, as some believe, or are distributed among the tissue elements of the wall itself.

THE CONCLUSION OF THE MATTER.

After all this talk, what in a few words is a reasonable explanation of the pain in angina? Angina results from an alteration in the working of the muscle fibres in any part of the cardio-vascular system, whereby painful afferent stimuli are excited. Cold, emotion, toxic agents interfering with the orderly action of the peripheral mechanism, increase the tension in the pump walls or in the larger central mains, causing strain, and a type of abnormal con-

[8] Johns Hopkins Hospital Bulletin, February, 1910.

traction enough to excite in the involuntary muscles painful afferent stimuli. Mackenzie suggests that there is rapid exhaustion of the function of contractability, which is after all only the *fatigue* on which Allan Burns laid stress; but I feel that in disturbance of this Gaskellian function is to be sought the origin of the pain, whether in heart or arteries. This is practically the explanation given by the late T. K. Chambers and by Lauder Brunton and has received, Sir, your sanction. In stretching, in disturbance of the wall tension at any point, and in a pain-producing resistance to this by the muscle elements, lie the essence of the phenomena. In a man with arterio-sclerosis and high pressure, and all the more likely if he has a local lesion, a syphilitic aortitis for example, disturbance, at any point, of the tension of the wall permits the stretching of its tissues. Spasm or narrowing of a coronary artery, or even of one branch, may so modify the action of a section of the heart that it works with disturbed tension, and there are stretching and strain sufficient to arouse painful sensations. Or the heart may be in the same state as the leg muscles of a man with intermittent claudication, working smoothly when quiet, but instantly an effort is made, or a wave of emotion touches the peripheral vessels, anything which heightens the pressure and disturbs the normal contraction, brings on a crisis of pain. I do not know of any better explanation of anginal pain, and it is nice to think that in its main features it came from one of the earliest and ablest of British student of diseases of the heart—Allan Burns.

What is the explanation of the sudden death? There are three modes of dying in angina pectoris. The one which specially interests us here is the form which, as Walshe says, "is sudden, instantaneous, coeval, with a single pang." It is the quickest death we see, and is that which may have been in John Henry Newman's mind when he penned the lines describing the death of his mother—

> "One moment here, the next she trod
> The viewless mansions of her God."

No form of death so placid, so peaceful, and so much to be envied, as it probably is without a pang. The functions of life appear to stop abruptly, with a gasp or two all is over. It is extraordinary how little a man may be disturbed in this death. An old doctor whom I knew well stopped at his house to write a prescription. With pen in hand he died at the desk, where I found him, as if in sleep, with his head peacefully on his arm and pen in hand. Another friend the subject of angina, whom I had only left a few minutes previously, talking quietly to Dr. Thayer, fell over on his bed, both pulse and breathing seemed to stop simultaneously. It must be a vagal death, a sudden inhibition of the inspiratory centre in the medulla. No other explanation seems possible for such a condition as that which I described in the last lecture, in which the respiration stopped abruptly and in which a feeble heart's action continued for 45 minutes. It is exactly paralleled in chloroform death, when the inspiration stops abruptly, while the heart may continue to beat. In a third case in which I saw the death the suddenness with which the change took place was extraordinary. He was a man, aged 48, who had had very severe attacks. During my visit he was very comfortable, and he talked pleasantly and hopefully about getting back to his work. I was about to leave the room when he gave a sudden cry, clasped his hands over his heart, the eyes became fixed, and he fell over dead after giving two inspiratory gasps. No pulse could be felt at the wrists, but feeble heart sounds could be heard for three minutes.

A second mode of death is also seen in which, following a series of severe attacks, the heart grows gradually feebler, and the patient dies in progressive asthenia, often with Cheyne-Stokes respiration.

And thirdly, a certain number of patients die in the cardiac complications, and it is interesting to note how after great misery, caused by repeated attacks, when cardiac insufficiency is established, even with the dyspnœa, the patient is much happier, and dies slowly, if not so suddenly and placidly.

LECTURE III.

Delivered on March 17th.

PROGNOSIS.

How well the introduction to the "Prognostics" fits angina pectoris! A very excellent thing is it indeed, Hippocrates says, for the physician to cultivate prognosis, and nothing so much inspires confidence as the power of foreseeing and foretelling in the presence of the sick the present, the past, and the future, and he will indeed manage the cure best who has foreseen what is to happen. And almost as if he had this very disease in view he adds: "For it is impossible to make all the sick well; this indeed would have been better than to be able to foretell what is going to happen; but since men die, some even before calling the physician, from the violence of the disease, and some die immediately after calling him, having lived perhaps only one day, or a little longer, and before the physician could bring his art to counteract the disease, it therefore becomes necessary to know the nature of such affections."

The essence of prognosis lies in recognising, as Hippocrates says, "the nature of affection." And yet the thought must arise how futile to discuss the future in a disease, aptly described in so large a number of cases in Sencea's words as "meditatio mortis." I am sorry my figures do not allow me to agree with my brother regius of Cambridge, that of "all perilous maladies it [angina pectoris] is perhaps the most curable."

A consultant has great difficulty in making his experience of any disease effective, particularly in this matter of prognosis. A patient seen once or twice arouses intense interest, and then vanishes from his clinical ken, and the oft-repeated impressions of other cases leave a blurred image like that of a composite photograph. My practice was to get the notes of each angina case in good order at once, type-written, and filed away, and then at intervals my secretary could write to the medical man in charge and add a note on the patient's condition.

It takes courage to make a prognosis. Fulness of knowledge does not always bring confidence; the more one knows the more timidity may grow. The faculty which enables a man to look all round a question, to take a philosophical view of it, may be tempered with doubt, and an inability to reach a conclusion. A cocksure diagnosis and a positive prognosis may express the assurance of ignorance. In reviewing a long series, the high mortality and the great frequency of sudden death give a sombre tint to the picture, and yet I shall hope to show you plenty of bright patches. Seeing the more severe cases, the experience of the consultant is apt to be misleading, nor is always the lesson of his mistakes so thoroughly learned as by the general practitioner who lives in the same town with them. To know of the future is naturally the ardent desire of the patient and his friends, and whether we like it or not an opinion must be expressed. Sometimes out of pure kindness the tongue belies the head and always the great aphorism rings its warning—Experience is fallacious and judgment difficult. Now that we know more of the diagnosis of disease we talk less about prognosis, and to be of any value the latter must follow the former and grow out of it naturally. Often the one thing needful, the diagnosis, may embrace both prognosis and treatment; more than once this has happened in connexion with the disease under consideration. The first step is to get a clear idea of the nature of the affection—Is it an expression of organic disease of heart or arteries or is it only a painful disturbance of vascular function?

Prognosis in Relation to Etiology.

From the standpoint of prognosis the disease may be studied in various ways. Naturally the most important consideration relates to etiology. In any case three questions are suggested: Is it syphilitic mesaortitis? Are the arteries involved in a general or local sclerosis? Is it a so-called functional condition unassociated with organic lesion of the arteries?

Syphilis is of the first importance, and we have learned to recognise the frequency with which this disease attacks the root of the aorta, causing angina pectoris, aortic insufficiency, or aneurysm. In 17 cases of my series there was a history of syphilis, and it is interesting to note that a majority of the patients were under 45 years of age. In many of the cases it was not possible to connect the attacks directly with the disease. I have already spoken of the lesion—a mesaortitis—sometimes limited to the supra-sigmoidal area. A characteristic paroxysm may be the first symptom; a patient may, indeed, die in the initial attack. Nothing may be detected on physical examination; there may, perhaps, be slight superficial tenderness on pressure over the region of the aorta. Insufficiency of the valves may come on under observation. A striking result of the extended use of Wassermann's reaction has been to show the importance of syphilis in aortic valve disease. The disease is not always confined to the root of the aorta; in three of my patients it was of the diffuse sclerotic type without special limitation. The prognosis is often very favourable.

The first case of angina pectoris I saw in Baltimore was a lieutenant in the navy, aged 30 years, who had had syphilis six years before. For a year he had attacks and had had to be off duty for many months. There was no enlargement of the heart, but there were systolic murmurs at both mitral and aortic areas. With the iodide of potassium he improved sufficiently to return to duty. After having lost sight of him for many years I then heard of him again, that he had remained perfectly well. A man, aged 58 years, seen on Oct. 28th, 1904, had severe attacks with moderate arteriosclerosis. I would not have recognised the specific nature of his trouble had I not seen him in 1898 with a most interesting syphilitic nephritis and periosteal nodes. The blood pressure was high, the aortic second sound ringing; but it was a favourable circumstance that the albuminuria had disappeared. He stood an anti-syphilitic treatment very well, progressively improved, the attacks gradually lessened, and he has remained well.

It is not always easy to determine whether or not syphilis is a factor, and yet it is well to give the patient the benefit of the doubt. A man, aged 56 years, who had had for three months very characteristic anginal attacks, had lived just the sort of life likely to bring them on—a gross eater, hard worker, heavy smoker, and yet the arteries were not specially sclerotic; the heart was not enlarged and the sounds were clear. He had had syphilis 30 years before. He improved with the use of iodide of potassium, and had no attacks for more than four years. I saw him very frequently, and it was not always possible to keep him in the "straight and narrow way." He died suddenly one night, probably in an attack, before a medical man could reach him.

In persons under 40 years of age it is always well to bear in mind the possibility of syphilis. A woman, aged 37 years, whose case had been a great anxiety, had paroxysms of angina with hypertension and acute pulmonary symptoms. There was no doubt as to the severity of the disease. The question of syphilis had not been discussed until she complained of an ulceration of the throat, which Dr. Warfield at once diagnosed as syphilitic. The transformation in a month was nothing less than marvellous. I had not thought of a possibility of her recovery.

The outlook is not always so satisfactory. I followed for a couple of years, with Dr. Julius Friedenwald, the various phases of aortic root syphilis in a man, aged 36 years, who had paroxysms of great severity, often associated with collapse, and once on the street with unconsciousness. Aortic insufficiency arose under observation. When I saw him on Feb. 2nd, 1904, he was having attacks every day, and could not walk more than 100 yards without pain and oppression in the chest, "as though there was a stone under the breast-bone growing larger and larger." Marked improvement followed anti-syphilitic treatment, and he was able to go back to his business for a year or more, and was comparatively free. Then, in spite of vigorous treatment, the attacks returned, and finally in one of them he died.

The sclerotic aortitis may be the only lesion. John W., aged 24 years, a farmer, died in an angina attack, of which he had three or four during the fortnight. He was admitted to the hospital on May 25th, and died on June 8th, so that his illness did not last more than three and a half weeks. He had had syphilis nine years before. He was a healthy, muscular fellow, with a good pulse, sclerotic arteries, and an apex-beat a little out from the normal position. The attacks were severe, and in one he died suddenly. Beyond dilatation of the chambers and some chronic passive congestion there was nothing special; the valves were normal, the orifices not narrowed; characteristic sclerotic aortitis involved the entire vessel. Many of the smaller arteries were thickened.

Individual History, Character of Attacks, and Vascular Condition.

"The cardinal fact in the prognosis of real angina is its uncertainty," with which statement of Walshe we all agree, and further he confessed that he knew no method by which we can reasonably tell whether a sufferer will be cut off the next minute or survive many years. The individual history, the character of the attacks, and the vascular condition are the important elements in the prognosis—taking it for what it is worth.

Much depends on the patient himself—on the life he has led—the life he is willing to lead. The ordinary high-pressure business or professional man may find relief, or even cure, in the simple process of slowing the engines, reducing the speed from the 25 knots an hour of a *Lusitania* to the 10 knots of a "black Bilbao tramp." The difficulty is to induce a man of this type to lessen "the race, an' rack, an' strain." As William Pepper used to say: "Give me the life of a hare rather than the existence of a tortoise." Not even the terrible outbursts of pain may suffice to check men of this stamp, and yet, like Kipling's ship, *The Haliotis*, many a sensible fellow, whose engines at 50 or 55 years of age had gone to pieces on the "long trail, the out trail," has been refitted and enabled to reach port in safety. We doctors are notorious sinners in this respect, but it is so hard to lessen work when in full swing, so much harder than to give up altogether, and how few of us at 50 or 55 are able to do this!

A severe attack of angina may save a man's life. A Congressman had burnt the candle at both ends—work and whisky, wine and women, had made a wreck of him at 49; and a spree culminated in a paroxysm of angina in which he nearly died. Five years subsequently he was in excellent health, in spite of a high blood pressure and moderate sclerosis of the arteries. He dated the change of life from the attack which had frightened him into sobriety. A group of most encouraging cases show that long intervals of good health, and even complete freedom, may follow the adoption of reasonable habits. Let me refer to one or two. Last summer I met in London a distinguished American lawyer, whom I had seen ten years ago in a series of severe attacks, one of which nearly proved fatal. Following in the track of the intercostal pain he had an outbreak of herpes, the only instance I have seen of this complication. After six months' rest he resumed work at an easy pace. I saw in the papers a few weeks ago the death of General P. whom I saw in 1901, then aged 65 years. For two months he had attacks of angina, and once had a succession of paroxysms which kept him in bed for three days.

Not much stress can be laid on the character of the attack so far as the ultimate outlook is concerned. The immediate prospect is always doubtful; a mild paroxysm may be succeeded by a severe one, or death may occur with the appalling suddenness which is one of the features of the disease. The vaso-vagal features—pallor, sweating, faintness, and nausea—are serious in proportion to their prolongation and to the resistance they display to remedies. A man may come out of a state which seems absolutely desperate. One does not often see recovery and subsequent good health after such a paroxysm as in the following case, which was studied with great interest by Dr. McCrae and myself.

J. H. W., aged 60 years, admitted to a private ward on March 24th, 1904, was a vigorous, active man, the victim of many acute infections, but not syphilis. He had taken an average quantity of whisky and had worked hard. In June, 1902, when salmon-fishing, he had his first attack, then a second one in January, 1904; a third on Feb. 22nd, which was very severe, as he lost consciousness; a fourth on March 10th, also very severe; and a fifth a few days before he came into the hospital. He was a robust, healthy-looking man with a good colour, a feeble heart impulse, no superficial heart dulness, distant sounds; pulse of good volume, slightly irregular; marked sclerosis of the arteries. On April 4th at 1 P.M. he had an attack in which he looked as if he were dying; the hands and feet were cold and clammy, and at intervals he sighed deeply and threw up the chin; he was conscious; the pulse was from 42 to 48, regular but small; the heart sounds were feeble and distant. By 1.30 the ashen grey colour was replaced by slight lividity; the pulse rose to 52; the blood pressure was 120 mm. of mercury.

At 2 o'clock the pulse was 60, better, quieter, and there was less cyanosis. At 2.30 the pulse was 68; he vomited several times, and at intervals had very deep sighing respirations. He was in a very critical condition all the afternoon, but gradually improved. Two days later, at 1.30 A.M., he had a mild attack of pain in the region of the heart with intermittency of the impulse. He gradually improved and left the hospital on June 23rd. Through Dr. McCrae I have heard from him at intervals, and he has kept very well. This man had six severe cardiac attacks, in one of which he nearly died, and yet he has now remained well and active for the past six years.

In the attack itself there are two bad prognostic signs—disturbance of respiration and slow, irregular heart action. The acute orthopnœa with signs of emphysema and œdema of the lung is serious, and not met with except in grave cases. Death may occur or the attacks may replace those of angina. Slow, grasping breathing, particularly if the patient has become unconscious, is of bad omen. Cheyne-Stokes respiration, a frequent accompaniment, is a bad sign when it comes on in a man who has not had it previously, in connexion with cardio-vascular or renal disease. The state of the heart is very deceptive. A man may die shortly after an apparently satisfactory examination. Listen to this report, jotted down at the bedside of a man in an attack, and who died five hours subsequently. "Pulse 92, at first regular and of good volume, but subsequently one or two beats dropped. There is nothing to attract one's attention in the pulse itself. (The blood pressure taken in the same afternoon was 160 mm. of Hg.) The arteries are not sclerotic; the apex beat is not visible; and between a high stomach tympany and an inflated edge of the lung it is not easy to make out the heart limits; the sounds are clear at apex and base, a beat drops occasionally; there is no gallop rhythm, nothing to indicate any serious disturbance; there is no heightened sensibility of the skin over the heart." This man had had anginal attacks on and off for a year. The heart was working with not more than 30 per cent. of a coronary circulation; one main stem was entirely obliterated, the other partially.

The small, feeble, rapid pulse is not of such ill omen as one of fuller volume, with marked arrhythmia; and a slow pulse with unconsciousness is always of grave import.

The circumstances that bring on an attack are almost of as much moment in the prognosis as its character. We all recognise the three chief factors—emotion, distension of the stomach, and muscular effort. Of the three emotion is of the least significance. Many instances of slight anginal attacks are brought on by anger, worry, or sudden shock; and while in individual cases they may be serious, yet the cause is rather easier to avoid, and always has seemed to me to be less dangerous, though John Hunter neither thought so nor found it so. In many elderly persons with stiff arteries the commonest cause is stomach disturbance; a full meal, indigestion, flatulence, particularly at nights, is certain to bring on an attack. And there are individuals who are sensitive to this cause only. As one patient expressed it: "Had I not to eat I never would suffer."

The angina of effort, the paroxysm that comes on invariably after a man walks a few hundred yards or after using his arms, is a coronary artery affair, and is, as a rule, more serious than that which comes on spontaneously or as a result of emotion. This feature is the most common indication of what you, Sir, call "primary cardiac angina." The parallel between the angina of effort and intermittent claudication has often been drawn, though the cardinal difficulty has been pointed out that in the one case a man stops walking, in the other the heart continues to work. A curious feature in some cases of this type is that a man may be able to walk freely in his place of business, or in his house, and not be able to do so on the street. While constituting some of the most distressing cases, since even the act of dressing may bring on pain (*angor de toilette*), yet life may be prolonged, as in the case I mentioned of the man who had been a victim for some 11 years, and whose coronary arteries were calcified to their finest ramifications.

And the third important factor in prognosis is the patient's cardio-vascular condition. Persistent high tension with marked sclerosis of the arteries occurs in a very large group of cases, but it is important not to over-estimate their seriousness. The outlook may depend much less upon the existence of these factors than on the sort of man in control of them. An engineer of the "McAndrew" type will so handle his machine that the ship makes the voyage round the Horn to London with safety; whereas a man of a different type will wreck the engines and leave his ship a derelict. A large majority of all cases of angina pectoris have no obvious signs of disease of the heart itself. Of valvular lesions the aortic alone is important—insufficiency in the young man usually means syphilis; stenosis in the old means calcified aorta, narrowed coronary orifices, and rigid coronary arteries. Disease of the aorta itself is not often recognised. The prognosis of cases of aneurysm beginning with angina is, of course, serious, though as the sac grows the attacks may disappear.

Forms of Angina Pectoris.

It was a distinguished President of this College, John Latham, who in 1812, I believe, first recognised that "certain symptoms did not always denote angina pectoris," and spoke of angina notha; and it is a useful division which recognises a minor and major type of the disease—or what I think is still better, a form without, and a form with, organic lesion of the cardio-vascular apparatus. A diagnosis of these two forms from each other is an essential preliminary to successful prognosis. It may have surprised some of you that the number of cases of mild or functional angina in my list was so small, but I carefully excluded all trifling forms of heart pain in nervous women, and have only considered the cases which presented the features of an anginal paroxysm. Of the 43 cases there were 23 in women, not so large a percentage as given by many authors. It is a useful division to group the cases of this type into the neurotic and toxic; the former occur much more commonly in women and the latter in men. In looking over the histories of 14 cases of the severer organic angina pectoris in women I see that in only two or three cases was the diagnosis in doubt. The average age was much above the other group—56 years. In not a single instance was there absence of sclerosis, high pressure, or heart disease, and the character of the attack in almost every instance stamped the nature of the case. I have more frequently mistaken organic angina for the functional form than *vice versâ*. Two of my worst mistakes were in medical men, and for their sakes I did not regret it, since both derived great comfort from the thought that they were not the subjects of angina vera. One man would have deceived Heberden himself, as he had hysterical attacks, at any rate, nervous outbreaks with spasm of the larynx, a sort of child-crowing, and a nervous dysphagia. Let me read the note I dictated at the end of his report:—"Against recurring attacks of moderate severity in a man of 53 must be balanced a healthy heart, a very nervous temperament, and the occurrence of laryngeal and œsophageal spasm. The patient is very apprehensive and feels sure he is going to die. I think the balance is in favour of a neurotic, functional condition." I was wrong; three years subsequently he died in an attack. The other patient had not a trace of obvious organic disease, but he had driven his engines very hard. He had smoked excessively, and at the time of the attack was very emotional. He improved so much that we all congratulated ourselves upon the correctness of our treatment and diagnosis. He dropped dead while speaking at the telephone.

Many subdivisions have been made of the neurotic form, but for prognosis they roughly fall into two, the distinction between which is the predominance of the vaso-constrictor or vaso-dilator phenomena. Many cases resemble what Gowers describes as vaso-vagal storms. Beginning with coldness of the hands and feet, numbness and tingling, with small pulse, pains are complained of in the heart itself, often more to the left, and in the pectoral rather than in the sternal region; the radiation may be marked, up the neck and down the arm, and much more than in the organic form superficial sensitiveness of the skin is noted. The attacks may pass off in the course of an hour or two, but in the severe ones there may be nausea and vomiting; the respiration is quickened, and there is an indescribable sense of fear and dread. With it all the patient may move about, and there is rarely present the characteristic immobility of the severe forms.

When the vaso-dilator features predominate the patient complains of fulness in the head, of a terrible distress in the back of the neck, or a general sense of superficial tension. As one woman expressed it: "I feel just like an inflated balloon on the point of bursting." The heart's action may be forcible, and there is widespread throbbing of the arteries. The face and hands may be congested and hot, the face sometimes slightly livid. Following these symptoms, or coming on at the same time, the patient begins to have heart pain, which may become very severe; the lines of radiation may be characteristic, and with these symptoms there may be remarkable prostration. One patient whom I saw very often in this type of attack never had cold hands or cold feet, and on several occasions so distended was the superficial vascular system that bleeding was suggested, but she would never consent. There is rarely much difficulty in determining the character of these attacks, with which are often associated neurasthenia and hysteria. Occasionally one meets with paroxysms of great intensity, in which as the pain reaches a maximum the patient is thrown into a sort of tetany. In a man aged 32 years, whose troubles began with palpitation, the pain was apparently very severe, and he had stiffness and cramp of the fingers, a sort of tetany in which they could not be moved. Sometimes he would get into a state of general rigidity, all the time complaining of terrible agony in his heart. Many patients have phobiæ.

The majority of these cases do well, and it sometimes happens, particularly in a man, that a reassuring diagnosis is all the treatment required. In attacks of extraordinary severity a fatal event may happen, as in the patient of Dr. Bullard, to which I referred in the last lecture. While gradual recovery in the course of a few months or a year is the rule, some cases are very obstinate. A man of 28, who had not worked for five years owing to constant recurrences of pain in the heart and along the inner side of the left arm, was exceedingly nervous, and after months of treatment we could do nothing with him. As he wrote pathetically: "I heard you say to the students that there was nothing wrong with my heart, but if you had it for a few nights and felt the pain in it, you would think quite differently."

The worst sort of neurotic angina may follow influenza, and the rapid recurrence of the paroxysms may render a man's life unbearable. An old student and valued friend in practice near Philadelphia, who was a little nervous and had occasionally had migraine, a month after influenza began to have the most extraordinary attacks. The pallor and coldness of his extremities exceeded anything I have ever witnessed; nothing could warm them; even after his legs had been for 15 minutes in water as hot as he could bear, when taken out he complained that they felt cold. In the attacks the mental distress was agonising, and he had a sense of terrible constriction across the upper part of the chest. He threw himself about the bed, and the condition was most painful to witness. He gradually recovered.

My experience of an angina which may be termed toxic is very limited. I have not seen more than a dozen instances in which to tea, coffee, or tobacco could the attacks be attributed. We may look forward to an increasing number of cases of heart pain, and of the mild type of angina in women, with the rapid increase of cigarette smoking I saw last winter in Italy an American woman whose daily allowance of cigarettes was never under 25. She had an unusual feature—cardiac pain only after rising from a recumbent posture, and this would worry her for half an hour, so that it made dressing in the morning difficult.

It is interesting to note that very heavy smokers may die a vagus inhibition death, just such as we see in angina pectoris. Three robust, healthy persons of my acquaintance, not known to have had heart disease, but all incessant smokers of very strong cigars, died suddenly in this way, without warning—one aged 53 while walking; one a man of 36 fell off a chair at his club; the other a man of 38 died on the beach after bathing.

Treatment.

A retrospect of one's experience in treatment will be coloured by the general character of the special disease under consideration. I look back with unmixed satisfaction at my experience with typhoid fever, every aspect of which may indeed be dwelt upon with pride by every member of the profession. On the other hand, pneumonia arouses feelings, also unmixed, but of a totally opposite kind. There have been certain gains: we know our enemy better, but there is no pleasure to be had in looking back upon the record. And the other night, in going over case after case of my typewritten reports, I could not help taking stock in this way of angina pectoris. And on the whole, in spite of the frequency of the broad arrow, the feeling was one of satisfaction. Terrible as it is in certain aspects, angina has many circumstances in its favour: it kills late, it kills quickly, we are able to do much to lessen the sufferings of the victims, and we cure a certain number of cases. There are but few deaths under 40 years of age; no known disease kills so peacefully, so painlessly, and there has been real and solid progress in the advance of our knowledge of how to treat it.

As with prognosis, so with treatment: there are three great groups to be considered—syphilitic, neurotic, and arterio-sclerotic.

When a man gets a specific aortitis it means he has not had efficient treatment. There is nothing in the lesion of the arterial wall which mercury and iodide of potassium cannot control. The spirochætæ excite a diffuse granulomatous mesaortitis, with destruction of muscle and elastic fibres, and the chief difficulty arises from its insidious progress, so that irreparable damage may be done before any warning is given. The details of treatment offer nothing upon which I need dwell in this audience. The value of mercury, no matter what the stage of the syphilis, is emphasised when one actually sees the spirochætæ in large numbers in the aortic wall, as has been demonstrated by J. H. Wright, since so far as we know the metallic drug alone acts as a specific. Iodide of potassium clears up the exudate and, as is well known, will cause a node to melt away even faster than will mercury. One thing, too, it does with almost invariable success—relieves pain. Here is the secret of its great influence in aneurysm in which in the early stage it is as good as morphia in giving relief, clearing the exudate in the media and adventitia, and in this way relieving the pressure on the nerve elements.

In the neurotic cases, with a recognition of a basic disturbance in the vaso-motor apparatus, the treatment is most satisfactory, and only a few cases prove refractory. A modified Weir-Mitchell cure with hydrotherapy meets the important indication. Long experience has taught the value of the wet pack in restoring stability in vascular ataxia. Counter irritation over the heart is sometimes helpful. Of drugs the patients have usually had enough by the time they reach the consultant, and one part of the battle is to wean them from all sorts of mixtures. One patient laid out before me 22 prescriptions, and was much aggrieved not to have a twenty-third. Sometimes a reassuring diagnosis is the only treatment needed. I have always been sorry that an article on angina pectoris was in the "British Encyclopædia," since it has helped to make the very name deadly in the ears of the public; and there is an advantage in speaking to nervous patients of a false variety, which may mimic every phase of the true disease. When high tension is present, which is not infrequently the case in neurasthenia, the nitrites are helpful, and they have a very special value in the toxic forms, particularly that due to tobacco. In the cases with extreme vaso-motor ataxia I have long used the extract of ergot (ergotin) with advantage two or three grains three times a day.

I have nothing to add to the general knowledge which we all have of the treatment of the severer type of the disease, but I may give you my experience very briefly: first of the treatment of the paroxysm itself and then of the general conditions out of which it arises. It was not to be expected that our generation could have in any one disease a second therapeutic boon of equal importance to that given us by our distinguished Fellow, Lauder Brunton. Of the value of amyl nitrite in loosening arterial spasm and relieving the tension and strain upon which the pain depends we are all agreed We see its remarkable benefit, more particularly in the cases which begin with a widespread vaso-constrictor influence. Many practitioners express disappointment that it does not always relieve the pain promptly in the severe paroxysms; but it is not itself an analgesic, but only loosens the muscle grip; and it may well be that the painful effect of the disturbance of tension may persist after the spasm itself has disappeared. At any rate, experience teaches us that we often have to resort to morphia to relieve the atrocious character of the pain. Moderate doses, as a rule, suffice; but it is to be remembered that, as Burney Yeo pointed out, there are cases extraordinarily resistant; and I have reported an instance of status anginosus in which, between 10 o'clock on Saturday night and 1 P.M. on Sunday, five grains of morphia were given hypodermically and by the mouth with relief of the pain, but without giving sleep. In these terrible cases, in which attack follows attack, the nitrites are of as little use as water. In despair one may have to resort to chloroform. I well remember to have done so at first with fear and trembling, as the patient's heart was feeble, but it seemed imperative to give the poor fellow relief. I have used it many times since, and never with ill effects; in no case did sudden death occur during the administration or immediately after it. Theoretically the practice is a risky one, but neither in my hands nor in those of the late George Balfour of Edinburgh were there ill consequences.

Oxygen inhalations are useful, particularly when there is a dusky cyanosis and in the asthma-like dyspnœa. In the weak, failing, irregular heart one is tempted to give digitalis, and it may be tried, preferably by the hypodermic method. There is one type of case in which the drug should be used—when marked cardiac weakness follows an acute single attack in a comparatively healthy man. Post-mortem experience shows that the lesion in such a case is very likely to be blocking one of the coronary vessels. While anatomically the coronaries are not endarteries, functionally they are, and an infarct is, we know, very apt to follow; and if after the attack a pericardial rub is heard we may be certain this has happened. By maintaining the pressure within the myocardial vessels the extent of the anæmic necrosis may be lessened.

For the general condition the value of iodide of potassium in arterial lesions, and specially in the syphilitic variety, is universally recognised, and it may be given at intervals for months. Last winter I had an interesting talk with the distinguished Roman clinician Marchiafava, whose experience in angina pectoris is very large, and he gave me reports on cases treated with theobromia, from 20 to 30 grains in the day. A number of them were greatly benefited. I have only had the opportunity of trying it twice; in one case the use had to be interrupted on account of a complication; the other patient has been remarkably helped, particularly in the capacity of taking more exercise.

In the middle-aged man who has had an attack of angina it is usually a question of high tension with beginning or actual sclerosis of the arteries. So soon as a man has crossed that point in life when the pace is the fastest, whether we put it at 25 with Plato, at 40 with Montaigne, or to be more kind, let us put it with the sexagenarian himself, at the grand climacteric (63), the tubing begins to show signs of wear and tear, and the blood pressure gradually rises. Now there is nothing more difficult than permanently to reduce persistent high blood pressure. Drugs have really very little influence. The nitrites are helpful in temporarily lowering it; but take a man with a persistent pressure of 230 to 240 mm. of Hg, and you may get the record to 210 or 220, but to get it back to 150 or 160 and keep it there is not often within our power. Much more important results may follow change in a man's habits of life. I usually give two prescriptions—"Go slowly," "Eat less"—on which I find a great many patients put about the same value as did Naaman on the prescription of Elisha. A man who has kept a full head of steam in the boilers must learn to lower the pressure and be content with the quiet 10 knots an hour speed. It is very difficult to stoke the engines in due proportion to the work expected. No wonder there is high pressure and the machine goes to pieces when the furnaces are stoked for the *Lusitania* and the engines are asked to do the work of an ordinary ocean tramp. Like longevity, angina pectoris is largely a question of the arteries. It is an old story, this association of a long life with a small intake, a story well told by Cornaro in the sixteenth century, and in our own day by our own Cornaro, Sir Herman Weber.

If, Mr. President, I have dealt with this important subject in a somewhat sketchy manner my apology must be that before such an audience I could not discuss trite and everyday features of so familiar a disease, so I thought it would be more interesting to give you my personal experience. It adds salt to life when men react differently to the same impressions. It is always with a shade of regret to find a colleague of the same way of thinking with myself on every question, so that I hope you have not all agreed with all of my conclusions. At any rate, Sir, mindful of the wise counsel of Lucretius,[1] I have tried not to base wide opinions on small signs, and so involve myself in the snare of self-deceit.

[1] Bk. iv., 816, 817.

From "THE PRACTITIONER" *for April*, 1910.

THE PUPIL SYMPTOMS IN THORACIC ANEURYSM.

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THE PUPIL SYMPTOMS IN THORACIC ANEURYSM

A CLINICAL LECTURE. RADCLIFFE INFIRMARY.

By WILLIAM OSLER, M.D., F.R.S.,
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THE patient before you attracts attention by his healthy appearance, a fresh complexion, iron grey hair, and a general bearing which suggests at once the man who has served "with the colours," whether on land or sea. To outward appearance the most vigorous person in the ward; you will all have noticed one peculiarity of great importance, marked inequality of the pupils. The right, the larger, is moderately dilated; both react to light, and on accommodation. It seems an instance of simple anisocoria. On more careful inspection no change is noticed in the eye-lids or eye-balls. The skin on the two sides of the face has the same tint and moisture, and the ears have the same degree of pinkness. Stripped he shows a strong frame; both sides of the neck are equal; there is no special congestion of the skin; impulse is visible in both carotids; the arms look natural; both hands are large and show slight congestion. Sitting directly in front and looking closely at the chest, nothing is to be noticed, but if he is turned, or if you move so as to look obliquely, there is seen to the right of the sternum, extending from the clavicle to the third rib, a slight heaving impulse. Once your attention is called it is easily recognised, and one may even see that the sterno-clavicular articulation is slightly moved with each beat. There is no prominence, and it is just the sort of impulse that requires careful inspection, good eyes, and a good light. I would ask you to note particularly that, sitting in front of him and looking directly at the chest, the pulsation is scarcely visible. The cardiac impulse is not seen, and there is no pulsation behind on either side of the spine.

On palpation the heart beat is not to be felt; the hand placed to the right of the sternum in the first, second, and third interspaces, feels a heaving impulse, which is appreciated slightly at the sterno-clavicular joint, on the clavicle itself, and is strong enough to move the fingers. It is not felt on the manubrium or in the notch above. There is no shock of either sound to be felt. Both carotids throb, the one not more than the other. The brachials and radials appear about equal on both sides. There is no retardation of the right radial pulse. The superficial arteries feel stiffened. The blood pressure, which has been taken by Dr. Gibson, is a little higher in the left arm than the right. On putting the trachea on the stretch with the fingers hooked under the cricoid cartilage, one appreciates immediately a very characteristic tugging, synchronous with the throbbing of the arteries. Percussion gives an area of impaired resonance from the clavicle to the third rib on the right side, and to a point three inches from the sternal margin. The area of cardiac flatness is not increased.

On auscultation, the sounds are clear at the apex and over the body of the heart; towards the base the aortic second sound is loud; over the area of impulse there is a soft, only just audible systolic murmur, and the second aortic sound is well heard. There is no murmur to be heard in the sternal notch or along the carotid arteries.

These are the main points to be determined by examination. I may add that there is nothing of any moment in the abdomen. The diagnosis is evident—an aneurysm of the arch of the aorta, projecting to the right, possibly involving the beginning of the innominate. The X-ray photograph taken by Dr. Sankey shows very clearly a large aneurysm extending above as high as the clavicle and projecting farther to the right than the examination suggests.

We may now ask a few points in his history. He has been a soldier, and has had fairly good health, but, as is so often the case, Mars and Venus have been in conjunction, and he had syphilis 15 years ago, not a severe attack, and for which he says he was well treated. He has had no symptoms for many years. He has worked hard; is a moderate drinker, and until a few months ago regarded himself as quite well. He then began to have irregular pains in the chest and shoulder, which were thought to be rheumatic. He had occasional flushes and giddiness, but no special shortness of breath. He has evidently not had very active symptoms, and the aneurysm, which has come on slowly and gradually, is now one of physical signs rather than of symptoms.

Our interest to-day is in the state of the pupils in relation to aneurysm. It is an old story which you will find very fully discussed in Gairdner's *Clinical Medicine*, and in his article in the first edition of Allbutt's *System of Medicine*, and by Ogle in his classical paper in the *Royal Medical and Chirurgical Transactions*, 1858.

We have been in the habit of explaining a condition such as exists in this patient in very simple terms; the unilateral dilatation is due to irritation of the dilator fibres of the sympathetic nerve by pressure of aneurysm. If the pupil on one side is contracted the dilator influences were supposed to be completely suppressed, and allowed the unopposed action of the sphincter controlled by the third nerve. Of late years we have found that the matter is not quite so simple; there are in reality three groups of cases.

I. *Cases due to Involvement of the Sympathetic Nerve.*—The distance from the right margin of the arch of the aorta to the cord of the sympathetic is only a few centimetres, so that one can readily understand how an aneurysmal sac growing to the right may involve the nerve. In reality in the post-mortem examination one very rarely sees the sympathetic cord compressed. Clinically, in the great majority of all cases of aneurysm, pupil features are present without other indication of the involvement of the sympathetic system. Only in a few instances, in my experience not more than four or five were there other signs, such as flushing and sweating of one side of the face, ptosis, and retraction of the eye-ball. In this patient, for example, there is no indication either of irritation or of paralysis of the cord of the sympathetic, and what you see is present in a large majority of cases of aneurysm with pupil symptoms, viz., simple dilation. It is possible, however, that the nerve may be irritated, as dilatation of the pupil on one side may be the sole indication of pressure. We see it sometimes in pneumonia, in tuberculous disease of the apex of the lung, or in a chronic pleurisy, in which cases the pupil symptoms usually occur alone. The X-ray picture shows the sac to pass far over the right, quite far enough, one would say, to reach the sympathetic cord. Unilateral flushing, increased heat and sweating with mydriasis are less common than myosis with profuse sweating, and occasionlly slight ptosis. The arm may be involved, and I have seen the skin of the hand wrinkled like that of a washerwoman; but these are very rare cases.

II. *Cases due to Changes in the Vascular Condition of the Iris.*—It has long been known that with a low blood pressure the pupils are large. On the other hand, small pupils are often seen in association with the high arterial tension of chronic interstitial nephritis, arterio-sclerosis, and old age. It has been much discussed whether changes in the blood vessels of the iris are accompanied with narrowing or dilatation of the pupil, and one well-known theory explains these variations as due to a diminution or increase in the contents of the vessels. Working on this theory, Wall and Ainley Walker [1] have studied a series of cases of thoracic aneurysm, and have come to the conclusion that the most common cause of anisocoria is unequal blood pressure in the ophthalmic arteries. They explain the relationship between the arterial blood pressure and the size of the pupils by the anatomical peculiarities of the vessels of the iris. "As Waller originally showed, they are spiral or zig-zag, so that during contraction or dilatation their lumen is not changed in calibre. It is a well-known physical fact that the raising of the pressure in a fluid tends to cause elongation and straightening of the tube. From this it follows that a rise of blood pressure in the spiral blood vessels of the iris would tend to lengthen them and lead to narrowing of the pupil, and vice versâ, a fall in the blood pressure to shortening of the vessels and enlargement of the pupil." Local variations in blood pressure occur in aneurysm. The radial pulse on one side is often smaller, and inequality of the carotid and temporal pulses is by no means uncommon. In 26 cases of thoracic aneurysm in which notes were made concerning the relative size of the radial pulse and of the pupils, these authors found that in 11 the radial pulse was larger on the side on which the pupil was smaller; so it does not necessarily follow that because there is inequality

[1] *Lancet*, July 12, 1902.

of the radial pulses there must be a similar inequality in the ophthalmic arteries. They studied and compared the relative sizes of the temporal arteries, and found that in all their cases the smaller pupil corresponded to the larger temporal pulse. Experimentally, digital compression of one carotid sufficient to abolish or partially arrest the temporal pulsation was associated with gradual enlargement of the pupil on the same side, followed a little later by enlargement of the pupil on the other side. They attributed the dilatation on the same side to the immediate fall of pressure in the ocular vessels, which results from the compression of the carotid. The gradual enlargement on the other side is due to the general fall of pressure in the circle of Willis, which results from the same cause. The explanation of the anisocoria which these authors give holds good in a large proportion of all cases of aneurysm of the thoracic aorta. In this patient the situation of the sac suggests involvement of the orifice of the innominate or of the vessel itself, though palpation of the carotids and temporals cannot determine any difference between the two sides, and the blood pressure in the brachials is only a few millimetres lower in the right arm.

III. *The Babinski Syndrome—the Association of Pupil Symptoms, Aneurysm, and Tabes.*—In a third group the pupil features and the aneurysm itself are part and parcel of a syphilitic infection. The distinguished Parisian clinician, Babinski, in 1901, first called attention to certain cases of aneurysm in which the irregularity of the pupils, or the myosis, had nothing to do with compression by the sac, but were the ocular manifestation of a tabetic or a tabo-paretic state. In the cases which he reported,[1] both in women, both syphilitic, with aneurysm of the arch of the aorta, in one the right pupil was smaller than the left, neither reacted to light, but did on accommodation; the knee-jerks were absent. In the other case the left pupil was dilated, the right pupil was normal, and the light reflex was not completely abolished. The knee-jerk on the right side was lost. Since the publication of this paper Babinski's syndrom has been used to designate a condition in which aneurysm is present, in association with tabetic features—the Argyll-Robertson pupil or unequal pupils

[1] *Bul. et Mem. de la Société Médicale des Hôpitaux*, Tome 18, p. 1121, 1901.

with absent knee-jerks or lightning pains. There have been several additional papers on the question, and the condition is now well recognised.

The man before you has had syphilis. There is a large aneurysm, and the pupils are unequal, and now on testing the knee-jerks we find that they are absent. He has never had any lightning pains, his station is good, and there is nothing else to suggest locomotor ataxia. We know that a large proportion of all cases of aneurysm in young and middle-aged men are due to a syphilitic mesaortitis. Absence of knee-jerks alone may be scarcely sufficient to warrant a diagnosis of tabes, but, taken in conjunction with the history and the presence of an aneurysm, we may say at any rate that this man is in the quaternary stage of the infection, in which among the earliest symptoms of locomotor ataxia is abolition of the reflexes. The pupil symptoms here are more likely to be vascular than tabetic. The light reflex is not abolished, and while one can make out no difference between the radials, carotids, or temporals on the two sides, the position of the aneurysm in the X-ray picture indicates that the innominate artery is involved, and the blood pressure on the right arm is lower than on the left side.

A more characteristic case seen last year was a professional man living in South America, aged 46, who consulted me for unpleasant sensations in the head and chest, and irregular shooting pains in the legs. He had had syphilis 20 years before, and considered himself cured. There was pulsation of the manubrium, trachial tugging, and well-marked signs of aneurysm of the arch, though the X-ray picture showed a condition suggestive rather of diffuse dilatation. Both pupils were contracted, and did not respond to light, the knee-jerks were absent, and he had had well-marked attacks of lightning pains.

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CERTAIN VASOMOTOR, SENSORY, AND MUSCULAR PHENOMENA ASSOCIATED WITH CERVICAL RIB.

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The symptoms of cervical rib have attracted much attention of late years, and are discussed in the exhaustive papers of Keen,[1] Thorburn,[2] and Lewis Jones.[3] The nervous and muscular features are those which most often attract attention. Last year I saw two remarkable cases, one of which threw light on a very inexplicable condition of the arm, which I had described years ago.

Mrs. L., aged thirty-one years, a strong, healthy woman, was referred to me by Dr. Andrew, of Thame. There was nothing special in her family or personal history. For ten or twelve years she had noticed a pulsation above the clavicle on both sides, most marked on the left; the physicians who first saw her suggested the possibility of an aneurysm. What has troubled her of late has been that after using the left arm for a short time there is a sensation of numbness, sometimes of "pins and needles," and if she continues to work, the skin gets red, and the arm feels swollen and hot; then in a little while she is quite unable to use the arm, and even has dropped things from her hand. The condition has increased very much of late, and it is for this that I was consulted. When quiet and at rest the arm feels natural, and she can do the ordinary work with her fingers. It is only when she attempts to use the arm that numbness and tingling begin; then if she persists, redness and swelling follow, and finally she has to give up work. She has become nervous about it, and two months ago she appears to have had an attack of unusual severity, in which she fainted.

She was a very healthy looking woman with high color, no cyanosis; the radial pulses were equal; above the clavicles there was pulsation, somewhat more forcible on the left side on which it extended from the outer end of the clavicle upward and inward toward the thyroid. It was very noticeable, and one was not surprised that it had been regarded as aneurysmal. There was no pulsation to be seen in the sternal notch. After exertion, and in the erect posture, the left

[1] Amer. Jour. Med. Sci., 1907, cxxxiii, 173.
[2] Med.-Chirurg. Society's Trans., 1905.
[3] Quarterly Jour. Med., vol. i.

supraclavicular space looked fuller than the right, and a marked pulsation occupied the whole of the lower triangle. On palpation, no definite tumor could be felt, nor could one grasp a vessel between the fingers, and yet the pulsation was marked and distinctly arterial. The swelling was a little tender; on deep pressure one felt a resistance suggestive of a cervical rib. On auscultation, there was a systolic murmur over the vessel on the left side, none on the right. The left arm looked smaller than the right. There was no wasting of the muscles of the hand. Sensation was everywhere perfect. After moving the arm up and down, and working the muscles, she complained that the skin felt prickly and numb, and a flush extended over it, but no swelling followed. This, she says, only comes on if she persists in using the arm. The heart's impulse was a little forcible, but the sounds were loud and clear. Dr. Sankey took an *x*-ray picture, which showed well-marked cervical ribs on both sides, curiously enough, the larger one on the right.

The special point of interest about this case to me was the explanation it offered of two very remarkable cases, one of which I showed at the Philadelphia Neurological Society.[4] I give here a brief abstract: A man, aged forty-eight years, always very healthy and strong, a carpenter by occupation, complained of inability to use the right arm, which had been gradually coming on for some time. When at rest and quiet, it felt perfectly natural, and all the ordinary actions of life could be done without discomfort. There was no pain, no numbness or tingling, and the hand and arm looked natural; but when he worked, or used the right arm for more than a few minutes, he began to feel an unpleasant sensation and numbness and great tenderness; the color of the skin changed, and the whole arm became congested and swollen. This would occur in a very few minutes, and the veins would stand out with great prominence. There was a general dusky lividity of the skin. If the exercises were continued, the arm became visibly swollen. At rest, the circumference of the thickest part of the forearm was eleven inches, after exertion twelve and one-half inches. At rest, the radial pulse on the two sides seemed normal and equal; after exertion the right radial became very small, only just perceptible. When the arm was held up above the head, the congestion and swelling rapidly disappeared. Nothing whatever could be felt in the axilla, or in the course of the bloodvessels. I saw this patient at intervals of six months longer; he could do no heavy work, but all ordinary minor actions could be done without any swelling of the arm. The case was one that excited a good deal of interest, but no very satisfactory explanation could be offered. Unfortunately we did not at that time appreciate the importance of cervical rib, which I do not doubt was the cause of the remarkable disturbance in this case.

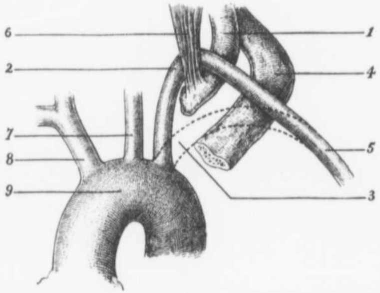
[4] Jour. Nerv. and Ment. Dis., 1888. p. 248.

The other case was a woman, aged thirty-eight years, who came to my out-patient clinic at the Johns Hopkins Hospital, complaining of redness, pain, and stiffness of the right arm on exertion. At rest, the arm looked natural, but when used for ten or fifteen minutes there was a remarkable change—the skin became flushed, the fingers slightly cyanotic, and she complained of a feeling of stiffness with numbness and tingling, and if she continued to work the hand, the forearm became swollen and so stiff that she had to stop. There was no disturbance of sensation, no atrophy of the small muscles; the pulses were equal; there was nothing to be made out in the chest, or in the course of the arteries. I suspected at first pressure of glands high in the axilla, but nothing could be determined by the most careful examination. I did not think of cervical rib. The condition had persisted at intervals for several years and was the cause of great disability, as she could not work continuously for any length of time. If she did not use the arm there was no inconvenience.

In both these cases the symptoms, though more aggravated, were identical with those complained of by Mrs. L., and I have no doubt that, could we have taken *x*-ray pictures, cervical ribs would have been found. In Keen's paper several cases are reported in which the hand and forearm became livid and swollen. But it seems probable that there is a special group in which the symptoms come on only after exertion, and they resemble closely the condition known as intermittent claudication. In many cases the subclavian artery has been compressed in the angle between the rib and the scalenus anticus. When at rest, and with very slight muscular effort, enough blood reaches the limb, but the demand for more blood which follows exertion is not met, and there is stiffness and numbness with vascular changes. So marked may these latter be, that there are cases reported suggesting Raynaud's disease, and Keen states that in at least seven instances local gangrene has followed.

An important suspicion was raised in this case as to the existence of aneurysm. As Keen remarks: "On the whole, the evidences of true aneurysm in most of the cases in which it has been reported are, to my mind, by no means always convincing. Usually the diagnosis has been based on the strong pulsation, sometimes with bruit and thrill. In a few cases, as in my own, the artery has been found, at operation, moderately enlarged, or in one case (Murphy's) flattened In several cases operation has, therefore, disproved the presence of the supposed aneurysm. The postmortem in Adam's case disclosed a cylindrical aneurysm. Bearing upon the history of pressure or tension of the artery as it crosses the cervical rib, it is significant in Fischer's (Braun's) case that when the arm hung down (pressure or tension) a bruit was present, and when it was held up (relief of pressure) the bruit disappeared."

But unquestionably, in a few cases, dilatation of the vessel, a cylindrical aneurysm, or even a sacculated tumor, has been present. In the case here reported, though the pulsation was diffuse and suggestive, there was no evidence of aneurysmal dilatation. To the Infirmary for Nervous Diseases, Philadelphia, Rose D., aged nineteen years, an inmate of the Pennsylvania Blind Asylum, was brought for a supposed aneurysm of the subclavian. There were the local paralysis and atrophy which one now recognizes readily enough as



Scheme to show the changed course and the consequent angulation of the subclavian artery when it passes over a cervical rib. The dotted line (3) represents the normal gentle curve of the artery. 1. Cervical rib. 2. Subclavian artery passing over the cervical rib. Note its high position, its angulation, and the likelihood of pressure by the scalenus anticus 6. 4. First dorsal rib. 5. Axillary artery. 7. Left carotid. 8. Innominate. 9. Aortic arch. (Keen.)

characteristic of cervical rib. Over this, no doubt, the subclavian artery was hooked, as in Keen's diagram, which I here reproduce, as it shows this angulation and elevation. It explains the position of the swelling in these cases, and the high pulsation. In the case of the blind girl just referred to the swelling in the supraclavicular region was marked, and while the mass itself did not pulsate, the vessel could be readily traced, and there was a loud murmur heard along its course.

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STOKES-ADAMS DISEASE

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

Pathological Section by A. KEITH, M.D.

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ANEURYSM

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

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STOKES-ADAMS DISEASE

STOKES-ADAMS DISEASE

By Prof. WILLIAM OSLER, M.D., F.R.S.
Pathological Section by A. KEITH, M.D.

Definition.—A condition of slow pulse with syncopal, apoplectiform, or epileptiform attacks associated either with (*a*) derangement of the junctional system of the heart, or (*b*) disease of the nerve-centres of the vagi or of the nerves themselves.

History.—Morgagni gave the first description of the disease. "I will just skim over . . . those many things which I have observed for a long time in my fellow-citizen, Anastasio Poggi, a grave and worthy priest. He was in his sixty-eighth year, of a habit moderately fat, and of a florid complexion, when he was first seized with the epilepsy, which left behind it the greatest slowness of pulse, and in like manner a coldness of the body. But this coldness of the body was overcome within seven hours, nor did it return any more, though the disorder often returned; but the slowness of the pulse still remained." Our modern knowledge dates from the work of two Irish physicians, Adams and Stokes, whose original descriptions may be summarised as follows:

Adams' patient, aged sixty-eight, was of full habit, and subject to oppression of breathing and cough. He was first seen when recovering from the effects of an apoplectic attack, which had come on suddenly three days before, but he was sufficiently well to be about the house and even to go out. What attracted Mr. Adams' attention was the character of the breathing and the remarkable slowness of the pulse, 30 to the minute. His regular attendant informed Mr. Adams that during seven years this patient had had not less than twenty apoplectic attacks; after a day or two of heaviness and lethargy he would fall down completely insensible, and on several occasions had hurt himself. The pulse would become slower than usual, and the breathing loudly stertorous. He never had any paralysis after the attacks. Death followed an attack, and the heart was found to be very fatty, the valves being sound. There was no statement about the coronary arteries.

In his much more important contribution, entitled *Observations on Some Cases of Permanently Slow Pulse*, Stokes describes the case of a man, aged sixty-eight, who had recurring fainting fits which, however, did not leave any unpleasant effects behind. In the course of three years he had had at least fifty seizures, which were induced by any circumstance tending to impede or oppress the heart's action, such as sudden exertion or a distended stomach. He was never convulsed and never had any paralysis. The duration of the attack was seldom more than four or five minutes, and during this time he was perfectly insensible. On admission his general health seemed very good. There was an apical systolic murmur, and a pulse of 28 in the minute. The arteries appeared to be in a state of permanent distension, "the temporal arteries ramifying under the scalp just as they are seen in a well-injected subject." An interesting feature in this case was that the patient could ward off attacks by a peculiar manœuvre; "as soon as he perceives symptoms of the approaching attack he directly turns on his hands and knees, keeping his head low, and by this means, he says, he often averts what otherwise would end in an attack." It was noticed that, while his heart-beats were reduced to 28, there were occasional semi-beats between the regular contractions, 8 of them in the minute. On readmission an entirely new sign was observed, namely, a remarkable pulsation in the right jugular vein, the rate of which was more than double that of the manifest ventricular contractions. Subsequently cases were reported elsewhere from time to time; in France Charcot called attention to it in 1872, and in his *Traité des Maladies du Cœur* (1889), Huchard gave an admirable description of the condition, which he named Adams-Stokes disease. In this country very little attention was paid to it until the appearance of Dr. Webster's paper, in which the cases were carefully studied by the graphic methods. In 1903 I drew attention to the comparative frequency of the condition and to the various groups of cases. In Germany the studies of W. His, junior (1899), Jacquet (1902), and Luce (1902) stimulated a physiological interest in the subject, and brought the syndrome into relation with the phenomena of heart-block described twenty years before by Dr. Gaskell. In the United States the clinical features of slow pulse were very fully considered by Prentiss and by Edes (1901). Recently the brilliant anatomical demonstration by Tawara of the intracardiac junctional system of fibres, the physiological studies of Erlanger on heart-block, and the pathological investigation of the cases by Dr. Keith and others have combined to arouse the keenest interest in the subject. More than sixty separate papers have appeared within the four years 1905-8, references to which may be found in the *Index Medicus*, and in Pletnew's critical digest in Vol. I. of the *Klinische Ergebnisse* (1908). Bachmann has collected 177 cases of the Stokes-Adams syndrome.

Nomenclature.—Bradycardia, a very common condition, is due either (i.) to influences acting on the nerve-centres (or the vagi) or (ii.) to changes in the heart itself; and the cerebral features which characterise the Stokes-Adams syndrome may be associated with both these, neurogenous and cardiac, groups. The disturbance of rhythm which we know as heart-block is not an invariable accompaniment of bradycardia. I do not know that its existence has been determined in the cases due to organic disease of the medulla, the cases in which the heart simply slows down, without change in its rhythm. The syncope and epileptiform features are epiphenomena of a bradycardia however induced. Whilst in some ways it is a pity that the syndrome was ever labelled a disease, yet, as in the case of angina pectoris, the clinical picture is very definite however varied its pathology. Since it is too late to attach Morgagni's name to it, we may continue to call the syndrome or disease by the name Stokes-Adams; and, remembering the dictum of Socrates, that "it matters little what names you give to things so long as you tell us just what the things are," I may repeat that under this designation a description will be given of the cases with slow pulse and syncopal and epileptiform attacks, and in two groups—cardiac and neurogenous.

Incidence, Age, and Sex.—That the disease is not uncommon is shewn by the number of cases reported in recent years. In 1903 I reported 13 cases, and since then I have seen 7 additional examples. Men are more often affected than women—in my series all were men. The age-incidence varies with the cause; in a small group, due to acute infections, young persons may be attacked; Schuster indeed reported it in a girl of four years of age. In the group due to syphilis, men between the ages of twenty and forty are affected; but the great majority of the victims are men who have reached the period of arterial degeneration. Of my 20 cases, 2 were between thirty and forty, 6 between fifty and sixty, 8 between sixty and seventy, and 4 above seventy. My oldest patient was a man of seventy-four. W. O.

Pathology of Heart-block and its Bearing on Cases manifesting the Stokes-Adams Syndrome.—**Heart-block.**—Since 1906 it has become almost certain that the manifestations of the Stokes-Adams disease depend on a lesion of the junctional system of fibres which unites the musculature of the auricles to that of the ventricles. The morbid change may be so slight as to cause *partial heart-block*, or so severe as to cause *complete* or *total heart-block*. In the first condition the stimuli set up by the contractions of the auricle traverse the junctional system at a slower rate than normal, the contraction of the ventricle being thus delayed, or some only of the stimuli excited by the auricular contractions may succeed in reaching the ventricles, so that some of the ventricular beats are missed. In complete heart-block the junctional system is impermeable to all stimuli arising in the auricle; if the ventricles continue to beat, it is at a slow rate, and with no relation to the contraction of the auricles. The occurrence of complete heart-block in man is usually marked by the appearance of the Stokes-Adams syndrome, but this is not invariably the case, for Chauveau, Dr. J. Mackenzie, and others have recognised a condition of complete heart-block without the manifestation of syncope or epileptiform attacks. Fits are more likely to occur in incomplete than in complete heart-block (T. Lewis). Bachmann has given a very full clinical history of a case of complete block without syncopal attacks.

The Nature of the Pathological Lesions in Cases of Heart-block.—Such a short space of time has elapsed since the auriculo-ventricular junctional system became a subject of inquiry and observation, that as yet our knowledge of its pathology is very meagre. I have access to observations on the auriculo-ventricular system of twenty-one hearts from cases manifesting symptoms of heart-block during life. Sixteen of these are from published cases, five are from hearts examined by myself. The twenty-one hearts fall into five groups: (1) in which the system has been broken by a gumma (cases observed clinically by Chapman, Ashton, Luce (see Fahr), Vaquez, Robinson, Heineke, and Otto Grünbaum); (2) in which the system was partly fibrosed, evidently as a result of arteriosclerosis (Hay, James Barr, G. A. Gibson, C. H. Miller, and Turrell and Gibson); (3) in which the bundle was implicated in fibrous or cicatricial tissue, probably from rheumatic endocarditis (Schmoll, G. A. Gibson and W. T. Ritchie (22), Aschoff, Fahr, Dock, and Gerhardt); (4) in which the system was the seat of fatty infiltration (Butler, Aschoff); (5) in which the system was injured by an acute infection (Jellinek and Cooper).

(1) *Cases in which the Auriculo-ventricular Bundle has been invaded by a Gumma.*—During 1906 and 1907 I minutely examined the hearts of five patients in whom the Stokes-Adams syndrome was well marked. Figs. 23 and 24 represent, somewhat diagrammatically, the right and left chambers of the heart of one of these cases, which was originally described by Dr. C. W. Chapman, and afterwards by Dr. Miller and myself. On the right side of the heart (Fig. 23), at the junction of the septal wall of the right auricle with the corresponding wall of the right ventricle, there is a mass of cicatricial and gummatous tissue extending from the opening of the coronary sinus (between *d* and *e*) to the pars membranacea septi (between *f* and *i*); the region involved contains two essential parts of the junctional system—the auriculo-ventricular node (*a.-v.* node)—which forms the auricular commencement of the system, and the upper part or main stem (*a.-v.* bundle) of the system. In Fig. 24 the left side of the same heart is shewn. The gummatous mass is seen below the aortic orifice of the left ventricle, occupying the upper part of the interventricular septum and also the membranous part of that structure. As is shewn diagrammatically in Fig. 24 the mass involves the main bundle. The oblong area of the septal wall indicated in both figures was excised, prepared, and cut serially, the sections being made transversely to the long axis of the mass excised; they commenced at the anterior or ventricular end, and were carried backwards to the auricular end. The sections were 10 to 12 μ thick; each 30th section was kept, and stained by van Gieson's method. In the anterior or ventricular end of the mass, the right and left divisions of the main bundle were found intact (see Figs. 23, 24), normal in structure, and larger in size than usual—the left division forming a layer of 5 or 6 fibres deep beneath the endocardium of the septal wall of the left ventricle. On proceeding towards the auricular end of the block, the main bundle became involved in the amorphous material of the cicatricial mass, no trace of the upper part or of the auriculo-ventricular node being found. On the other hand the right and left divisions of the junctional system, and the final ramifications of these divisions in the sub-endocardial layer of the ventricles—these ramifications being most numerous and best developed at the bases

of the musculi papillares—were, as far as the microscope could shew, normal in structure and rather more than normal in amount.

The patient, a man aged fifty-six, died in 1905. In 1892 he first manifested symptoms of heart-block. No tracings were taken of his

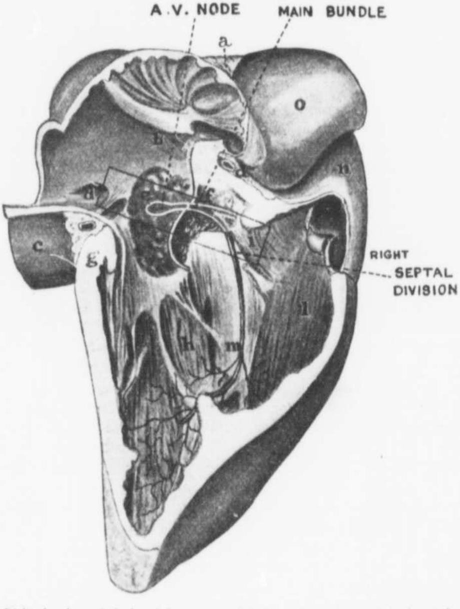

FIG. 23.—Right chambers of the heart, from a case of Stokes-Adams disease of the heart, described in the text, with position of *a.-v.* node, main bundle, and right septal division indicated. *a*, Remnant of superior vena cava. *b*, Position of orifice of superior vena cava, which is quite closed. *c*, Greatly dilated inferior vena cava. *d*, Fossa ovalis. *e*, Cicatricial tissue of interauricular septum (stippled). *f*, Pars membranacea septi and extension of cicatricial tissue into interventricular septum, in which the auriculo-ventricular bundle is involved. Between *d* and *e* is the opening of the coronary sinus. Oblong figure indicates the block cut out for examination. *g*, Base of right ventricle. *h*, Body of right ventricle. *l*, Infundibulum. *m*, Moderator band. *n*, Pulmonary artery. *o*, Aorta. For convenience of printing, the figure is placed base up; part of the septal cusp of the tricuspid is cut away to shew the gummatous mass and position of the *a.-v.* node and main bundle, which were destroyed by the disease. Two-thirds natural size.

jugular pulse. The terminal part of the superior vena cava and the musculature in which the heart-beat is believed to arise were completely destroyed by a gummatous infiltration (see Fig. 23). By itself this case does not prove that a lesion of the junctional system is the cause of the Stokes-

Adams syndrome, but since Humblet, Erlanger, Hering, and others have shewn that the main bundle of the junctional system is not merely the normal but the only path by which the auricular rhythm can be transmitted to the ventricles, it may be inferred, apart from the clinical symptoms, that this patient must have had a condition of complete

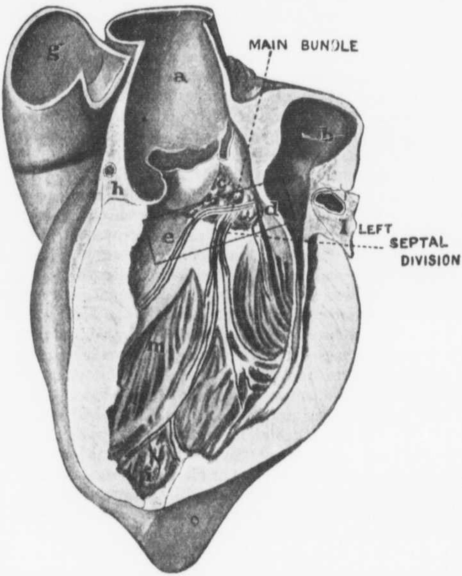

FIG. 24.—Left side of the same heart as is shewn in Fig. 23, and the position of main bundle with its left septal division indicated. *a*, Aorta. *b*, Contracted left auricle (stippling shews the extent of the cicatricial tissue). *c*, Pars membranacea septi; the stippled area below shews the extension of the gummatous tissue into the interventricular septum, in which the auriculo-ventricular bundle is situated. *d*, *e*, The block cut out for examination. *f*, The left septal division of the bundle. *g*, Pulmonary artery. *h*, Cicatricial tissue at origin of aorta. *l*, Coronary sinus. *m*, Septal wall of the left ventricle. Two-thirds natural size.

heart-block; this case has also an important bearing on the functional nature of the junctional system. If this were, as was at first supposed, merely a conducting system, it should, after being unused for over twelve years, have become atrophied. Since an opposite condition has resulted, we must suppose that it has the power of initiating as well as conducting contraction stimuli—a conclusion which has been supported by many, especially Mackenzie and Aschoff, and also by Lohmann from the result of an experimental inquiry. Dr. Gaskell's experiments on the tortoise's heart, when considered in the light of comparative anatomy, also favour this supposition.

Other Cases of Gumma in the Heart invading the Auriculo-ventricular Bundle.—Another case, somewhat similar to the one just described as regards the situation and nature of the lesion, was examined by me for Dr. Otto Grünbaum, who has briefly recorded the clinical symptoms. The main bundle, for an extent of nearly a centimetre, was completely destroyed; the condition of the auriculo-ventricular node and the ramification in the ventricle were not examined, this being one of the earliest hearts examined to discover the pathological condition of the junctional system. Five excellently recorded cases of a similar kind are to be found in recent literature, one by Ashton, Norris, and Lavenson, another by Vaquez and Esmein, the third by Fahr, the fourth by Robinson, and the fifth by Heineke, Müller, and v. Hösslin. The first of these cases was that of a man of thirty, who manifested the Stokes-Adams syndrome for twenty-one days before death; the interventricular septum was infiltrated with a gummatous mass which had destroyed the main bundle at its bifurcation; in the second, that of a man aged forty-three who had manifested the symptoms of Stokes-Adams disease for ten months before death, there was a gummatous mass occupying an area of the septal wall of the heart similar to that found in the first case examined by me. Fahr's case resembled that described by Miller and myself. Robinson examined a museum specimen of a "gumma of the heart," and finding that it occupied the part of the septum through which the auriculo-ventricular bundle runs, referred to the clinical notes, which shewed that the symptoms of Stokes-Adams disease had existed before death. The cases recorded by Dr. Handford and by Dr. Phillips, although the condition of the junctional system was not examined, were similar as regards the nature of their lesion to the six cases just cited. In Sendler's case the bundle was apparently interrupted by a cartilaginous tumour.

(2) *Pathological Lesions of the Auriculo-ventricular Bundle in Cases of Arteriosclerosis.*—Cases of arteriosclerosis presenting the Stokes-Adams syndrome do not shew any well-marked pathological lesion. In the heart of a case recorded by Dr. John Hay—that of a man aged sixty-five, presenting all the symptoms of complete heart-block for eleven months before death, I found the following condition:—The auriculo-ventricular junctional system was nowhere broken; the central fibrous body, against the right aspect of which the auriculo-ventricular node is applied, was atheromatous with patches of calcification; the coronary arteries were markedly arteriosclerotic, their lumen being reduced to half in the larger vessels; this was also the condition of the artery to the bundle—a small branch that arises from the right coronary artery at the upper end of the posterior interventricular groove. Microscopical examination of the musculature of the auriculo-ventricular junctional system shewed that the muscle-fibres were larger and that some of them were more fibrous than usual; instead of the fibres of the main bundle forming an open

reticular arrangement they lay in parallel leashes; there were scattered foci of slight inflammatory exudation—especially near the commencement of the bundle. But it could not have been said, from the morbid appearances, that this case should have presented a condition of complete heart-block; hearts in which there has not been any heart-block may shew an equally fibrous condition of the bundle. It must be mentioned that occasionally in this case, even some days before death, the pulse-rate, instead of being from 24 to 36 a minute, ran up to 60, as if the block were then incomplete or removed. In Sir James Barr's case, a man aged sixty-four, a very similar pathological condition was found; the bundle, though intact, was manifestly stretched and attenuated; there was an unusual proportion of fibrous tissue in its main part, and the central fibrous body, especially round the point at which the main bundle perforates it, was atheromatous and infiltrated with lime salts; here again it would have been impossible to say, on the pathological data alone, that a condition of heart-block had been present. In some twenty pathological hearts, submitted to me by Dr. James Mackenzie, all of them accurately recorded during life, none being cases of heart-block, some shewed a degree of fibrosis almost equal to that found in the cases of heart-block; in another case, in which the nodal rhythm (Mackenzie) was present, a small endocardial ulcer had eaten right into the bundle, so that two-thirds of its diameter were destroyed or invaded by inflammatory material. Yet there was no heart-block. A third heart examined by me, belonging to the arteriosclerotic group of cases manifesting the Stokes-Adams syndrome, gave absolutely negative results. The case was examined by Dr. Charles Miller. The heart was that of a man aged fifty-five, with a pulse-rate of 22 to 36 per minute, who suffered for eight days before death from frequent fits, before each of which the rate of the pulse slowed; the patient lost consciousness for about 20 seconds, the limbs became rigid, eyes open and staring. No record was taken of the auricular rhythm. Before cutting out the central part of the heart for microscopic section, the position of the auriculo-ventricular node was seen to be indicated by a dark-red patch. But in the examination of the sections, there was, in my opinion, no appearance that could be called pathological; the bundle was particularly well developed and apparently healthy. Probably a case of heart-block recorded by Dr. G. A. Gibson, that of a man aged forty-four, should also be included in this group. The auriculo-ventricular bundle was intact, but there was a cellular infiltration amongst its fibres with some degree of fibrosis; to the naked eye the bundle appeared paler than normal. Edes found that a condition of arteriosclerosis was present in 33 of 41 recorded cases of heart-block. The pathological condition of the case described by Drs. Turrell and Gibson was exactly similar to that found by me in the cases of Sir J. Barr and Dr. Hay; but in Turrell and Gibson's case there is no evidence that the block was complete. Heineke's second case also belongs to this group. Recently, Drs. G. A. Gibson and Ritchie (22*a*) have published a full account of the case of the well-known physician, Sir

William Gairdner. At the age of seventy-five he became subject to syncopal attacks, which occurred frequently until he was seventy-nine years of age. Then the slow pulse (28-34 per minute, usually 32), at first only temporary during the attacks, became permanent and the syncopal attacks ceased. He died when eighty-three years of age. At the necropsy, the coronary arteries were found to be atheromatous; the node and upper part of the bundle fibrous and calcareous; the lower part of the bundle partly fibrous, partly muscular.

(3) *Pathological Lesion of the Bundle in Hearts which may have been affected by Rheumatic Endocarditis.*—In another group of recorded cases with Stokes-Adams disease, in which the junctional system was examined after death, the results of pathological investigation were indefinite, as in the last group. The morbid condition in this group was probably the result of endocarditis which, in some of the cases at least, was rheumatic. The best-marked lesion was found in Schmoll's case of a woman, aged sixty-six. The main bundle was large, more fibrous than usual, and infiltrated by cicatricial tissue, but from the photomicrographs published, it would appear that the main bundle was not seriously damaged. At the division of the main bundle into its right and left septal divisions, the muscular tissue of the junctional system was interrupted by a cicatrix. There was also a certain degree of arteriosclerosis of the artery to the bundle, but I have seen this artery much more severely diseased in cases without any symptoms of heart-block. The case recorded by Fahr is very similar. In a case examined by Aschoff the continuity of the junctional system was not broken at any point, and the arteries of the node and bundle were not markedly diseased. There was some fibrosis and infiltration of the bundle, but not to such an extent as to suggest that its function was seriously impaired. In two other cases (Dock, and G. A. Gibson and W. T. Ritchie (22)) the junctional system was intact, but certain fibrous patches were seen partly to invade the main bundle or one of its limbs. A moderate degree of endarteritis was present in both cases. In the case recorded by Stengel, the main bundle was supposed to be involved by a patch of atheroma, but no microscopic examination was recorded when the case was first published. In Gerhardt's case there was a recent inflammatory exudate at the point where the bundle perforates the central fibrous body of the heart.

(4) *Cases in which the Junctional System was the Seat of Fatty Infiltration.*—Butler has recorded a case of heart-block in which the junctional system, although not anywhere broken, was infiltrated with fat and atrophied to one-fifth of its normal size. The patient, a man of forty-five, with the characteristic symptoms of Stokes-Adams disease for ten days before death, had a temperature of 101° F.—not a sign likely to result from fatty infiltration alone. Aschoff has recorded a very similar condition in the heart of a patient with symptoms of heart-block; and I have seen two cases in which this system was infiltrated with fat, especially its connective-tissue sheath, so that the whole of it, including the right and left septal divisions with their ramifications, was plainly

seen as greyish-yellow strands, when the ventricles were laid open. In one of the cases—examined clinically by Dr. J. Mackenzie—there was no heart-block, but the nodal rhythm was present before death. In the other the clinical notes do not refer to any peculiarity of the cardiac rhythm.

(5) *Cases in which the Junctional System was damaged by an Acute Infection.* —The last group of cases to be described here is that in which the bundle is involved in an area of necrosis, due to an acute infection. The best—indeed the only—recorded case of this nature is that published by Jellinek and Cooper. It was that of a man aged thirty, with acute gonorrhoeal infection, who manifested symptoms of heart-block for fourteen days before death. The upper part of the interventricular septum, containing the main bundle, had undergone an acute necrosis, and the arteries in it were thrombosed. Foley's case was probably similar in nature, but there was no examination made of the bundle. Dr. Gossage has observed heart-block after influenza, and it is known to occur after diphtheria, but so far the pathological condition of the junctional system has not been examined in such cases.

Condition of the Central Nerve-centres.—The cerebral symptoms seen in cases of Stokes-Adams disease have frequently been ascribed to a lesion of the central nervous system. In two cases, Medea systematically examined the central nuclei of the vagus and spinal accessory, as well as the trunks of these nerves, but found no lesion. Dr. A. Webster shewed that the slowing of the heart preceded the cerebral manifestation, and it is now generally agreed that the cerebral symptoms are a direct result of a circulatory disturbance, following a momentary failure of the left ventricle. Amongst recorded cases shewing the Stokes-Adams syndrome, Edes found three in which disease of the bulbar or upper spinal centres was discovered after death.

Experimental Pathology of Heart-block.—Of the 21 cases of heart-block here recorded, 8 only shew a definite break in the continuity of the auriculo-ventricular junctional system, the interruption being in the main bundle itself or at its bifurcation into the septal divisions. The lesions caused by disease that do provide convincing evidence that heart-block and the Stokes-Adams syndrome are the result of a failure of the junctional system to transmit the auricular impulse to the ventricles; the proof must be sought in the results obtained by direct experiment on this system. Dr. Gaskell's observations on the auriculo-ventricular junctional musculature of the tortoise's heart, published in 1883, laid the foundation of our knowledge of heart-block; he demonstrated that this system transmitted the auricular impulse to the ventricles, and that in the absence of the auricular impulse it could give rise to a stimulus which brought about a ventricular systole. In 1893 Dr. Stanley Kent and W. His, junior, discovered independently that the junctional system of the tortoise was represented in the mammalian heart by a muscular strand, the auriculo-ventricular bundle. Tawara in 1906 shewed that the bundle was but one part of the junctional system; that in the mammalian heart this system commenced in the septal wall of the right auricle as a small node of reticulated muscle-tissue (*a.-v.* node), out of which issued the *main bundle* to divide at the upper margin of the interventricular septum into right and left septal *divisions*, one to each ventricle, these divisions ending in the ventricular musculature by widespread *sub-endocardial ramifications* (see Figs. 23, 24; also Keith and Flack). Wenckebach proved in 1899 that disturbance in conduction at the auriculo-ventricular junction of the heart was the cause of certain arrhythmias; but W. His, junior, was the first to try the effects of section of the bundle (1895), and in publishing a case shewing the Stokes-Adams syndrome in 1899 he definitely stated that he regarded the condition to be that of heart-block, and due probably to a lesion of the auriculo-ventricular bundle. Humblet, Hering, and Erlanger proved that section of the bundle produced heart-block; in 1906 Erlanger, from experiments on the hearts of dogs, had obtained ample proof that the Stokes-Adams syndrome was a result of a lesion of the junctional system. He found that the symptoms which followed heart-block produced by clamping or cutting the main bundle depended on the readiness with which the ventricle assumed an automatic rhythm. The ventricles may respond at once, and this is more likely to be the case when the block is produced slowly, calling gradually into action the latent automatic power of the ventricles; or they may not respond until the auricles contract sixty times or more. In two of Erlanger's experiments the ventricles failed to respond sixty seconds after the block was established; in these two cases respiratory convulsions appeared. In cases such as those recorded by Chauveau, Mackenzie, and others, in which the auricles and ventricles contracted independently of each other, without any manifestation of cerebral symptoms, we must suppose that the automatic rhythm of the ventricles was speedily and well established. The less the inherent tendency of the ventricles to assume the power of automatic contraction—and clinical as well as experimental observation shews there is a considerable degree of individual variation in this respect—the more probable is it that cerebral symptoms or sudden death will appear. At the present time there is not sufficient evidence to decide whether the ventricular response is a special quality of the junctional system or of the whole ventricular musculature. I have now seen three cases in which the ramifications of the junctional system in the apical half of the left ventricle were destroyed by arteriosclerosis of the coronary vessels, and yet the only clinical symptoms were extra-systoles of the ventricles.

It is conceivable that heart-block might be produced by a lesion of any part of the junctional system: (1) of the fibres which unite the auricular musculature to the auriculo-ventricular node; (2) of the auriculo-ventricular node itself; (3) of the main bundle; (4) of the septal divisions, and (5) of the sub-endocardial ramifications. All the ramifications cannot possibly be diseased, as the whole ventricular musculature would then necessarily be implicated. Biggs found that section of some of the ramifications in perfused hearts did not alter the contraction of that part of the ventricle to which they were distributed, results in agreement with those obtained by Drs. L. Hill and Flack. I have seen such ramifications in a morbid condition in cases in which the symptoms of heart-block had been absent. The anastomosis between the ramifications is so free that anatomical considerations are quite in accord with the results obtained by Biggs. In 1899 W. His, junior, suggested that heart-block might be due to a refractory condition of the ventricular musculature or a failure of this muscle to respond to the stimuli transmitted to it by the junctional system, but of this there is as yet no evidence. The part of the junctional system at which it is possible for a gross single lesion to produce heart-block is limited to the auriculo-ventricular node and the main bundle; this area is small and has a lineal extent of about 25 mm. in the human heart, being bounded at its auricular end by the orifice of the coronary sinus, and at its ventricular end by the lower margin of the pars membranacea septi. Experimental lesions must sever every strand of the bundle to give complete heart-block; a few intact strands serve to convey the auricular impulse. If the auriculo-ventricular node possesses a superior degree of excitability—a proposition which has the support of comparative anatomy,—then a lesion between the auricle and the node, while giving a condition of heart-block, should at the same time give a fairly rapid ventricular rhythm (Mackenzie's nodal rhythm). We know that in complete section below the node the ventricular rhythm varies in most cases between 22 and 36; 28 may be regarded as the average manifestation of the inherent rhythm of the ventricles.

It must be kept in mind in connexion with the intact condition of the bundle found in some cases with the symptoms of Stokes-Adams syndrome, that heart-block may be produced by a functional derangement. Dr. J. Mackenzie and v. Tabora have shewn that digitalis has such an effect under certain conditions, and Prof. Cushny and Knoll have also been able to produce it by pharmacological means. As is well known, it may be brought on by stimulation of the vagus; Erlanger demonstrated that after section of the main bundle, stimulation of the vagus had no longer any effect on the ventricle; hence atropine does not affect the ventricular pulse in cases of heart-block. The vagus cannot exert a direct influence on the ventricles; it can influence them only through the auriculo-ventricular junctional system. In a case of complete block, Bachmann found that the administration of 5 minims of the tincture of strophanthus three times daily increased the ventricular rate and diminished that of the auricles, so that an occasional ventricular beat resulted from the auricular contraction, the block becoming thus incomplete.

A. Keith.

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A. K.

Pathological Physiology.—As already stated, the bradycardia may be due to many causes, grouped into the two divisions neurogenous and cardiac. It may be a true bradycardia involving both auricles and ventricles, and there may then be complete or partial heart-block. In a majority of all cases of the Stokes-Adams syndrome there is dissociation of the auricular and ventricular contractions, as shewn in the tracings, and the ventricular rate becomes permanently slow. This condition may persist for many years without symptoms, or there may be transient attacks of giddiness. The explanation of the remarkable cerebral phenomena of Stokes-Adams disease is to be found in a study of the cases of disease of the cervical vertebrae, and in the well-known Kussmaul and Tenner experiment. In a patient with destruction of the check ligaments of the odontoid process, a movement which caused pressure on the medulla was immediately followed, instantaneously indeed, by reduction in the pulse-rate and by loss of consciousness (*vide* also p. 145). It was remarkable with what rapidity recovery took place when his head was straightened. He had had a score or more of such attacks. The irritation of the vagus centres (or of the nerves) slowed the heart and a relative ischaemia of the brain with loss of consciousness at once resulted. Kussmaul's observation is still more striking, and the description of an experiment on a friend may be given in his own words:—"His carotids were most favourably placed. Scarcely had I compressed them with my fingers when he turned pale and collapsed off the stool. I had just time to catch him. He recovered consciousness immediately and said, 'Where am I?'" It is interesting to note that Kussmaul attributes a knowledge of this result to Galen. The transient loss of consciousness may be followed by convulsions if the pressure be maintained. In the cardiac group of cases it may not be altogether ventricular in origin, for there is often widespread arteriosclerosis, and, as Huchard suggests, the arteries of the medulla may play a part. If calcified and stiff they may not so readily adapt themselves to changes in the action of the ventricle, and we know that in a certain stage of sclerosis arteries are very prone to spasm: the cerebral features of Raynaud's disease, and the transient aphasia and monoplegia seen in the subjects of arteriosclerosis, indicate what an important part is played by spasm and relative ischaemia. But for most of the cases of Stokes-Adams disease the Kussmaul experiment satisfactorily explains the cerebral symptoms, and an appeal to angiospasm and reflex action is unnecessary.

Clinical Picture.—A. *Cardiac Group.*—A man of sixty or seventy, healthy and strong, or a younger man who has had syphilis, is attacked by vertigo, faints, or has a slight epileptic seizure and is found by his physician to have a pulse of 40 or 50 per minute. Weeks or months may pass before there is a second attack, and meanwhile the patient feels and looks well, and goes about his business as usual. There may be no subjective sensations about the heart, but the pulse remains permanently slow, and may sink to 20 or 25 and remain at that rate for years. Examination of the heart shews nothing abnormal, the sounds being clear and the beats strong and natural though slow. In a few cases they may be very feeble. Careful inspection usually shews the venous pulse in the neck to be 2, 3, or 4 times the rate of the carotid. Sometimes in the intervals between the cerebral attacks the pulse-rate is normal, but as a rule it is permanently slow, and may not vary more than a beat or two in rate per minute for years. Angina pectoris may complicate the cardiac condition, or there may be signs of myocarditis with oedema of the lungs, dyspnoea, and Cheyne-Stokes breathing; but, once established, the even tenor of the cardiac rhythm is not often disturbed. In several cases the cerebral attacks are pseudo-apoplectic, as Stokes called them, and they may recur with great frequency, and, though they are apparently serious, the patient recovers quickly and may return to work as if nothing had happened.

The cerebral symptoms vary in different cases. Attacks resembling petit mal are perhaps the most common, with twitchings of the limbs and face. The epileptic fit with its orderly sequence of events is rare. A slight aura may precede an attack, and the patient may be able to ward it off; after recurring for a year or more the attacks may cease;

in other cases they become extraordinarily frequent, 30, 50, or even 150 in a day, and consist of brief periods of loss of consciousness with twitchings of the muscles. During these paroxysms the pulse-rate may fall to 6 or 8, and there may be prolonged intervals between the ventricular beats. After presenting the symptoms for a period of two to ten or more years the patient dies in an attack, drops dead suddenly, or dies in an attack of angina pectoris; more rarely he is carried off by heart failure or by an intercurrent disease. In the syphilitic cases complete recovery may follow proper treatment. This is the clinical picture of the average case, and anatomically there have been found lesions in the heart implicating the junctional system—either sclerosis of the Kent-His bundle or fatty degeneration, or a gumma or widespread changes in the system itself (*vide* p. 132).

B. *Neurogenous Group.*—In a second group of cases a lesion of the medulla or of the vagi causes slow pulse and convulsions. The following categories will be briefly mentioned:—

(1) In a fracture of the cervical spine or dislocation due to injury or disease, slow pulse is more commonly present alone, but the pressure may also cause transient loss of consciousness. A man in the Montreal General Hospital with tuberculous disease of the first and second cervical vertebrae had on several occasions attacks of syncope and slow pulse. I well remember when helping to put on a "jacket" to support his head that as the result of a sudden movement he became unconscious and the pulse dropped to 10 or 12 per minute, so that we were afraid he would die before the head could be so placed as to relieve the pressure. He died subsequently in an attack, and the necropsy shewed ulceration of the check ligaments.

(2) Of a very similar nature are the cases with narrowing by disease of the lumen of the vertebral canal. This was the condition in Holbertin's patient who had had a fall five years before, and was found to have enlargement of the odontoid process. In Lépine's case narrowing of the canal caused pressure on the left side of the medulla, and in another instance there was narrowing of the occipital foramen (Boffard).

(3) Tumours of the medulla, such as aneurysm, sarcoma, and gumma, and tumours in its neighbourhood, for example in the cerebellum, may cause slow pulse and syncopal attacks. Edes gives a long series of cases collected from the literature, a majority with slow pulse alone. In a sarcoma of the medulla which I reported the young man had had vertiginous attacks, but at the end he had syncope and a pulse-rate of from six to eight per minute. Neuburger and Edinger report the case of a man aged forty-six with vertigo and fainting fits, who for nine days before his death had deviation of the head and eyes and a pulse of 18 per minute; the necropsy revealed absence of the right lobe of the cerebellum and a varix so situated that it might have irritated the vagus. In Brissaud's case there was a gumma in one cerebellar peduncle.

(4) In Triboulet and Gougerot's case marked atheroma of the vertebral and basilar arteries had produced a sclerosis of the medulla and pons

with atrophy of the cells, which shewed chromatolysis and a rounded outline.

(5) The vagi may be involved in a neuritis. The case of Zurhelle's (quoted by Pletnew) is possibly of this nature. In the second week of a febrile attack a man began to have pains on the left side of the neck and later on the right side increased by pressure. Swallowing was difficult. The heart became irregular, the pulse-rate gradually sank to 36 in the minute, and there were attacks of fainting with clonic contractions of the muscles. Then he had inflammation of the lungs, and a bilateral paralysis of the recurrent laryngeal nerves with huskiness of the voice. Recovery took place gradually.

(6) In the absence of careful investigation by modern methods of the medulla and heart we must for the present rule out the functional group into which such a case as the following, reported by Edes, has been placed. An excessively neurotic woman, aged fifty, had for seven or eight months recurring attacks of loss of consciousness, in which the pulse fell to 20 per minute. No morbid changes were found in the heart or brain; but as a microscopical examination was not made, there may have been degenerative changes in the junctional system. The cases in this group require further study by modern methods. We do not know whether heart-block exists or not; and I am not aware of any cases in which careful tracings have been taken and analysed.

Symptoms complained of by the Patient.—As a rule, it is a painless affection, and the cerebral features first call attention to its existence. Transient vertigo, a "die-away" feeling, an attack of fainting, or a more complete loss of consciousness with or without convulsions alarm the patient and make him seek medical advice. Morgagni's patient complained of pain in the right hypochondriac region; in other cases headache and dyspnoea or pain on exertion may be present. Palpitation, a sense of cardiac oppression, and in a few cases attacks of angina have been recorded, but as a rule there are no unpleasant sensations about the heart. There may be evidence of cardiac failure in cyanosis, dyspnoea, and dropsy; but these are rare, being present in two only of my series. The patients may become highly nervous and apprehensive, or even present a picture of aggravated neurasthenia.

The Cerebral Attacks.—The pulse may be slow for years without causing any discomfort, but so soon as giddiness or fainting or an epileptic fit occurs the patient becomes alarmed and seeks advice. Vertigo is one of the earliest and most common symptoms. On getting out of bed or in the street the patient experiences a sudden sensation as if he were about to fall, but he recovers himself easily. One of my patients (No. 2) had as many as twenty-five of these spells in the day, but never lost consciousness. The condition may be mistaken for the ordinary arteriosclerotic vertigo, so common in elderly people. In the neurasthenic group of cases of bradycardia, giddiness may be a very prominent feature. In one case (No. 14 of my series) a man aged twenty-six, with a pulse of 42, had attacks in which he felt "giddy-headed," and everything in the room seemed to turn round; when he tried to get up he was very unsteady, and was obliged to support himself by a chair. Transient mental confusion may be associated with the vertigo. In one case (No. 2) transient aphasia (a common symptom in cerebral arteriosclerosis) not infrequently followed an attack.

Fainting.—Syncope is one of the most common features of the cases. Without warning, while about his work or in the street, or when speaking in public, the patient falls unconscious, usually with pallor or an ashen-grey hue of the face. The suddenness of onset, without the slightest premonition, is an interesting feature of the attack, and gives to it a cerebral rather than a cardiac character. On this point the late Sir William Gairdner wrote to me about himself, October 1903, "The sensations, so far as I could judge, were not those of swooning, and still less of any apoplectiform seizure, but rather, I would say, epileptiform." The loss of consciousness may be for a few seconds only, so that the patient falls, but gets up immediately, or it may last a minute or two. The longest simple syncopal attack in any of my cases was ten minutes. There are remarkable attacks with all the associated phenomena of a fainting fit, but no loss of consciousness. One patient would turn pale, the hands and feet got cold, he sweated, and the heart became slower and more feeble, but in constantly recurring attacks of this sort he only twice actually fainted. As the late Sir William Gairdner insisted these are really epileptiform, that is cerebral, not syncopal in character.

Apoplectiform Attacks.—Stokes described these as pseudo-apoplectiform, as the patient had all the appearance of having had a stroke, but in a little while recovered without any trace of paralysis. This is not a common form, and occurred in one only (No. 6) of my cases. A large full-blooded man had for ten years a slow pulse, vertigo, and occasional attacks in which he dropped unconscious, had stertorous breathing, and the pulse fell to 20 per minute. After lasting from five to fifteen minutes consciousness returned, and after a short interval he was able to go about his business. This patient had hundreds of these attacks, sometimes two or three a week. Later he had transient losses of consciousness like petit mal, in which he did not fall, followed by motor aphasia of short duration.

Petit Mal.—The vertiginous attacks are sometimes of the nature of petit mal, and in some cases there are recurring periods of momentary dazing or a sensation of "dying-away." In others true petit mal occurs, transient loss of consciousness with pallor of the face, but without loss of control of the voluntary muscles so that the patient does not fall. Mental confusion may follow, but as a rule the individual knows when he has had an attack, which is not always the case in petit mal. "The absolute instantaneousness of the attacks, the absence of premonition and of all permanent results seemed to me more in harmony with a minor epilepsy than with either syncope or apoplexy . . . in some of the attacks in which the loss of consciousness was not absolute, and I retained sufficient self-possession to watch carefully for the access (occurring as it did in some nights between twelve and twenty times), I seemed to realise in my consciousness something like a faint trace of an aura" (Gairdner).

Convulsive Attacks.—These may be mild or severe, either localised twitchings of the muscles of the face and arms, or general convulsions which have all the characters of a true epileptic attack. The mild seizures are the more common. In my series fourteen had attacks of unconsciousness only; four had slight movements of the muscles of the face or arms or both, and two had more severe attacks. Aurae may precede the attacks, but they are not so common as in true epilepsy—peculiar feelings in the head, buzzing in the ears, precordial distress, or a sensation starting from the heart, tingling or a sensation as of a wave of heat passing from the periphery, or a sensation of a lump in the stomach rising through the right side to the head, where it burst with a thunder-clap (Stokes), are among the sensations which I find described. The following are descriptions of attacks, the onset of which I have seen:—"The eyes were turned to the left, became fixed, and consciousness was lost, the muscles of the face twitched, and those of the hands worked in slight clonic movement. The face became pale. The heart-beats which had been 18 per minute sank to 12, but remained regular and forcible; the apex-beat could be seen. In about half a minute he regained consciousness and seemed quite himself." In another case, "The patient shook hands with me and spoke quite naturally; the pulse was 20 per minute. After I had finished the examination the pulse suddenly stopped at the wrist, and I could not feel the heart's impulse, the features became fixed, the face slightly cyanotic, the breath was held, there was a general tremble of the muscles with 'rigidity,' the eyes twitched, the eyeballs rolled up, and the hands moved slightly. Within half a minute he was conscious again, the pulse began its regular rhythm at about 20. The intervals in which no heart-beat could be felt or heard ranged from twenty to thirty-five seconds. The patient had scores of such attacks in the day—150 by actual count!"

The rate and vigour of the heart do not necessarily change in these attacks, but there may be a complete cessation of the heart's action for from half a minute to two minutes and ten seconds in Stengel's case. The loss of consciousness is rarely more than a few minutes, but it may last half an hour, and Strayesko's patient remained unconscious for thirty-six hours. The breathing may be impeded for a few seconds, sometimes it is quickened; Cheyne-Stokes rhythm is not infrequent, and may begin during a prolonged attack. In some cases the slight epileptiform seizures occur daily with great regularity, one or two in the day. A patient seen with Dr. Turrell had them most often just as he was taking his breakfast. In other cases the attacks occur at long intervals. After persisting for years they may cease entirely. Mental excitement, bodily exertion, and flatulence are liable to bring on the attacks. One patient never had them when resting quietly, but when up and about or if he tried to do a little gardening the attacks recurred. The attacks may sometimes be averted. When Stokes' patient felt the symptoms approaching he turned on his hands and knees, keeping the head low, and in this way prevented a seizure. Dr. Turrell's patient could sometimes stop the attack if he could in time grasp firmly the bar of the bedstead, just above his head. Case 12 of my series could sometimes keep himself from fainting by rubbing the wrist forcibly.

Cardiovascular Features.—A majority of the cases in my series had arteriosclerosis, usually the senile form. As Stokes remarked, the permanently slow arterial pulse is the special characteristic of the condition. It is usually under 40 per minute and regular. In a few cases it is between 40 and 60, whilst some patients have a pulse-rate between 20 and 30 for long periods.

Dr. Turrell's patient had the pulse taken by a nurse three times a day for eight years—a unique record which is worth quoting (22). The records begin on July 25, 1900, some few days after a series of convulsions; the rate was then 38 to 40. On July 26, 1900, it became quicker, about 53 to 55. From that date on it ranged about 60, never being below 50 and never above 72 till September 21 of the same year, when a rate of 40 was recorded. On October 1 a pulse-rate of 32 was recorded, and from that date the rate was for the most part between 30 and 40, except for intervals of two or three weeks, when it was 50 to 60. From October 31, 1901, it was below 40, except for an isolated observation on July 22, 1904, when it was 68 after an attack of convulsions. During this period up to the patient's death the rate was never observed below 16—that is, apart from the convulsive attacks—and seldom above 37.

In Case 20 of my series the slow pulse only came on at the time of the attacks, and in the intervals the rate was normal. He passed an entire year without an attack, and the pulse was always above 70; then for two months it was between 25 and 28, and the syncopal attacks recurred.

In the senile form the pulse becomes permanently slow, and the patient may be perfectly comfortable for years with a rate of from 25 to 30 per minute. The rhythm is nearly always regular, but a few cases shew extra-systoles. The arterial pulse-rate is not easily influenced when once permanent bradycardia is established; thus emotion and exercise may not raise the rate more than a few beats. After the cerebral attack, however, the rate may be quickened, and a bout of indigestion or a febrile attack may have the same effect. The pulse-rate may remain the same in the recumbent and standing postures, and before and after exercise. As a rule atropine does not produce any quickening of the ventricular rate in the cardiac cases, whereas in bradycardia of vagomedullary origin the pulse is accelerated.

The Pulse in Relation to the Cerebral Attacks.—As Dr. A. Webster pointed out, a slower pulse usually accompanies the attack, for example, a rate of 20 or 25 per minute may fall to 10 or 12. In a severe attack, particularly in cases in which many occur in the day, the radial pulse and the heart-beats may be imperceptible for some seconds, or even for more than two minutes, as in Stengel's case. In some cases the attacks follow a drop of 8 or 10 beats per minute; on the other hand, when a permanently slow rate is established, say at 25, attacks may be more likely to come on, as in Dr. Turrell's patient, when the pulse rises to 30. In this case irregularity had a marked influence; an occasional drop made no difference, but if the pulse missed two beats in succession the patient had to make a great effort to retain consciousness, and often an attack followed. The very slow beats may be extraordinarily vigorous and convey a sense of fulness, which corresponds with the powerful action of the heart.

The Venous Pulse.—Stokes noted in his case the remarkable pulsations of the jugular vein which were more than double the ventricular contractions. When the patient is thin this peculiarity is constantly present, and its investigation by the modern graphic methods has thrown much

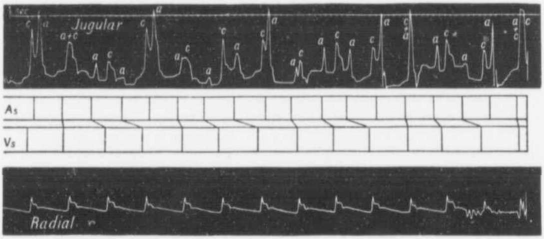

FIG. 25.—The upper tracing is from the jugular pulsation, the lower from the radial artery; the interpolated diagram between represents graphically the beats of the auricle and ventricle. *a* and *c* in the jugular pulse represent the waves due to the auricle and the carotid artery respectively. As. = auricular systole; Vs. = ventricular systole. The diagram shews an increasing difficulty during three beats in the transmission of the auricular contraction to the ventricle, followed by an auricular beat which fails to reach the ventricle. From a case of Stokes-Adams disease with partial heart-block. (A. G. Gibson.)

light on the physiology of the condition. Sometimes an undulatory impulse only is seen, or a series of beats following each other so rapidly that it is hard to distinguish them; whereas in other cases the beats are readily counted; but the graphic method enables the rhythm to be studied accurately. The accompanying tracings with analyses will give a clear conception of the relation of the venous and arterial pulses.

The heart may not shew anything abnormal on inspection. In 11 of my cases the apex-beat was visible; in 9 it was not seen; in 5 the impulse was forcible and outside the nipple line. Sometimes, as in Case 5 of my series, although there was no cardiac hypertrophy the impulse was very strong, and shook the chest. A wavy impulse has been seen in the diastolic period over the precordia. An ordinary normal impulse may be felt, only the beats are slow; in other cases there is no palpable pulsation, even after exertion; in other instances again a gallop rhythm may be both seen and felt. The shock of the first sound may be very intense and a sharp diastolic snap at the base may be felt; with valvular disease or with senile sclerosis a thrill may be present, usually at the base (Case 2). The area of cardiac dulness may be normal, or in the aged diminished by emphysema; when increased it is usually in association with valvular disease. In only 6 of my cases was the heart evidently hypertrophied.

Auscultation.—The sounds may be normal in tone and in relative intensity; this applies to a majority of the patients, particularly in the intervals between the cerebral attacks. The sounds may be muffled or quite inaudible. In Case 4 of my series it was impossible at times to hear the sounds; after exertion a feeble first could be heard with a soft murmur, but I repeatedly examined him when it was impossible to hear

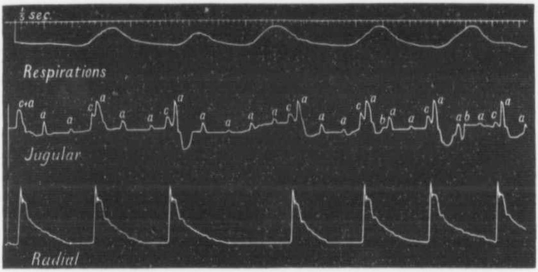

FIG. 26.—The respirations and the jugular and radial pulses, from the same case as Fig. 25, about three months later when complete heart-block had been established. The auricle is beating regularly at a normal rhythm; the ventricle pursues its own rhythm, unaffected by the auricle as is shewn by the dropping out of one ventricular systole. a = auricular systole; c = the carotid wave. Time-marker = 1/5 sec. (A. G. Gibson.)

anything at the apex or base. On the other hand the sounds may be exaggerated, the first either clear or valvular, like the ringing, flapping sound in mitral stenosis; or a loud booming cannon-tone of extraordinary intensity. The second sound at the base may be greatly accentuated, and of a bell-like amphoric quality. Disease of the myocardium and valves may be accompanied by the usual phenomena, such as gallop rhythm, which was present in several of my cases; in 8 a mitral systolic murmur, in 2 an aortic systolic, and in Cases 10 and 15 the signs of aortic insufficiency were present. A terminal pericarditis occurred in Case 8.

In several cases soft sounds were heard in the interval between the ordinary heart-beats. In Case 5 a faint systolic sound was heard after the loud first; when this patient was having many fainting and epileptiform attacks with a radial pulse of 12, very loud booming heart-sounds, and a fluttering jugular pulse of about 120 per minute, there were seen in the 4th and 5th interspaces "small regular systolic impulses exactly 100 to the minute, and corresponding to these would be heard faint systolic sounds at the same rate." In Case 6 feeble tones were heard in the long diastolic interval, but I could never determine that these soft intervening sounds corresponded accurately with the auricular beats, and they are not heard in a majority of the cases, even when the pulse in the neck is well marked.

During the attacks the pulse-rate may not alter, but as a rule the heart beats more slowly, and there may be prolonged intervals in which no impulse or sounds are perceptible. Thirty-five seconds was the longest interval I have noted, but in Stengel's case neither sound nor impulse could be determined for more than two minutes. The impulse may be much more forcible during the attack; in one case of my series (No. 5) the heart-beats, at 12 or 15 per minute, shook the front of chest with each impulse, and the first sound had a booming cannon-like quality. By means of skiagraphy Batjer was able to see clearly the auricles beating without the ventricles in one of my cases (No. 17). In one of Dr. G. A. Gibson's cases the auricular beats were seen on the electro-cardiogram.

Pulmonary Features.—Cases with chronic myocarditis present the usual symptoms of this condition, attacks of cardiac dyspnoea, cough, or angina pectoris. In several cases I have seen the acute emphysema which Dr. Goodhart describes in angina pectoris, a state in which the lungs are full of wheezing and bubbling rales, and the area of pulmonary percussion is increased—the *Lungenschwellung* of von Basch. Cheyne-Stokes breathing is not uncommon, and was present in 3 of my series. In the pseudo-apoplectic attacks the stertor, with deep laboured respiration and expiratory puffing of the cheeks, may have all the intensity of the genuine stroke. Before the epileptiform attacks there may be transient arrest of respiration with flushing of the face.

Clinical Course.—(i.) *The Cardiac Group.*—The cases associated with post-febrile myocarditis form a very definite and remarkable category. Cases have been reported in connexion with diphtheria, pneumonia, gonorrhoeal infection, and streptococcic pharyngitis complicated with nephritis. It has long been known that bradycardia may follow any of the acute infections. Usually regarded as an indication of myocarditis, it is quite possible that the nerve-centres are implicated, but in the reports with the Stokes-Adams syndrome there were no symptoms to suggest a lesion of the medulla. Next to the syphilitic this form is the most hopeful. Schuster's patient, a child aged four years, recovered after very severe attacks. The slow pulse may last for a few days only, as in Case 1 of my series in which the condition followed pharyngitis and nephritis. In some of the post-febrile cases the bundle of His is involved in an acute mural endocarditis.

The syphilitic category is also well-defined; the lesion, whether arterial or a coarse gumma, may invade the bundle. In my series 2 cases only had a history of syphilis. The picture may be very typical. A man (No. 17), aged thirty-four, was seen, November 17, 1904, with attacks of loss of consciousness and slow pulse. He had had syphilis in 1897, and a gumma of one rib in 1901. The heart-block, at first complete, was carefully studied by Erlanger, in whose paper the case is given in full. While under observation he had five or six severe syncopal attacks. He recovered rapidly on iodide of potassium, gaining twenty pounds in three months. Both cerebral and cardiac symptoms disappeared and he has remained well, his heart being normal when I examined him in January 1906.

By far the largest group is made up of the cases in which there are degenerative changes, fibrous, fatty, or pigmentary, at the auriculo-ventricular node, in the bundle of His, or in the ramifications of the junctional system. A diagnosis of the nature of the lesion is not possible. The cases occur in older individuals than in the other groups, and in a large proportion the anatomical change is an atrophy due to arteriosclerosis. In Case 19 (Turrell and Gibson) of my series, the coronary arteries were sclerosed and partially calcified. The bundle of His and its main ramifications were implicated in fibrous tissue, the bundle itself being represented only by a few indolent strands of muscular tissue. A majority of the senile cases will probably be found to present this kind of lesion. In a group of cases (Schmoll, Gibson, Stengel, and Dock), the bundle of His was implicated in a patch of chronic endocarditis. Degenerative changes of a fatty nature were present in the case of Adams, and of recent cases those of Butler and of Aschoff. In Case 20 of my series Dr. A. G. Gibson found a widespread brown atrophy in the fibres of the system.

The cases of the arteriosclerotic group present certain special features:—

Extraordinary Chronicity.—Although from five to six years may be taken as the average duration, in some cases the symptoms have persisted for twenty years or more. Heineke's first case was a women, aged sixty-four years, who had suffered from her thirtieth year, and in Case 7 of my series the attacks had lasted for more than ten years.

A Remarkable Variability in the Frequency and Character of the Cerebral Attacks.—After causing a great deal of trouble and worry the syncopal and epileptiform seizures may disappear, and for years, as with the late Sir William Gairdner, the patient may be very comfortable. Isolated epileptic attacks may occur over a long period of years. One patient had 9 attacks only in twelve years, and in the intervals enjoyed good health. Possibly Napoleon may have had this disease, as he is said to have had a slow pulse, and he is known to have had epilepsy.

When the attacks recur with great frequency, 50, 100, or more times in a day, the condition is serious. The prolonged syncope, with slowing of the pulse to 8 or 10, and the attacks with protracted intervals of asystole are always dangerous. The pseudo-apoplectic attack, which looks so serious, is one of the least ominous; Adams' patient had them for more than seven years, and Case 7 of my series for more than ten. As already mentioned, certain circumstances are apt to bring on the attacks, but we are quite at a loss to say why, with an apparently unchanged cardiovascular condition, the cerebral symptoms should disappear.

The Liability to Sudden Death.—As in all myocardial affections this accident is very likely to happen, either in an attack of syncope or while the patient is up and about and feeling very well. This occurred in 10 cases in my series.

Ordinary Myocardial Symptoms.—Dyspnoea on exertion, cough, signs of oedema of the bases of the lungs occur in a few cases, but it is remarkable for how many years the efficiency of the heart may be maintained with a ventricular rate under 40, the cerebral attacks alone indicating any disturbance of the cardiovascular function. Angina pectoris has been present in a few recorded cases; the attacks *sine dolore* have much in common with the syncopal seizures in Stokes-Adams disease, and the pulse may fall to 20 or 30, or there may be the same prolonged period of asystole.

The duration depends upon the cause. The acute myocardial forms are of short duration, but the arteriosclerotic and degenerative cases last for from 8 to 10 or 12 years, and in the intervals between the cerebral attacks the patients may be very well, and able to work, and enjoy life.

(ii.) *The Neurogenous Group.*—After injury to the cervical spine or caries of the 1st and 2nd cervical vertebrae bradycardia is common, but cerebral features are exceptional, and there are only a few well-marked cases with the Stokes-Adams syndrome. With gradual narrowing of the upper part of the spinal canal, as in the cases of Holbertin, Lépine, and Boffard, the condition may be more chronic, and recurring attacks of syncope give a very characteristic picture. The cases of meningitis (chronic and gummatous), tumour, and abscess usually present the localising symptoms due to pressure on other parts. The cases are very rare; Edes pointed out in his collected series that bradycardia is common, but the combination of slow pulse with characteristic syncopal and epileptiform seizures is exceptional.

Diagnosis.—There is rarely any difficulty in recognising the cases. In a patient seen for the first time in an attack of syncope or of pseudo-apoplexy the slow pulse should suggest the condition, as neither in true apoplexy nor epilepsy is bradycardia a prominent feature. The prompt recovery and the slight after-effects are peculiarities which distinguish the attacks from true epilepsy and apoplexy. There is a large group of borderland cases of bradycardia with occasional vertiginous attacks—*formes frustes* of the French. Some of these are very remarkable, as heart-block may be present for years without cerebral symptoms. In a man of sixty-eight, after an attack of pain beneath the sternum and slight vertigo, the pulse was noted to be slow, and for four years it remained at about 32, the auricular pulse as counted in the jugular vein being about double this rate. In senile bradycardia, with the pulse below 60, transient vertigo or syncope is not uncommon. In arteriosclerosis at any age vertigo may be an early symptom, but it is not necessarily associated with a slow pulse. The question of the existence of true epilepsy may arise, as in Burnett's case, a naval officer who sixteen years previously had had an epileptic attack and then at the age of forty-six had bradycardia with paroxysms of an epileptiform character. In Case 15 of my series a man of sixty had, at the age of forty-eight, a convulsion, and in twelve years had nine attacks. In the attack in September 1902 the pulse was noted to be very slow. When I saw him in October 1908 he had a pulse of 40, which had been the usual rate for a year. He had moderate arteriosclerosis, slight hypertrophy of the heart, and a soft diastolic murmur at the base. It is quite possible that the attacks at rare intervals during the twelve years were of the Stokes-Adams character, and his physican did not think there had been any change in their nature, though he had never been able to see one.

Slow pulse may be associated with neurasthenia, and there is a group of cases with certain of the features of Stokes-Adams disease. As already mentioned (p. 146), it is doubtful if Edes' well-known case should come in the group. I have reported 2 cases, both in typical neurasthenics, with pulses under 50; one patient, aged forty-four, had peculiar swaying attacks with pains in the head; the other had vertigo of a severe character. Both patients recovered. A third patient, a man aged thirty, very healthy and strong but excessively neurotic, felt faint while in church, so that he had to sit down. The attacks recurred for three months, one or two in a week. The pulse was 44; there was no evidence of arteriosclerosis, and the heart was normal; no jugular pulse could be seen as he was very stout. For more than a year the pulse-rate was under 50. He gradually improved, and when last heard of, on June 6, 1906, three years after my first note on his case, he was quite well.

Treatment.—In the post-febrile form the patient should be kept in bed. Small doses of iodide of potassium may be of use, but it is very doubtful if any medicine has an influence on acute myocarditis. With rest a majority of the cases recover. The syphilitic cases require thorough treatment; Case 17 in my series recovered rapidly on moderate doses of iodide of potassium. To any young man who admits exposure, it is well to give the benefit of the doubt and a thorough antisyphilitic treatment, inasmuch as gummas and arteritis may clear away and leave no damage. In the large group of arteriosclerotic cases in middle-aged men the life should be carefully regulated, moderation in food and drink and exercise enjoined, and, if the blood-pressure is high, nitroglycerin or sodium nitrite may be used. Iodide of potassium may retard the progress of the sclerosis.

There is no satisfactory method of accelerating the pulse-rate. The rhythm may return to normal for months without any special treatment. Atropine may be tried hypodermically, beginning with doses of $\frac{1}{100}$ of a grain, and, if this be well borne, the amount may be increased. Dehio, Gibson, and others have reported good results, but when once the heart-block is established in a man over seventy, nothing seems to influence it. Strychnine may be tried; a patient whom I saw in Oxford had great faith in it, and attributed the long intervals of freedom from attacks to its use. Digitalis is rarely called for, though in Case 7 of my series, a patient with an extremely feeble heart action and signs of oedema of the bases of the lung, it gave relief.

During an attack the usual restorative measure may be employed. The transient syncopes are usually over before anything can be done. A bottle with smelling salts may help to avert an attack. In the prolonged syncope with reduction of the heart-beats hypodermic injections of ether or of strychnine, strong electrical currents over the heart, and inhalations of oxygen may be tried. Nitrite of amyl does not appear to be of much service, but it may be used in the presence of pallor and marked vaso-motor disturbances.

Patients should be encouraged to watch for the earliest symptoms of the cerebral attacks, and attempt to ward them off by a sudden movement or a sharp stimulus to the skin. Blisters over the heart may be used.

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ANEURYSM

ANEURYSM

By Prof. W. Osler, M.D., F.R.S.

Definition—History—Classification—Etiology—Pathological Anatomy—Dilatation-Aneurysm—Dissecting Aneurysm—Saccular Aneurysm of the Aortic Arch—Aneurysm of the Descending Thoracic Aorta—Aneurysm of the Abdominal Aorta—Arterio-venous Aneurysm—Diagnosis—Prognosis—Treatment.

Definition.—A tumour containing fluid or solid blood in direct communication with the cavity of the heart, the surface of a valve, or the lumen of an artery.[1]

History.—There is no mention of the disease in Hippocrates. Galen was well acquainted with it, and he described two forms, one from dilatation, in which the tumour was deeply seated, and when pressed upon communicated to the fingers a noise (so that he must have recognised the thrill); the other, which arose from wounding of a vessel, was rounded and felt more superficial. He also gave an account of the aneurysm following venesection at the bend of the elbow, and cured one

[1] This definition embraces a majority of the conditions to which the term aneurysm is given, but it cannot be said to include simple dilatation of the aorta or of its branches, and the abnormal communication between two vessels.

due to this accident by the application of a sponge and bandages. That the Graeco-Roman profession knew external aneurysm thoroughly is shewn by the brilliant operation of Antyllos (*circa* 55-118 A.D.), which is still recognised in surgical textbooks. With Galen this author recognised two kinds of aneurysm—one from local enlargement of a vessel, the other following an injury, and speaks of the thrill as the distinguishing feature of the latter. In his operation the sac was enclosed between ligatures, and then laid open and emptied. That the modern practice of extirpation of the sac must have been carried out by some of his contemporaries is evident from a criticism which he makes upon this procedure. Practically nothing was added to our knowledge of the subject until the recognition of internal aneurysm by Fernelius, a distinguished French physician of the sixteenth century, who remarked, "that aneurysm likewise happens sometimes in the internal arteries, especially under the breast, about the spleen and mesentery, where the venous pulsation is often observed." In 1555 the great anatomist, Vesalius, was called to Augsburg to see one Leonhard Wolser suffering with severe pains. He found in the region of the back a pulsating tumour, which he diagnosed as an aneurysm and said it was incurable. Two years later the patient died, and an aneurysm of the aorta was found eroding the spine above the diaphragm. The sac had perforated the chest and projected beneath the skin. The patient had had severe haemoptysis. In the letter which Vesalius writes to Gassner, thanking him for sending him an account of the necropsy, he remarks on the frequency of aneurysm and on the varied character of the contents of the sac. He also mentions the case of a woman with an aneurysm in the abdomen, so that to Vesalius belongs the credit of having first described both abdominal and thoracic aneurysms. The first case is in many respects a remarkable one historically; not only was the diagnosis made by Vesalius, but we possess Gassner's very full notes of the necropsy describing the hard, fleshy concretions in the aneurysm; and the comment of Vesalius in reply shews that in his wide clinical and anatomical experience he had become very familiar with the disease. From this time on scattered references occurred in the literature, of which an excellent account is given by Freind in his *History of Physic*. Next to Vesalius, perhaps the most important sixteenth-century writer on the subject was Ambroise Paré, who recognised aneurysm by anastomosis, rupture, erosion, and injury. He was the first to suggest the relation of aneurysm to syphilis, and he describes the noise or blowing sound associated with the tumour, and the frequency of thrombosis in the sac and the occasional calcification. In the eighteenth century a number of important works on the subject appeared. In 1728 there was published the great monograph of Lancisi, the distinguished Roman physician, who recognised the importance of syphilis in the disease, and even spoke of a "venereal aneurysm." Morgagni's famous work, *De Sedibus et Causis Morborum*, 1761, gives an excellent impression of the very full knowledge which the men of that time had of the disease. An account of the symptoms and morbid anatomy of thoracic aneurysm could almost be compiled from Morgagni's description alone, and we owe to him the knowledge of the Valsalva method of treatment. As already mentioned, Galen had recognised two forms of aneurysm—one in which the vessel dilated spontaneously, and the other which followed injury. Throughout the eighteenth and early part of the nineteenth century the forms and classification of aneurysm were much discussed. Lancisi, adopting the Galenic view, divided aneurysm into true and false, corresponding to our division of spontaneous and traumatic. William Hunter not only made an important contribution to the subject of arterio-venous aneurysm, but he gave us the division into *true*, in which all the coats were dilated, *spurious*, in which one or more of the coats were ruptured and the other or others dilated, and a *mixed* aneurysm, in which the coats were dilated, and subsequently, by a rupture, a true was converted into a spurious aneurysm. A great discussion took place about the mode of origin and classification. Scarpa, whose famous monograph appeared in 1804, disregarding all these divisions, insisted that whatever its situation or its form an aneurysm did not arise by dilatation, but by rupture or corrosion of the internal lining of the muscular coats. He laid special stress upon the importance of the media in maintaining the strength of the vessel. Scarpa did not regard the uniform dilatation of the vessel as aneurysmal, holding that form only to be aneurysm which arises "at some point of the parietes of the arteries from the rupture of their proper coats." The exclusiveness of the views of Scarpa were criticised by Hodgson (1815), who believed that loss of the natural elasticity of the vessel-wall might lead to general dilatation, which he also regarded as an aneurysm. In his *Anatomie Pathologique* Cruveilhier gave an accurate account of the structure of the aneurysm, and in opposition to Scarpa held that the dilatations of all three coats existed at first, and that as the aneurysm grew the inner and middle coats were stretched and there were secondary sacculations. In the great monograph of Rokitansky (1850) spontaneous aneurysm was held to arise either through inflammation of the external wall, through tears or splits of both inner and middle coats, but most commonly by disease of the coats themselves, whether resulting in a diffuse cylindrical dilatation or in the formation of a sac.

The modern views of the origin of aneurysm date from the studies of Helmstedter (1873) and Köster (1875), who shewed that the primary and important change is in the elastic and muscular fibres of the middle coat of the vessel. Since then there have been many researches upon aneurysm, the two most important studies being Eppinger's and Thoma's. Both emphasised the changes in the media as the primary event, Eppinger regarding this change as rupture, Thoma holding that various disturbances of nutrition led to atrophy. The latter brought his views on aneurysm into accord with his studies on arteriosclerosis, believing that the compensatory thickening of the intima could even obliterate a small aneurysm. His article upon the dilatation-aneurysm is the most important that has appeared of late years. Of special interest is the confirmation of the old views of Paré and Morgagni of the syphilitic origin of the majority of cases of aneurysm of the aorta. The relation of the mes-aortitis to syphilis has been demonstrated by Köster, Heller, Chiari, Benda, and others. The introduction of the *x*-rays has given us an important help in the diagnosis of internal aneurysm. For clinical reference the most important monographs are those of Crisp (1846), Broca (1856), and Sibson's papers in his collected works; the recent pathological literature is admirably given in Lubarsch and Ostertag's *Ergebnisse* (1904).

Classification.—Numerous classifications have been made of aneurysms of the larger vessels, based on their external forms, the structures of the wall of the sac, or on the etiology. For practical purposes the following may be adopted:—

I. *True Aneurysm* (aneurysma verum or aneurysma spontaneum), in which one or more of the coats of the vessel form the wall of the tumour: (*a*) Dilatation-Aneurysm. (1) Limited to a certain portion of a vessel, fusiform, cylindroid; (2) Extending over a whole artery and its branches —cirsoid aneurysm. (*b*) Circumscribed saccular aneurysm in which there is a localised distension of two or more of the coats, or a dilatation of a limited area of the wall after destruction of the intima and part of the media. This is the common form of aneurysm of the aorta. (*c*) Dissecting aneurysm with splitting of the media, and occasionally with the formation of a new tube lined with intimal endothelium. II. *False Aneurysm* following a wound or the rupture of an artery, or of a true aneurysm, causing a diffuse or circumscribed haematoma. III. *Arterio-venous Aneurysm*, either with direct communication between an artery and vein, aneurysmal varix, or with the intervention of a sac, varicose aneurysm. IV. *Special forms* such as the parasitic, the erosion, the traction, the mycotic.

Etiology.—There are two chief factors, weakening of the coats of the aorta by disease, and strain, as expressed in sudden or prolonged increase of the intra-aortic blood-pressure. "In the normal condition, notwithstanding the variations in this stress from moment to moment, and its maintenance up to the point of physiological efficiency during a long lifetime, the balance existing between the elastic resistance of the vascular walls (chiefly due to the middle coat) and the forces tending to expand it is wonderfully well preserved; and persons may attain an advanced age in whom neither the heart nor any of the larger arteries appear to have suffered in any appreciable degree. This, if duly considered from the purely physical point of view, is nothing less than wonderful; and the wonder of it will surely increase when we remember how difficult—nay, how impossible—it would be to construct an artificial machine of elastic and distensible materials, which would not only resist indefinitely a constant mean internal pressure acting upon it through the contained liquids, but also a sudden impulse and variable increase of that pressure repeated periodically at the rate of over 100,000 times a day, or, say, 40,000,000 times a year, unceasingly, for all the seventy years of an average healthy human life" (Gairdner).

Disposing Causes—Age.—Hospital statistics and the Registrar-General's reports shew that aneurysm of the aorta is most common between the ages of forty and fifty. Of the 1101 deaths from aneurysm in males in England and Wales in 1906, 549 occurred between the thirtieth and forty-fifth years. In Crisp's well-known figures dealing with 555 cases of aneurysm in different regions, the largest number, 198 cases, occurred between the ages of thirty and forty. In the young, and in the very old, aneurysm of the aorta is rare, though it may occur at any age. Le Boutillier has collected 80 cases of aneurysm in persons under twenty years of age, 14 cases being under twelve years of age. Only 18 of these were of the thoracic aorta, and 5 of the abdominal. The cases may have all the features of thoracic aneurysm in the adult. Congenital aneurysm is very rare; one of the abdominal aorta was large enough to obstruct labour (Phénomenow). In the aged, thoracic aneurysm is more frequent than the figures indicate. It is very often latent, and multiple sacs are not infrequently met with.

Sex.—All statistics shew a marked predominance of males in aneurysm of the aorta, according to Lebert, in the proportion of 10 to 3. Both the factors mentioned above prevail in males; in females strain does not play an important part. In 1906, 882 males and 219 females died of aneurysm in England and Wales. The age-incidence in females is very much higher than in males.

Race and Locality.—Statistics indicate that the disease is much more common in Great Britain than on the Continent. In Vienna among 19,300 necropsies, there were 230 of aneurysm, whereas at Guy's Hospital among 18,678 there were 325 cases. It is stated that aneurysm is more frequent in England than in France, but I do not know of any comparative statistics to justify this statement. The truth is that neither race nor locality are important factors in comparison with the prevalence of syphilis among the hard-working members of the community. In the negroes of the Southern States of America aneurysm is more common than among the whites. At the Johns Hopkins Hospital, Baltimore, of 345 admissions to the medical wards for aneurysm, 132 were in coloured and 213 in white patients, a ratio of 1 to 1·61, whilst the proportion of white to coloured, among the total admissions to the hospital, is 5 to 1.

Prof. Leonard Rogers has very kindly analysed for me the post-mortem records of the Calcutta Medical College for the last thirty-five years. There were only 30 aneurysms in 5900 subjects—0·5 per cent. The Europeans, who formed only 7 per cent, had 0·22 of cases as against 0·28 per cent of the Hindu. Prof. Rogers states that syphilis and arterial disease are common among the natives, and he attributes the comparative scarcity of aneurysm to the low blood-pressure.

Occupation.—Persons who use their muscles to excess, particularly those whose occupation necessitates sudden strain, are particularly liable to aneurysm of the aorta. Sir Clifford Allbutt in 1871 called attention particularly to sudden strain as "not only the cause, but the commonest cause of aortic aneurysm." Soldiers, sailors, draymen, iron- and steel-workers, and dock-workers are particularly prone to the disease. The great frequency of aneurysm in the British Army demonstrated years ago by Myers and by Welch still continues. The figures for 1907 give 8 deaths from aortic aneurysm in a total strength of 118,521 for the home contingent. In Germany, 1904-5, there were only 4 cases of aneurysm in a strength of 555,777; in Italy in 1903, there were 6 cases in a strength of 206,468. In the British Navy in 1907 there were 24 cases among 108,740 men. At the Naval Hospital, Haslar, aneurysm is very common; 47 cases were admitted in seven years.

Determining Causes.—These may be placed in three groups: those which weaken directly the coats of the vessel; strain or internal trauma, leading to a break in the enfeebled coats; and certain special causes. I. The acute infections are the most important single cause of arterial degeneration; in scarlet fever, measles, diphtheria, enteric fever, small-pox, foci of degeneration are common in the aorta, but so far as aneurysm is concerned they are not very important. In many instances the intima alone is involved, but, as W. S. Thayer has pointed out in connexion with enteric fever, and Wissal in connexion with the acute infections of children, the changes may be in the media. There is only one infection of any moment with which aneurysm is connected, namely, *syphilis.* This was recognised, as we have already mentioned, by Paré. Both Lancisi and Morgagni realised the great influence of venereal disease, and in his wonderful section on aneurysm the latter gives case after case with a history of syphilis. In 1876, Francis H. Welch of the British Army called attention to the great frequency of syphilis among the subjects of aneurysm in the British Army—66 per cent. These figures have been amply confirmed, and among the percentages given may be mentioned the following:—Malmsten, 80; Heller, 85; Hampeln, 82; Etienne, 69 to 70; Pansini, 65. As has proved the case with locomotor ataxia, the more closely individual cases are investigated the higher the percentage is shewn to be infected. Indeed, in men under 40 it may be said to be by far the most important single cause.

There is now a consensus of opinion regarding the existence of a syphilitic aortitis with very definite characters. Macroscopically it is limited in extent, involving the root of the vessel or a band an inch or two in width of the arch or of the descending aorta just above the diaphragm, or there is a patch at the orifice of the coeliac axis. The intima does not present the usual appearance of the atheromatous change, but there are shallow depressions of a bluish tint, short transverse and longitudinal puckerings, sometimes with a stellate arrangement, or the intima is everywhere scarred with depressions and linear sulci. In most cases the diagnosis may be made at a glance, but there may be much more disease than indicated by inspection, and under a smooth and normal-looking intima there may be widespread mes-aortitis in an early stage. Microscopically there are found (1) foci of small-celled infiltration in the adventitia and media, sometimes so large that they look like miliary gummas, and were so described as far back as 1877 by Laveran and by Heiberg. (2)

Necrosis, fracture, separation, and disappearance of elastic and muscular fibres of the media, usually in patches, but often widely spread throughout the aorta. (3) The spirochaetae may be found in the lesions. The following features suggest syphilis in a given case:—The age—under forty a large majority of cases are luetic; sudden death due to perforation in the small aneurysm of the arch; multiple sacs, particularly the small cup-shaped form; the presence of syphilitic lesions of bones, eyes, liver, testicles, etc.; the onset with angina pectoris and aortic insufficiency; parasyphilitic manifestations as tabes and general paralysis; or the husband may have tabes and the wife aneurysm, or, as reported by Jaccoud, both husband and wife may have aneurysm; and, lastly, the beneficial effects of antisyphilitic remedies.

In any of the infections a patch of mes-aortitis may lead to a localised weakening of the wall and aneurysm, and in this way pneumonia, erysipelas, and influenza may be mentioned as possible causes. French writers, particularly Lancereaux, lay great stress upon malaria as a cause, but recent studies have not borne out this view. In Baltimore, where aneurysm is so common among the negroes, we were never able to trace any direct connexion with this disease. In another way the acute infections may be associated with the formation of aneurysm. The endocarditis of rheumatic fever, pneumonia, or of septicaemia may extend directly from the aortic valves to the intima of the vessel with the production of an extensive aortitis and aneurysmal dilatation. Quite as frequently, I think, as in the remarkable case I have reported, the process is embolic, and over foci of mes-aortitis the intima splits with the production of an aneurysm. Rheumatic fever as a cause of aneurysm has been specially studied by French writers, and the literature is fully given by Feytaud. The cases are in young subjects who have had repeated attacks.

The other great factor in weakening of the coats of the vessel is the intoxications:—the exogenous poisons, such as alcohol, lead, and tobacco, and the endogenous poisons, the results of perverted metabolism in gout, diabetes, chronic Bright's disease, etc. These lead to widespread degeneration of the arteries, but they are in themselves rare determining causes of aneurysm. The relation of atheroma of the aorta to aneurysm has been much discussed. It has long been recognised that the age-incidence of atheroma and of aneurysm of the aorta is not the same. A large number of cases of aneurysm occur in aortas that are not extensively diseased. On the other hand, the most extreme endarteritis deformans may exist without aneurysm. Arterial degeneration does not necessarily weaken the vessel, as when the intima is chiefly involved it may be, as Thoma points out, protective and defensive. The danger lies in the localised areas of degeneration in the elastic and muscular elements of the media, not in the widespread pan-aortitic changes or what is called atheroma (*vide* also p. 599).

II. The second important factor in the production of aneurysm is high blood-pressure—*internal strain*—particularly that which is associated with sudden and violent muscular effort. Aneurysm occurs most frequently at the active periods of life, and in men who use their muscles very vigorously for short periods of time. A permanent high pressure may lead to degeneration of the coats, but what is much more important is that in a severe exertion, as in lifting, jumping, straining at stool, or in the act of parturition, a sudden heightened tension (an internal trauma) picks out a weak spot and the intima cracks over an area of mes-aortitis. The experimental production of aneurysm illustrates very clearly these two methods of the formation of aneurysm. Following the introduction of adrenalin, there is widespread aortic degeneration with areas of calcification of the media. In certain regions of the aorta local bulgings are found in which the intima is pushed directly into an area of weakened media and externa; in others, as so well figured by Fischer, over local areas of degeneration of the media the normal-looking intima splits, and behind this is a small saccular dilatation—the beginning of an aneurysm. In man the latter method is the more common; the former may occur in the aged in any vessel extensively diseased.

III. *Occasional Causes.*—(*a*) Embolism.—The emboli may consist of valve vegetations, bits of thrombi, or calcified fragments from the valves. The cases are most commonly met with in infective endocarditis. The aneurysms are often multiple, and may be in the peripheral or mesenteric vessels. They are most frequent in the smaller arteries, and they rarely attain a very large size. The septic embolus may infect the arterial wall, causing acute inflammation of all the coats and the formation of a circumferential aneurysm. This is the common event in infective endocarditis. In the larger vessels the embolic aneurysm is due to foci of softening of the media in consequence of infection through the vasa vasorum. The intima over these small areas ruptures, and in this way small and large saccular aneurysms are formed. As many as four or five of such sacs may be present in the aortic arch, as in a remarkable case which I described in 1888. The embolic aneurysm is not always mycotic. A small calcified fragment may lacerate the wall. In an interesting case of this kind at the Radcliffe Infirmary, Oxford, the patient, an old examination subject, whose musical aortic diastolic murmur had been well known for some years, had a sudden severe pain in the calf of one leg, which became swollen, hot, and painful. When admitted, there was so much swelling and pain that it was not possible to say what was the nature of the trouble, but as these subsided pulsation became visible and he recovered in a few weeks with a well-marked aneurysm of the posterior tibial artery. A point of special interest was the disappearance of the musical quality of the diastolic murmur, which makes it probable that a calcified spike of vegetation had been whipped off as the embolus.

(*b*) External injury has been recognised as an occasional cause of aneurysm since the time of Vesalius. A blow on the chest, a sudden fall, or the jar of any accident may cause rupture of the aorta with the formation of a dissecting aneurysm, or in the course of a week or a month the clinical features of aneurysm may be present. Usually the cases present the symptoms of ordinary saccular aneurysm of the aorta, but in one of my cases, reported by M'Crae, there was dilatation of the aorta. Trauma is a very common event in aneurysm of the abdominal aorta. The essential feature is a split of the intima and inner portion of the media; the wall may rupture completely, a dissecting aneurysm may follow with healing or with rupture, or the split may be small in extent and behind it the weakened media and adventitia yield with the gradual formation of a saccular aneurysm.

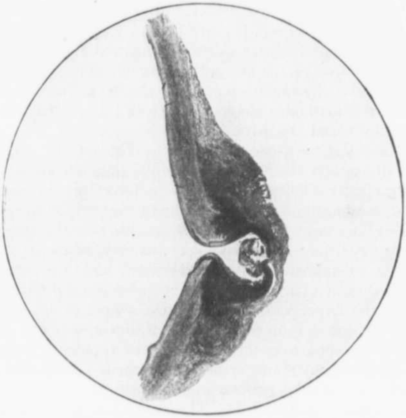

FIG. 80.—Tuberculous aneurysm of the aorta. The section is through part of the thoracic aorta. From a case of intensely acute miliary tuberculosis in which there was an old focus of tuberculosis in the apex of one lung, and this by haemic infection produced tuberculosis of the adventitia of the aorta. This extended until the media was so weakened that dilatation occurred. There were numbers of tubercle bacilli in the loose coagulum at the bottom of the aneurysm, and also in the caseous material around it. × 8. (Councilman.)

(*c*) Among the rarer causes of aneurysm may be mentioned external erosion. A bullet may lodge near the wall of an artery or abraid it, or the wall may be weakened by an adjacent tuberculous focus or by a small abscess.

(*d*) Hypoplasia of the aorta may be associated with aneurysm. Lee Dickinson described two cases in young adults with very small aortae without arterial sclerosis. One case presented three aneurysms.

Pathological Anatomy.—Two different groups of cases of aneurysm of the aorta come to necropsy. In hospital practice we see the large tumours in patients who have had well-marked symptoms. Only a limited number die suddenly in the wards without the condition having been recognised. The second group come under the notice of the medical jurist, and it is only the coroner-physician in a large city who appreciates the extraordinary importance of aneurysm as a cause of sudden death. These are the small tumours above the aortic ring, the syphilitic aneurysms in young men, the splits and fissures of the intima, and the dissecting aneurysms.

Considering how commonly the tumour perforates the sternum, rupture with death from external bleeding is very rare. Not uncommonly the area of skin at the point of maximum protrusion becomes necrotic, or the fibrinous laminae may be exposed. After death, a large external tumour may diminish greatly in size. In opening the thorax in a case of suspected aneurysm it is important to make a very careful dissection of the relations of the great vessels in situ. Rupture takes place frequently into the pericardium, in which case the sac is distended and may contain a pint or more of blood. In a few rare instances the fatal result does not follow at once, and there may be firm and laminated thrombi. Rupture into the pleura is also very common, in which case the volume of blood is large, amounting to three or more pounds, the lung is compressed, and there is a large solid clot at the posterior part of the pleura with the clear liquor sanguinis above. When perforation has taken place into the trachea or a bronchus, blood is usually brought up and some may pass into the bronchi. In a few instances blood is not brought up, but passes into the stomach; I dissected one case of this kind in which death occurred without any external bleeding.

Situation of the Aneurysm of the Aorta.—The arch is most commonly affected, and the ascending portion more frequently than the transverse; the descending thoracic aorta being the part least often affected. The ratio of implication of the abdominal and thoracic was about 1 in 6 in the Guy's Hospital series. In the collected statistics of Crisp, Lebert, and Myers the ascending aorta was involved in 159, the transverse arch in 113, the descending thoracic aorta in 49, and the abdominal aorta in 83.

Number.—As a rule, only a single aneurysm is present, but it is not uncommon to find two or three. Cases are recorded of a dozen or more in the course of the vessel. The mycotic aneurysms are usually multiple. In the ascending arch there may be four or five small cup-shaped tumours. Some individuals are peculiarly subject to aneurysm of different vessels; the late Dr. Thomas King Chambers had first an aneurysm of the left popliteal artery, then of the right vessel, and finally of both carotids.

The *size* of the aneurysm of the aorta ranges from a cup-shaped sac the size of the tip of the little finger, to a huge tumour as big as an adult's head, the contents of which may weigh five or six pounds. The largest sacs are connected with the terminal portion of the arch and the descending thoracic aorta. Growing in these situations, the tumour may occupy a large part of the thorax, or it may perforate the chest-wall and form a huge subcutaneous tumour, as shewn in Fig. 81.

Form.—There are two great types, one in which the lumen of the aorta is dilated, the other in which the limited section of the wall gives way with the formation of a sac. The dilatation-aneurysm may be cylindrical, in which case there is uniform enlargement of the tube, either in a limited section or, as it sometimes happens, of the entire aorta. More frequently it is a localised enlargement of the arch alone, either cylindrical or fusiform. Sometimes the arch forms a huge flabby sac, or there may

FIG. 81.—Aneurysm of the thoracic aorta perforating the chest-wall.

be a very definite spindle, or even the sections of two spindles. Some of the most typical fusiform aneurysms are of the abdominal aorta. The localised aneurysmal tumour may be saccular, communicating with the lumen of the aorta by a narrow neck, saucer- or cup-shaped, crater-like, tent-shaped, or sphenoid, or multilocular when on a large sac a series of secondary tumours arise. Clinically, the dilatation and the saccular aneurysm are very different. Sometimes they are combined.

Structure.—The large fusiform or cylindrical aneurysms of the aorta present a rough atheromatous intima, often with calcified plates, foci of atheromatous softening, and here and there localised bulgings or secondary sacs, with flakes of adherent thrombi. The walls of the dilated vessels are thin. There may be very little adhesion to adjacent structures. In other cases parts of the fusiform dilatation may be occupied by firm thrombi.

In the localised saccular aneurysm, whether cup-shaped, crateriform, or tent-like, the intima of the aorta usually terminates at or close to the margin of the sac. In the small cup-shaped aneurysms just above the aortic ring the walls are thin, even translucent, and there is frequently a spot of perforation into the pericardium. Only in small sacs is the lining composed of a thickened intima; in the larger ones it is made up of remnants of the media and a thickened adventitia. Then comes a stage in the growth of large sacs when part of the wall is no longer made up of arterial coat, but is in direct connexion with the adjacent tissues, lung, pericardium, bone, mediastinal tissues, or skin.

Evolution of an Aneurysm.—Three factors are concerned, first, the necrosis and fracture of the elastic and muscular elements of the media, permitting a split or tear of the intima or its gradual yielding over the weakened area; secondly, a constant blood-pressure in the aorta, heightened by many causes; and, thirdly, remarkable reparative processes, namely, new growth of connective tissue and a strengthening of the wall of the sac by the deposition in sheets of fibrin. Once started it becomes a struggle between the blood-pressure, which tends gradually to stretch the weakened spot, and the reparative processes which strengthen it. In some very acute cases there is little or no attempt at repair; but in a majority of aneurysms of the aorta the reparative processes are among their most distinctive anatomical features. Two structures are at work in repairing the break—the connective tissues of the wall and of the adjoining structures, and the blood, from which tough fibrinous mats are laid down. In small aneurysms, in which the connective-tissue repair is seen to perfection, it is an intimal affair. As Thoma has pointed out, a local bulging on the wall of such an artery as the ophthalmic may be completely obliterated by new growth from the intima, so that the inner surface of the artery and of the sac are on a level. Even in small sacs of the aorta this process may be effective (see Fig. 5, Pl. I., *Virchows Arch.*, Bd. cv.), but it is much more common in the smaller vessels. This power of repair is present in every aneurysm in which the intima remains; but as a rule the growth of the sac is far too rapid for the reparative endarteritis to be of much service. In the ordinary aneurysm of the aorta the active proliferation of the tissues of the adventitia, the thickening of the mediastinal, pericardial, pleural, and other structures, and the passive resistance offered by neighbouring parts, are the three great factors in resisting the gradual enlargement by the incessant strain of from 60 to 80 charges per minute of a powerful pump into its interior. The second important element in the repair of an aneurysm is thrombosis—the deposition from the blood of laminated fibrin. It is not the ordinary clotting, the red clot, but it is by the formation of white thrombi, the active clotting of Broca, that the fibrin is deposited layer by layer, until a sac the size of an orange may be completely filled with from 30 to 60 layers, which may be peeled out like the coats of an onion. We know nothing of the circumstances in which this process occurs, except that it is seen most often in sacs with narrow necks, but there may be no trace of it in aneurysms that look most favourable for the process. It may occur in the spindle or cylindrical forms. The process may be traced on the wall which shews a greyish-white deposit of platelets ribbed like sand on the sea-shore, or arranged in a network. The lamination

FIG. 82.—Healed aneurysm of the arch of the aorta. The specimen is in the museum of M'Gill University, Montreal.

is in some way connected with the deposition of the blood-plates, with which, as we know, the thrombosis is associated. Leucocytes and red corpuscles take part in the process, and at first the layers of fibrin are reddish-brown, but in very old sacs the colouring matter disappears and the laminae become greyish-white. In long-standing cases lime salts may be deposited, and the whole becomes a firm calcified mass. In the natural process of healing the sac may be obliterated, a cup-shaped depression remaining at the mouth, but the surface of the thrombus may be as smooth and hard as the palm of the hand. Healed in this way the sac shrinks to a firm solid mass, which may remain unaltered for twenty years or more. On cross-section, as shewn at Fig. 82, the concentric laminae are seen. Organisation does not take place, and even at the periphery, where the thrombus is embraced by a firm fibrous capsule, vessels do not pass into the laminae. In the fusiform aneurysm, as shewn beautifully in Hodgson's figure, the thrombus appears to be canalised; but this represents in reality the original lumen of the vessel.

Effects of Compression.—In its growth an aneurysm destroys all structures which resist its advance. Soft structures, as the vessels, the oesophagus, and the lung, may be pushed aside, but the incessant pounding hour by hour, day by day, gradually destroys the hardest tissues. Passing anteriorly the sac erodes the sternum, the cartilages, and the ribs, and may force a breach in the wall of the chest sufficiently large to admit two fists. By the growth of the aneurysm backwards the bones of the spine may be eroded even to the canal, and not uncommonly the half-destroyed bodies of from three to six or even more vertebrae may be found free in the sac. As noted by Morgagni, the intervertebral discs, which are yielding structures, are not destroyed at the same rate as the bone, and may remain more or less intact, while the bodies are deeply eroded. The cord may be compressed, and the dura mater has been exposed for 4 or 5 inches in the sac. In rare cases, the spinal changes are so extensive and deep that a curvature follows. In the upward growth of an aneurysm of the arch the clavicle may be dislocated, and its sternal half destroyed. A solid organ may completely disappear; in one of my cases the left kidney had been absorbed. Many hypotheses have been advanced to explain this destruction of solid bodies by the aneurysm—a "corrosive ichor," from the blood, mechanical erosion, and, in the case of bone, a rarefying osteitis. The mechanical effect of the intermittent pounding is the important factor, and the structures are worn away as the often-falling drop erodes the hardest stone.

DILATATION-ANEURYSM.—Diffuse dilatation-aneurysm of the arteries is met with under two conditions. In one there is a passive dilatation of the aorta or of its main branches, due to disease of the walls; this may be local or involve the aorta in its entire course. In the other condition, which is seen most frequently in the smaller branches, there is an active dilatation, due to growth and enlargement of the vessel.

Dilatation-Aneurysm of the Aorta.—Morgagni drew a clear distinction between the aneurysm which occupied the whole circumference of the vessel and the tumour which affected one side only. Scarpa, who recognised dilatation of the whole aorta, did not regard it as aneurysm. Joseph Hodgson, in 1815, distinguished the condition clearly from ordinary aneurysm, and spoke of it as a "preternatural, permanent enlargement of the cavity of an artery." He described it as specially affecting the arch, and observed that the symptoms suggested organic disease of the heart rather than aneurysm. He knew of its association with insufficiency of the valves, and it is this combination to which the French gave the term *Maladie de Hodgson.* In his well-known study on aneurysm Thoma gives by far the best recent account, and he describes and figures a number of forms. The following are among the most important varieties :—(1) Diffuse dilatation of the entire aorta. Occasionally the entire tube is uniformly dilated, measuring 7, 8, or even 9 cm. in circumference. Nearly every museum contains one or two illustrations of this, the specimens having usually come from very old persons with extensive endarteritis deformans. Cruveilhier gives a good figure of this condition in his atlas. (2) Localised dilatation. This is much more common in the arch, which may be uniformly affected, sometimes cylindrically, in others spindle-shaped. The disease may be confined to the thoracic or to the abdominal portion of the aorta. Thoma figures a whole series of these dilatations, particularly the varieties of fusiform aneurysm. Some of these are multiple, and not uncommonly a sac is engrafted on a spindle-shaped aneurysm. In connexion with the upper part of the thoracic aorta, Thoma describes a special form, the tent-shaped or sphenoid, which he regards as the result of extra tension at the point where the upper intercostal arteries are given off. Thrombi may be present, and occasionally form firm laminae; a fusiform aneurysm of the descending thoracic or of the abdominal aorta may be almost completely occupied by firm laminae. The vessels given off from the arch and the iliacs are not infrequently involved in the dilatation. With dilatation of the arch the aortic ring may be dilated, and the valves themselves are often sclerotic and shortened.

Etiology.—The essential factors are really those of chronic aortitis leading to loss of elasticity and with gradual dilatation. In T. M'Crae's series of 35 cases at the Johns Hopkins Hospital the ages were as follows: thirty to forty years, 8; forty-one to fifty years, 12; fifty-one to sixty years, 11; sixty-one to seventy years, 3; seventy-one to eighty years, 1. These figures from the wards of an active general hospital scarcely give the true incidence, as the condition is common in old people and is met with much more frequently in almshouses and asylums. Of the patients under forty years 4 had a definite history of syphilis. Males are much more frequently the subjects of the condition—31 to 4 females in M'Crae's series.

At the Johns Hopkins Hospital our attention was early called to the great frequency of arterial disease in the coloured patients, and in M'Crae's series of dilatation of the aorta 14 of the 35 were negroes. Syphilis is an important factor, and there was a definite history in 10 cases and a strong probability in 7 others. A large proportion of the patients had done heavy muscular work. In 1, the dilatation seemed to have followed a severe strain and exposure in a shipwreck.

Symptoms.—As Hodgson remarked, the condition is very frequently mistaken for heart disease. Pressure features are not so often met with as in the saccular aneurysm. On the other hand, the symptoms of aortic insufficiency, myocarditis, and angina pectoris are common. Now that the *x*-rays have given such important aid in the diagnosis the condition will be more frequently recognised. Thoma remarks in connexion with his interesting series of cases that in scarcely one had the condition been recognised in the wards. There are several groups of cases: (1)

The latent in which the dilatation is discovered in persons who have not had any indications of cardiovascular trouble. In the post-mortem work of infirmaries and almshouses it is not very uncommon to find extensive dilatation of the arch or, indeed, of the entire aorta in individuals who have not presented any special symptoms. An old woman, in the Philadelphia Hospital, whose calcified peripheral arteries edified the students of successive ward-classes, had otherwise a very normal circulation; her heart's action was slow, and it was frequently a matter of comment that it should be so normal. After her death from an intercurrent malady we were all greatly surprised to find that her thoracic aorta was very markedly and uniformly dilated, and in a state of the most advanced endarteritis deformans. (2) The clinical picture may be that of angina pectoris. This is most commonly seen in the young syphilitics with aortitis and slight dilatation of the arch. Sometimes it is in the senile form that the attacks may recur at intervals for years without any other sign of heart disease. (3) A group in which the clinical features are those of aortic insufficiency, or the symptoms are directly associated with progressive failure of the heart-muscle. This was the group which Hodgson referred to as having the clinical features of disease of the heart. Lastly, in a few cases there are the symptoms and physical signs of aneurysm. Pain was a prominent feature in 6 cases. In the 35 cases analysed by M'Crae, dyspnoea was the most constant symptom, and was almost always associated with cardiac insufficiency, which also explained other features such as oedema of the feet and cough.

Pressure Effects.—In striking contrast to the saccular aneurysm these are not well marked. Fulness of the veins of the neck and arms was noted in 12 cases. The radial pulses were unequal in 2. In a few cases of great dilatation the trachea is flattened, but paroxysmal dyspnoea is rare. Tracheal tugging was noted in three instances. Inequality of the pupils was present in 4 cases, and paralysis of the left vocal cord in 2. Dysphagia was present in 1 case. Erosion of the bones is rare; it may occur in connexion with the saccular aneurysm engrafted upon the dilated arch.

Physical Signs.—Inspection gives the most important indications. Visible pulsation in the episternal notch is present in a majority of the cases, and it may extend above the right sterno-clavicular articulation. Barié thinks the throbbing in this situation, due to elevation of the right subclavian, is one of the best indications of dilatation of the arch. Sometimes there is a prominent tumour filling the sternal notch. Pulsation in the first and second right interspaces is not nearly so common. It was present in 6 cases in the series. A diffuse pulsation of the manubrium is present in about half the cases, but in old persons with rigid chest-walls there may be an extreme degree of dilatation without any visible pulsation. Careful inspection in a good light is very necessary for the detection of the diffuse impulse over the manubrium. In no case of the series was pulsation visible in the back. By palpation the forcible throbbing of the dilated arch may be felt in the sternal notch. A rough systolic thrill is sometimes felt over the manubrium, and occasionally, when the valves are insufficient, a diastolic thrill. A sharp diastolic shock may be felt over the aortic area. In a majority of cases, 29 out of the 35, percussion reveals dulness over the manubrium, which may extend into the interspaces on either side. On auscultation the most characteristic sign is a bell-like second sound of a very clanging and metallic, sometimes an amphoric, quality. Another important auscultatory feature is the transmission upwards, when present, of the diastolic murmur, which may sometimes be heard loudly over the manubrium, and even propagated into the vessels of the neck. The blood-pressure of 20 of M'Crae's 26 cases in which it was taken was below 140 mm. In two patients there was an average of 80 mm. The highest pressure was 260 mm.

Examination by *x*-rays.—In skilled hands the diagnosis is readily made with the fluoroscope, as the dilated aorta casts a very definite shadow extending high in the thorax, much larger than the normal aorta and shewing very little difference in extent during systole and diastole.

The *diagnosis* is not often made, unless a constant outlook is kept for the condition. The important points are: (1) The diffuse pulsation, for the detection of which a good light is always necessary, and sometimes trained eyes. (2) The clanging metallic quality of the second sound. (3) When present, the widespread diffusion of the diastolic murmur upwards; and (4) lastly, and most important, the fluoroscopic examination.

Active Dilatation-Aneurysm.—Diffuse Arterial Ectasia.—Cirsoid or Racemose Aneurysm.—In this remarkable form the arteries enlarge actively by a new growth of vascular tissue. The blood-vessels retain their embryonic power of growth throughout life, and when a main vessel of a limb is tied, the collateral circulation is re-established by an active growth and enlargement of the arteries. The enlargement of arteries in splenomegaly, in the pregnant uterus, and in many other conditions illustrates the extraordinary plasticity of these structures. Spontaneous enlargement with dilatation is chiefly seen in the smaller branches, and is known by the names already mentioned. Vessels of the fourth and fifth dimensions are most frequently affected. In many cases the process is confined to the arteries; in other instances the veins are dilated, and even the capillaries may be implicated, forming a diffuse angioma. The vessels most often attacked are those of the head and the hands, but the blood-vessels of the feet or any group in the body may be involved. Occasionally those of the internal organs are affected.

Etiologically there are three groups of cases. In the first, the process begins in a small birth-mark or a tiny angioma, particularly in those about the ears or the forehead. In such the angiomatous structure is preserved, the skin is involved, and while the arteries progressively increase in size and throb forcibly, the veins and capillaries also enlarge. In the second group, aneurysmal dilatation follows directly upon an injury, such as a blow upon the head, a slap on the face, a slight burn; and, lastly, in a remarkable group the condition follows an acute infection. In a case reported by Bazy, a man, aged nineteen, had, during convalescence from an attack of enteric fever, an induration on the palmer surface of one hand. In a few months dilatation of the arteries of this hand began, which progressively increased, and within a couple of years the radial artery was as large as the brachial. In a patient of Reverdin's, aged thirty-one, an illness resembling enteric fever was followed by a swelling over the left eyelid. It gradually increased and formed a pulsating tumour of the temporal region. Reverdin operated and removed a bunch of convoluted branches of the temporal artery. In 1903 a patient, convalescent from enteric fever, under my care at the Johns Hopkins Hospital, presented a very remarkable bruit high up in the interscapular region, and on both sides of the spine a group of greatly enlarged, tortuous, throbbing arteries not involving the skin. Two other bunches, not quite so large, were present in the subcutaneous tissues of the abdomen. He was aware of their presence, but he thought they had enlarged since the fever.

Symptoms.—When small the cirsoid aneurysm causes no trouble. The patient just referred to had no unpleasant sensations. The large throbbing angiomas, which invade the skin, cause great disfigurement, and in the hands or feet considerable disability. In those starting from a small birth-mark or a naevus, the skin is swollen, of a bluish tint, the dilated arteries are readily seen, and if the whole skin is not involved there may be numerous telangiectases. With the large angiomas on the side of the head there may be exophthalmos, and the process may implicate the skull and the dura mater. One of the most extraordinary features of the cirsoid aneurysm is the rapidity of its growth, and in this respect it may resemble a neoplasm. Over the dilated vessels there is pulsation, and usually a thrill. With the stethoscope, if the arteries alone are dilated, there is a loud systolic murmur. When the veins and capillaries are extensively implicated there is a continuous whirring murmur with systolic intensification. Another remarkable feature is the occasional spontaneous disappearance, of which a number of cases are on record. In several the diminution has followed an acute erysipelatous inflammation. A striking instance is reported by Fernell: A man, aged twenty years, had a large pulsating tumour 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 arteries were easily felt, greatly enlarged, and tortuous. During an attack of measles, in which the temperature rose to 106·5° F., the tumour 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. After the attack the tumour began to subside, gradually the pulsation and thrill disappeared, and it shrank to a mass of hard connective tissue which could be rolled about.

Dissecting Aneurysm.—A majority of aneurysms of the aorta begin with a split or crack of the intima over a spot of mes-aortitis. Recently experimental work has shewn the important bearing of these fissure. When a fracture has once started, five events may follow:—The aorta may rupture in all its coats; an ordinary aneurysm may form at the site of the split; the fracture, though large and even circumferential, may heal completely; the blood may extend between the coats of the aorta separating them for many inches or in the entire length of the vessel; and, lastly, a dissecting aneurysm thus formed may heal perfectly.

I. **Rupture of the Aorta.**—There are two groups of cases: (*a*) The traumatic, in which the accident follows a blow on the chest or back, or a fall; and (*b*) the spontaneous, in which, during rest or during a sudden effort, the vessel ruptures. Four-fifths of the cases come in this class. Prolonged straining efforts, as at stool, during confinement, or in lifting, emotional excitement, laughing, crying, the strain of coitus, are among the exciting causes. It occurred in a healthy boy of thirteen after prolonged muscular exertion. Men are more liable to it than women in the proportion of 70 to 24, according to Maurice Martius. It is more common after the thirtieth year of life. The usual seat of the rupture is the first part of the arch, 89 cases; there were 18 of the transverse portion, and only 5 of the abdominal aorta. In a large proportion of the cases rupture takes place into the pericardium.

The vessel may be almost torn away from the heart; the intima usually shews a very sharp-edged break, which may be from a few millimetres in extent to the entire circumference. Some little separation of the coats is usual before the blood bursts through the adventitia, so that the external opening is not always opposite the break in the intima. The vessel itself is almost always diseased, though little may be apparent, as there may be extensive mes-aortitis with a smooth intima.

Symptoms.—Death may take place instantly (26 cases); in others it follows in the course of a few hours, but in about half the cases there are two very characteristic stages, one corresponding to the rupture of the inner coats, the other to the external and fatal break. In one of the first and one of the best reported cases in literature, by Linn, a woman, aged twenty-nine, while in labour, started up in bed with an agonising pain in the heart, and said she was dying, and became cold and pulseless. Linn thought the heart had ruptured. After delivery she revived and improved gradually until the fourteenth day, when she again had an agonising pain in the chest, and died in a few minutes. The aorta had ruptured into the pericardium. The interval from the internal rupture, which seems always to be accompanied with great pain and collapse, may be from six or eight hours to fifteen or sixteen days. The cases are of great medico-legal interest as rupture may follow a very slight blow or fall, or occur in a scuffle during a quarrel.

II. **Rupture of the Inner Coats with the Formation of a Saccular Aneurysm.**—Weakness of the media due to necrosis and fracture of the muscular and elastic fibres is the essential factor in ordinary spontaneous aneurysm. A split of the intima may occur over this weakened spot, and the blood, instead of separating the coats, may cause a bulging or aneurysmal dilatation. This may be well seen in experimental aortitis in the rabbit. The little fissures in a perfectly smooth intima lead into a pocket or pouch. In the embolic mes-aortitis, which may follow endocarditis, I have seen in the arch five splits of the intima, each one leading into a small aneurysm. A woman, aged thirty-five, who died suddenly, presented in the thoracic aorta a linear fissure 1·5 cm. in extent, which led into a sac the size of a small apple; this had ruptured into the oesophagus. This aspect of the subject will be more fully considered under ordinary aneurysm (p. 650).

III. **Fracture of the Inner Coats with Healing.**—Rokitansky first pointed out that splits and tears of the intima might heal completely; he reported 5 cases. The condition is one of the most remarkable in the whole range of vascular pathology. A man, aged sixty, was

FIG. 83.—Completely healed split of the intima surrounding the entire aorta just above the valve. Recent split with dissecting aneurysm, which burst into the pericardium. Daland's case.

admitted dyspnoeic and dropsical, with pain in the chest and a very feeble heart; after death there were found above the aortic valves splits of the intima with separation of the middle coat, but the edges were smooth and rounded, and where the middle coat was exposed it had a cicatricial appearance. Von Recklinghausen, Zahn, von Schroetter, and others describe and figure the condition. Reproduced here is the drawing made from Daland's case, the heart of which I dissected with him. Three years before death the man had an attack of severe pain in the chest and unconsciousness, from which he gradually recovered. Death occurred suddenly from rupture into the pericardium. In the entire circumference of the aorta the intima was split as if cut with a razor. From this a dissecting aneurysm had separated the coats of the ascending aorta, and broken into the pericardium. But the remarkable feature was the scarred and cicatricial first inch above the valves, where on a former occasion, probably in the attack three years before, the intima had ruptured and exposed the media which, with the edges of the intima itself, is smooth and fibrous.

IV. **Dissecting Aneurysm.**—Extensive separation of the coats of the aorta beginning at the site of the split is rare. There were only 2 cases in sixteen years at the Johns Hopkins Hospital, but in medico-legal work it is comparatively common. The late J. B. S. Jackson, of Boston, U.S.A., made a large collection in the Warren Pathological Museum, where I was able to look over twenty specimens. One of the earliest cases described was that of George II., who died of rupture of the right ventricle, and in whose aorta there was also a transverse fissure through which the blood had passed under the external coat forming an ecchymosis. Nicholls, who described the case in the *Philosophical Transactions*, made a number of experiments to determine the strength of the aorta, and the conditions under which rupture could occur. Laennec gave an excellent account of a case, and Pennock, of Philadelphia, who reported a remarkable case, determined experimentally that the situation of the aneurysm was between the layers of the middle coat. Peacock wrote two admirable monographs, from which our statistical information on the subject dates. The primary split, most frequently in the arch from 2 to 3 centimetres above the valves, is in the form of a transverse or vertical clean-cut incision, as if made with a razor. The intima about it may be smooth or it may be atheromatous; sometimes the splitting of the coats takes place at the edge of an atheromatous ulcer. The extent may vary from a few millimetres to a long tear of 4 or 5 centimetres extending round the entire circumference of the vessel, or running obliquely along the inner surface of the arch. There may be two or more tears near each other. The extent of the dissection is variable. If it reaches the adventitia rupture is certain to take place, for it is only the structures of the middle coat that can resist for any time the pressure of the blood. The blood may pass for an inch or more between the layers of the media, and a clot, an ecchymosis as Nicholls calls it, raises the intima. In other cases the blood passes for 3 or 4 inches or more, separating the coats, and then may burst externally or into the lumen of the vessel. In other cases the dissection is most extensive, reaching from the ascending arch to the bifurcation, and even passing down the iliacs and femorals to the vessels of the legs. Upwards the dissection may reach to the branches of the carotids and the brachials. In rare instances, as in one described by Rokitansky, the dissection involved the aorta from a little above the ring, and nearly all its main branches in the head, arms, and legs. In the circumference of the aorta a small section only may be involved, or the coats may be so separated that a double tube is formed, joined here and there by bridles of the media and by the arterial branches. Curiously enough it is these very extensive dissections that appear to heal, as will be considered in the next section. In nearly all cases there is an orifice of exit, through which the dissecting aneurysm communicates with the interior of the aorta, or there may be two or three. The state of the cavity depends upon the length of time it has lasted. If the patient has only lived a few days, there will be fresh clots adherent to the rough walls, but at the end of a few months the thrombi are firm and may be laminated. In a few cases complete healing takes place.

The symptoms are those already described under rupture (p. 638), a sudden sharp pain in the chest with great shock and collapse, in which death may take place; or recovery may follow for a week or ten days, and sudden death occurs from rupture. There may be agonising pain along the course of all the arteries extending into the limbs.

V. **Healed Dissecting Aneurysm.**—When there is a great rent of the intima, and the coats of the vessel are separated from the valves to the bifurcation and the branches torn off, it is impossible to conceive a lesion of greater severity; and yet, so marvellous are nature's capacities, complete healing may follow, even to the extent of an internal lining for the new tube. So perfect may be this *restitutio ad integrum* that not only by the older observers, but every now and again at the present day the condition is described as a congenital anomaly—a double aorta. Shekelton, a Dublin surgeon, first reported a case of this kind which he thought was possibly an anomaly, but in a second case he clearly understood the condition. Pennock, of Philadelphia, who, in 1838, reported a remarkable case, appreciated the mode of formation, and made a number of experiments to shew that it was in the middle coat alone that dissecting aneurysm was possible. So extraordinarily natural did the outer tube appear to be that Hope, in his well-known book on the heart, favoured the view that it was a congenital anomaly. The best recent accounts are given by Boström and by Adami. The latter has collected 39 recorded cases, among which women and men were about equally affected. In a majority of the cases there was no advanced disease of the aorta itself. The site of the primary rupture was in the ascending aorta in 13 cases, below the origin of the left subclavian in 12, at the lower end of the thoracic aorta in 5, in the abdominal aorta and in the iliac in one each. As shewn in the figure in Boström's paper, the outer tube may extend the entire length of the aorta, occupying a variable extent of the circumference. The branches may take their origin from the outer tube, the lining of which is smooth, like a normal intima, and Rindfleisch shewed that the intima was in reality reformed. Atheromatous changes may occur in the new tube. The duration extends over many years. The late James E. Graham reported a case in which a soldier, who had been discharged from the army for aneurysm after the Crimean War, died thirty years later. When a student in Toronto, I often saw this man with Dr. Richardson, and knowing my interest Dr. Graham sent the aorta to me for dissection. There was a healed aneurysm at the terminal portion of the arch, and from the margin of this sac to the iliacs the aorta formed a double tube, exactly like the one depicted by Boström. As the patient was discharged from the army for aneurysm, it is probable that this had lasted for more than thirty years.

Saccular Aneurysm of the Aorta.—A great majority of the cases in medical practice affect the aorta, and are of the type known as saccular. As the arch is most commonly involved, we shall describe first the aneurysms of this part, and then those of the descending thoracic and abdominal portions.

I. **Aneurysm of the Arch.**—General Features.—For purposes of description this part of the vessel may be divided into the sinuses of Valsalva, the ascending, and the transverse portions.

Aneurysm of a sinus of Valsalva is a common and most important variety, with special features. One, two, or all three sinuses may be involved. The tumours are small and cup-shaped, and rarely attain a size sufficient to give physical signs. The coronary arteries may be given off from the sac, or one or other of these vessels may be dilated. The aortic ring is apt to be involved, and one or more of the valves may be rendered incompetent. Perforation is common, usually into the pericardium, more rarely into the superior vena cava, the pulmonary artery, or one of the auricles. In some cases the aneurysm appears to be given off directly from the aortic ring, and involves as much of the ventricle as of the sinus. Whilst a few of the cases are in association with ordinary atheromatous changes, this special form is most frequently met with in acute syphilitic aortitis. The special features may be thus summarised: (1) It is very often latent, sudden death occurring before any symptoms have appeared; (2) it is a medico-legal aneurysm, met with in connexion with coroners' cases; (3) angina pectoris is not infrequent; (4) aortic insufficiency is often associated with it; and (5) in the majority of cases characteristic syphilitic changes are present in the aorta.

Aneurysm of the Ascending Arch.—The convexity of the vessel as it passes up is the common point of origin of the ordinary saccular aneurysm. The tumour grows to the right and anteriorly, "pointing" in the 2nd or 3rd right interspace, and as it increases pushes aside the lung. Some of the largest sacs are in this situation. Perforation occurs into the pericardium, the superior vena cava, the right bronchus, the pleura, and rarely externally. As the sac enlarges it may erode the sternum and the 2nd and 3rd ribs and cartilages, and appear as a large smooth external tumour. Less often it passes back and erodes the spine.

Aneurysm of the Transverse Arch.—A very common situation is at the orifice of the innominate, or this vessel and the arch may be involved together. The sac may originate from any part of the circumference of the vessels, most often from the posterior or postero-inferior. Owing to the very small space between the spine and the sternum, aneurysm in the situation has not much room for growth, so that pressure-symptoms appear early—pressure on the windpipe producing cough and dyspnoea, on the veins causing congestion of the face and arms, on the recurrent laryngeal nerve causing hoarseness, and on the oesophagus causing dysphagia; a small tumour may give all the symptoms of aneurysm without a single physical sign. As the result of its growth in a forward direction the sternum is eroded, and a large tumour may appear externally; when it grows backwards the spine may be eroded, and sometimes the sac reaches a very large size and involves the bodies of three or four vertebrae. Tumours growing from the concavity and terminal portion of the arch implicate the recurrent laryngeal nerve at an early period, and there may be only tracheo-laryngeal symptoms.

In the terminal portion of the arch occurs the rare *traction* aneurysm, described by Thoma, which arises at the point of insertion of the ductus arteriosus. Usually funnel-shaped and small and not of much clinical importance, it is met with in young persons, and particularly in cases of kypho-skoliosis with displacement of the thoracic viscera.

Symptoms. — Many cases are latent. The records of coroners' inquests prove how frequently sudden death in apparently healthy individuals is due to rupture, more particularly in robust persons with syphilitic aortitis and the small cup-shaped aneurysms just above the valves. An aneurysm, however, may attain quite a large size without causing any symptoms. Indeed, it may perforate the chest-wall and project as a tumour of considerable size. An instance of this sort I saw at the University Hospital, Philadelphia, in a very intelligent working man, who assured us that he had had discomfort for a few days only before he noticed a prominent bulging tumour which had eroded the 2nd rib on the right side. As Sir William Broadbent pointed out, there is a certain antagonism between the symptoms and physical signs, and he suggested a useful division into aneurysms with symptoms and aneurysms with physical signs. Usually, both are combined, but it is not uncommon to see cases with every symptom without a physical sign or, at any rate, with scarcely a physical sign; and, on the other hand, a large bulging tumour may present all the possible signs in a patient who is quite free from cough, pain, and shortness of breath. The symptoms arise from two causes—the aortitis of the root of the vessel, and from pressure. Early in the disease the aortitis may be associated with severe pain, often recurring in attacks of angina pectoris. The sudden splitting of the intima over a patch of mes-aortitis may cause severe and agonising pain. It is interesting to note in how many cases the patients have at the onset attacks of pain of the greatest severity, which gradually disappear as the tumour grows larger and the signs of aneurysm become manifest. I have reported a series of such cases, and have recently had under observation a man, aged forty-nine, who for two years had attacks of agonising pain in the chest, which had completely incapacitated him. For months he was unable to assume the erect posture. For five years now he has had a large aneurysmal sac to the right of the sternum. The attacks of pain ceased suddenly and have not returned. As a rule the symptoms of aneurysm are those of tumour, and their intensity depends on the situation, the rapidity of growth, and the size of the tumour. Certain functional disturbances are associated with its growth and may be the earliest symptoms complained of—palpitation of the heart, unpleasant forcible throbbing, and pronounced vertigo or actual fainting. Almost all of the symptoms may be referred to compression of adjacent parts in the growth of the tumour, and these may be considered in detail. From the situation of the aorta in the narrow space, measuring a few centimetres only, between the spine and the posterior wall of the sternum, tumours growing either directly backwards or forwards are very apt to cause compression of adjacent parts, even before they reach a large size. A small sac from the posterior part of the transverse arch may cause the most intense symptoms without any physical signs. On the other hand, the tumour growing from the ascending portion may pass to the right and go into the pleura, pushing aside the lung, or forward through the chest-wall, and this situation may contain quite large tumours which have caused very few symptoms. From the terminal portion of the arch just beyond the left subclavian, the sac may grow into the pleura compressing the lung, or into the lung itself.

Pain is one of the earliest and most distressing results of compression. As already mentioned, this may be associated with aortitis. When due to compression it is one of the most constant and enduring features of the disease. When one considers the richness of the nerve plexuses in the neighbourhood of the heart and the close relations of large nerve-trunks to the aorta, it is indeed surprising that so many patients with aneurysm of the arch have comparatively little pain. The character of the pain varies a good deal in different cases. There may be (1), as already mentioned, anginal attacks occurring very early and before any symptoms are present, but occasionally they are met with throughout the course of the disease, either with all the well-known features of paroxysmal angina or with modifications. (2) Neuralgic pains, shooting up the neck, cervico-occipital, down the arm, or in the course of the intercostal nerves. The former are very common and may be associated with numbness and tingling of the fingers. The patient may complain of ordinary cervico-brachial neuralgia. The attacks may vary greatly in intensity and in some cases may disappear for weeks, whilst in other instances they form a most persistent and distressing feature. (3) In deep-seated aneurysm associated with erosion of the bone and compression of the nerve-roots near the spine, the pain may be of an intense boring character without intermission and often requiring large doses of morphine for its relief. It is surprising how little pain may be caused in the process of erosion of the costal cartilages and the sternum. The most severe and persistent pain is met with in aneurysm of the descending thoracic and abdominal aorta; it may be of a characteristic girdle form or it may take the form of an ilio-lumbar neuralgia. In connexion with the formation of a dissecting aneurysm, the rupture of the intima is associated with intense pain usually in the region of the heart, and with symptoms of profound collapse which may pass off in the course of a few hours. It is a good practical rule, as laid down by Gairdner, that "whenever a case of obstinate or frequently recurring pain, such as might, constructively, be due to pressure upon nerves or upon solid parts, and such as is not fairly in accordance with some disease known to exist in the organs of the thorax or abdomen, the suspicion, at least, of an aneurysm ought in all cases to arise." Drs. James Mackenzie and Head have called attention to the sensitiveness of the skin areas on the chest and arm in connexion with thoracic aneurysm. The skin may be sensitive to touch in the region of the nipple along the left sternal border and the left side of the neck over the sterno-mastoid muscle.

Certain special nerves may be compressed or irritated with the production of remarkable symptoms. Hiccup may be caused by irritation of the *phrenic nerve* and in rare cases paralysis of the diaphragm has followed its destructive compression. The *pneumogastric nerve* may be stretched and even destroyed on the sac without causing any special symptoms. In some cases nausea and vomiting and dyspeptic troubles generally have been attributed to irritation of this nerve and its branches. The pulmonary affections attributed to implication of this nerve are most frequently due to compression of the trachea or bronchi.

Compression of the Sympathetic.—Macdonnell, senior, of Montreal, in 1850 described a case in which a malignant tumour pressed on the sympathetic, and thus caused contraction of the pupil and ptosis on the same side. Walshe in 1853 noted contraction of the pupil in connexion with aneurysm; Gairdner in 1854 called special attention to it, and in 1858 John Ogle exhaustively discussed the whole question. The common features attributed to compression of the nerve are contraction or dilatation of the pupil on the affected side, and certain thermic and secretory phenomena. Pressure on the sympathetic cord itself, a rare event in aneurysm of the aorta, may be associated with all these characteristic symptoms. Dilatation of the pupil on the affected side occurs when there is simple irritation, permanent contraction when there is complete paralysis; a slight drooping of the eyelid, with contraction of the eyeball itself, increase of heat and redness of the ear and flushing with sweating of one side of the face may be present. In a few instances the sweating is very profuse; I once saw it extend to the side of the chest and to the right arm, and the skin of the hand was like that of a washerwoman.

The *oculo-pupillary features* of aortic aneurysm are of special interest. Thought formerly to be due always to implication of the sympathetic, they are in reality of varied origin. (1) In rare cases as just mentioned the cord of the sympathetic is involved. (2) The anisocoria or inequality of the pupil present in a very considerable number of cases has been shewn by Drs. Cecil Wall and Ainley Walker to be due to local vascular conditions. In twenty-six consecutive cases of thoracic aneurysm with inequality of the pupils a definite relationship existed between the state of the pupils and the arteries. As is well known, low blood-pressure is associated with large pupils, contracted pupils with a high pressure; and these authors found that in aneurysm there was a relation between the state of the pupils and of the arteries—where the temporals or radials were small the pupil was large. Compression or obstruction of the carotid in the neck is associated with enlargement of the pupil on the same side. In one case of aneurysm at the root of the neck in which the pupils were equal, deligation of the right common carotid was followed by enlargement of the right pupil, and an operation is reported on the carotid artery in which the same sequence followed. This is, to my mind, by far the most satisfactory explanation as yet given of this common feature in aneurysm. (3) Inequality of the pupils, myosis, and absence of the reaction to light in aneurysm may be parasyphilitic manifestations, and be associated with tabes. This combination of aneurysm, absent knee-jerks, lightning pains, and oculo-pupillary phenomena has been called in France, Babinski's syndrome.

Pressure on the Recurrent Laryngeal Nerve.—Aneurysm of the transverse portion of the arch is particularly likely to press on the left recurrent. The large saccular aneurysm of the ascending aorta may pass far enough over to implicate the right recurrent. In the former the nerve may be compressed by very small tumours. In the rare cases in which both nerves are involved there may be two aneurysms. It is still an open question whether irritation of the recurrent can cause attacks of spasm of the larynx with dyspnoea and aphonia, and in some cases loss of consciousness, since it has not been proved that the recurrent laryngeal nerve in man contains centripetal fibres, and indeed it is more likely that when these symptoms do occur, they are due to pressure upon the pneumogastric nerve. These differences were well pointed out many years ago by the late Sir George Johnson.

Compression of the recurrent laryngeal nerve causes unilateral paralysis, which is on the left side in two-thirds of the cases. As Sir Felix Semon has pointed out in cases of organic progressive paralysis affecting the roots or trunks of the motor nerves of the larynx, the abductor fibres of the recurrent laryngeal always[1] suffer first. He has discussed the whole question in Vol. IV. Part II. p. 260, and it is therefore sufficient to state here that, if the abductor fibres of the recurrent are gradually disabled by the increasing pressure of an aneurysm, paralytic contracture of the adductors in conformity with general neurological laws gradually supervenes, and forces the affected vocal cord into the middle line. When it is fixed in this position there is no dyspnoea, and the voice at first remains perfectly normal. This is of great importance from the point of view of diagnosis, since it is only by methodical laryngoscopic examination in cases of suspected aneurysm of the aorta that the laryngeal complication can be detected when in its early stages. Later on, when the pressure further increases, first paralysis of the internal tensor (the internal thyro-arytaenoid muscle) is superadded, and then the paralysed vocal cord, although still standing *in* the middle line, appears somewhat excavated; eventually the adductors too become paralysed, and the cord recedes into what is called the "cadaveric" position. In these stages alteration of the character of the voice is always present.

[1] Only one exception to this law has hitherto been recorded.

As Walshe puts it, "The speaking voice may be husky, muffled, cracked, and hoarse, or simply weakened or tremulous and variable in pitch or actually lowered in register." The epithet "cracked" is often applied to it, and sometimes the voice may be reduced to a whisper. With bilateral paralysis, which is certainly very rare in aneurysm and is not often complete, there is more or less stridor during exertion.

Associated with laryngeal paralysis there may be paroxysmal dyspnoea with stridor and retraction of the intercostal spaces and epigastrium. This is the most distressing of all the features of aneurysm. It is due to irritation of the vagus, for Sir G. Johnson shewed that bilateral spasm may result from irritation of one vagus only, an observation which has been confirmed by experiment (Horsley and Semon). In bilateral abductor paralysis, which is very rare in aneurysm of the aorta, the dyspnoea and stridor are not paroxysmal but continuous, although they may be aggravated from time to time either by spasm or direct compression of the trachea and bronchi. In a few cases a double stenosis may exist, namely, there may be double abductor paralysis in the larynx and direct compression of the trachea or bronchi, both symptoms being due to an aneurysm. In such cases the performance of tracheotomy will not, of course, relieve the patient if the compression-stenosis is considerable, unless in addition a Koenig's cannula or a soft tube is successfully passed through the compressed part of the trachea. These cases of double stenosis, however, are more frequent in carcinoma of the oesophagus than in aneurysm of the aorta. Gerhardt states that one of the most important points is that, if the obstruction is in the larynx, this organ makes violent respiratory excursions, whilst in tracheal stenosis the larynx remains still; "in spasmodic and stridulous breathing movement of less than one centimetre is a certain sign of tracheal or tracheo-bronchial stenosis."

Compression of the Wind-pipe and Bronchi.—Often the very first symptoms are associated with irritation of the trachea, causing cough, more particularly when the sac is near the bifurcation. It may be a dry, irritative cough, occurring chiefly on exertion and coming on in paroxysms. The characteristic brassy cough is due to compression of the air-tubes and not to the laryngeal paralysis. When there is tracheitis there is much secretion which may be blood-stained. There may be paroxysms of intense severity associated with dyspnoea and stridor. An extreme degree of compression of the wind-pipe may exist with very little dyspnoea if the patient be at rest, but the slightest effort or an attempt to assume the erect posture at once brings on a cough with a noisy stridor. When a small sac projecting from the posterior wall of the transverse arch grows directly backwards upon the bifurcation of the trachea, there may be orthopnoea with paroxysms of suffocative dyspnoea and stridor without a single physical sign pointing to the nature of the compression. The pulsations of an aneurysm compressing the trachea can be seen by means of the bronchoscope (*vide* Vol. IV. Part II. p. 310).

Very remarkable symptoms may be caused by slow compression of a main bronchus or of its principal branches; the respiratory murmur may be absent or greatly diminished on one side. When the process is slow, the lung or one lobe may become atelectatic and gradually fibrotic, and sometimes this is associated with recurring haemorrhage into the bronchi. Figure 84 from the first edition of this work shews this lobular condensation. But much more frequently the aneurysm causes retention of the secretion and intense bronchiectasis with expectoration of large quantities of mucus and pus. There may be irregular fever with sweating and emaciation, so that the patient may be sent to hospital for pulmonary tuberculosis. In the Montreal General Hospital I saw several cases of this sort with George Ross, who used to speak of them as "aneurysmal phthisis." Dilatation of the bronchi may follow, but more commonly the lung becomes consolidated and the bronchi filled with inspissated pus and there may be small abscesses and cavity formation. One lobe or the entire lung may be in this state.

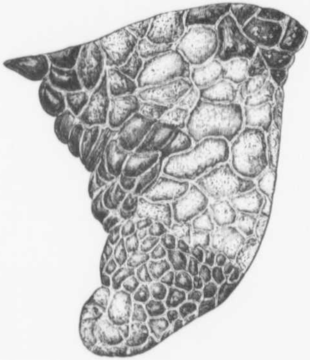

FIG. 84.—Surface of the left lung shewing lobular condensation from old and recent haemorrhage into the left bronchus. The differences of colour and of prominence of the lobules are due to differences in date of the haemorrhagic condensation; the older haemorrhage being nearly decolorised, and in part absorbed, or converted into puriform matter which is seen at some points to be forming small abscesses below the surface. (Gairdner.)

Compression of the Lung.—By the growth of the sac the lung may be pushed aside and slightly compressed, or in other instances it may form part of the wall of the sac. Very large tumours may lead to extensive compression of the lung, the upper lobe of which may be atelectatic and fibroid. When the sac grows directly into the lung, more important symptoms result. Even a small sac, growing from the convexity of the arch into the right upper lobe or from the terminal portion of the arch upwards into the left upper lobe, may early become adherent to the lung and grow directly into its tissue. Haemoptysis almost invariably follows, and may be early and even fatal before there are any features suggesting aneurysm. In other cases the sac may grow into the lung and form a large tumour completely filled with laminated clots, as in a remarkable specimen in the McGill Museum shewing a large portion of the left lung occupied by an aneurysm which is completely obliterated by firm thrombi.

Compression of the Oesophagus.—In a majority of cases aneurysm of the aorta does not involve the gullet. Dysphagia may result from spasm in connexion with pressure on the recurrent laryngeal. Small sacs growing directly backwards may compress it before there are any suggestive physical signs. The dysphagia is rarely extreme, but it may be sufficient to prevent the patient from swallowing solid food, and it may come on in paroxysms. The condition may be mistaken for simple stricture or for cancer. When ulceration or sphacelus occurs, swallowing may be very painful and the dysphagia increases rapidly. Gairdner states, on the authority of Sir Spencer Wells, "that one of the most consummate surgeons of the last generation had been so unfortunate when exploring a case of dysphagia as to plunge an oesophageal sound into the sac of an aneurysm lying close to and compressing the oesophagus, with the result that the patient died in the consulting-room." Janowski describes a similar case. Compression may be followed by necrosis of the wall and ulceration with pain in swallowing. Perforation may take place from a small sac and the patient may bleed to death into the stomach, or the blood may be vomited. As in the trachea, the perforation is not always fatal and the orifice may be closed by thrombi. The pulsations of the aneurysmal sac have been registered by means of an oesophageal tambour, but the procedure is not without risk. An abdominal aneurysm or one of the lower end of the thoracic aorta may compress the cardia and cause great dilatation of the gullet, with regurgitation of food and great emaciation.

Compression of Blood-vessels.—The pressure may be on either cava, on the innominate, or on one of the subclavian veins. In the common aneurysm of the arch congestion of the veins of the neck and head, and sometimes of one or other of the arms, is a frequent symptom. One side of the face and neck may be more engorged than the other. In view of the situation of the superior cava the rarity of complete compression and obliteration of its vessel is remarkable. Narrowing is common enough with engorgement of the vessels of the upper part of the body. Obliteration due to aneurysm was present in only 4 of my 29 collected cases of complete obliteration of the superior cava. In these circumstances the collateral circulation is carried on through a number of channels: (1) When the obliteration is above the point of entrance of the vena azygos major, a large amount of the blood from the arms and trunk finds its way into this vein through communications of the intercostals with the internal mammary veins. (2) Over the surface of the chest the plexus of mammary veins enlarges and the swollen subcutaneous tissues of the entire front of the chest become occupied by a system of greatly distended veins. These may be seen in and beneath the skin as tortuous channels the size of the finger and converging to two or three large vessels which unite with the epigastric veins. 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 vena azygos major, or when the orifice of that vein is obliterated numerous channels are established between the lumbar vessels and the tributaries of the inferior vena cava. Perforation into the superior cava will be considered with the arterio-venous aneurysm (*vide* p. 667). Compression of the inferior vena cava is not common in aneurysm, so that we do not often see signs of congestion of the lower extremities and the formation of an extensive collateral circulation. Compression of the vena azygos major may cause oedema of the chest-wall or effusion into the right pleura. Symptoms due to compression of the *thoracic duct* are rare, but there may be great enlargement of the abdominal lymphatic vessels with varices and lacunae, as noted by Morgagni in one of his cases. Compression of the pulmonary artery is not uncommon, but is rarely associated with any symptoms. It is stated that gangrene of the lung has been caused by it; perforation of the vessel will be considered on p. 667.

Compression of the *spinal cord* may follow erosion of the bodies of the vertebrae. The cases are rare. I have not seen one, but several are on record; this event is one of the causes of painful paraplegia.

Symptoms due to Rupture.—Rupture of thoracic aneurysm into the air-passages is very common and causes *haemoptysis*, which is by far the most frequent form of external haemorrhage. The bleeding may come from erosion of the trachea or of a bronchus, or directly from the lung tissue. The common situations are just above the bifurcation and in the left bronchus. In a few cases the sputa are bloody for weeks or months, as the result of a granular tracheitis. As a rule, the haemorrhage is profuse and rapidly fatal. In other instances small bleedings occur for weeks or months, especially when the trachea is eroded and the laminae of the sac have blocked the orifice. There may be two or more orifices, or the trachea and one bronchus may be perforated. Recovery, however, may follow a profuse and almost fatal haemorrhage. A patient whom I saw with Dr. Fussell, of Philadelphia, lived for four years after his first very severe haemorrhage. The famous surgeon Liston, in July 1847, had a feeling of constriction at the top of the wind-pipe and slight difficulty in swallowing; this was followed by a profuse haemorrhage of from 30 to 40 ounces, from the effect of which he nearly died. It is interesting that Liston himself suspected aneurysm, but neither Watson nor Forbes could find anything in the chest. The symptoms were greatly relieved by the haemorrhage and he was able to return to work, but in October the symptoms returned and on December 6th he died in a paroxysm of dyspnoea. An aneurysm was found compressing the trachea. T. W. Clarke has reported a case in which sixteen haemorrhages occurred between July the 23rd and September the 15th, the amount of blood ranging from a few ounces to 36, a total of 14 pints in seven and a half weeks. Here the bleeding came from the small bronchi of the right lung into which the sac projected. Gairdner reports a remarkable instance in which a man, aged forty at the time of his death, had been the subject of aneurysm for about ten years. Five years before his death he had a severe haemoptysis, and then occasionally he had rusty-coloured sputum and sometimes a more copious haemorrhage, in one of which he died.

The deep-seated sac growing into the middle of the left lung or into the upper lobe may be associated with cough and haemoptysis, and simulate tuberculosis. As the sac grows it compresses the main bronchus, leading to retention of secretion and fever. Gairdner's comment on this may be here quoted: "In cases of aneurysmal haemoptysis (to which the majority of observations refer) it has been established (*Clin. Med.* p. 520) that haemorrhages short of a directly fatal result may take place for weeks or for months in the form of (1) a frothy bronchitic sputum streaked with blood; (2) a rusty sputum very like that of pneumonia, but usually more abundant, more frothy, and less viscid; (3) a deeply-dyed purple or brownish-purple sputum, like the so-called 'prune-juice' expectoration, closely resembling that of pulmonary haemorrhagic condensation from valvular disease of the heart; (4) any of the preceding, alternating with small discharges of pure, unmixed, but generally imperfectly coagulated blood. When such haemorrhagic sputa approximate to the characters observed in pulmonary condensations, it is legitimate to infer that such condensations exist; and it is probably quite impossible, in some cases at least, to distinguish the aneurysmal from other forms of such condensations; but it is desirable, none the less, to have it clearly in view that such changes may be due to an aneurysm pressing on a main bronchus. The pulmonary alterations thence arising may vary almost indefinitely from recent condensations, with partial lobular collapse of the lung (and giving the impression as if blood had been pumped backwards into it through the bronchus), and infiltrations of older standing, 'nodulated and dense, some violet-coloured, others of a sandstone-gray tint.' In other cases, also, softening and ulceration of the tissues of the lung take place, leading up to a true bronchial and aneurysmal phthisis, of course non-tuberculous."

Oesophagus and Stomach.—When the sac perforates the oesophagus, or in abdominal aneurysm the stomach, blood is brought up in large quantities. This is much less common than haemoptysis. Perforation of the gullet occurred in only 9 out of 226 of Crisp's collected cases, and in 40 of Boinet's series of 195 cases of rupture. Weeks or months before perforation occurs pressure on the oesophagus may lead to erosion, and bleeding may follow from the granulations, or the laminae may be exposed and the sac weeps. The usual situation for the rupture is where the arch crosses the gullet. The wall may be much stretched, and shew small superficial ulcers; in other cases there are two or three perforations. Gangrene may occur, with perforation of the lung or pleura, and a case is on record in which the aneurysm perforated a carcinoma of the gullet.

Rupture through the skin is a comparatively rare event in aneurysm of the aorta, occurring in only 3 or 4 per cent of the cases. It is not uncommon to have necrosis of the skin, and even exposure of the laminae of fibrin, and the sac may weep for months, and yet the patient may die of internal haemorrhage or some complication. William Hunter reported the case of a man with an aneurysm 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 most common site of external perforation is just to the right of the sternum. In the process of external rupture the skin becomes reddened and gradually necrosed, sometimes with the formation of a small subcutaneous abscess. In rare instances a cutaneous perforation has cicatrised and the patient has lived for several years. Sometimes the rupture takes place into the subcutaneous tissues, with the formation of a huge haematoma.

Internal Rupture.—Into the *pericardium* the small rapidly-growing sacs of the ascending aorta are very liable to rupture. The frequency with which this occurs is well-known by those engaged in medico-legal work, and is very much higher than indicated in the statistics of Crisp and of Sibson. There may be a small pin-point perforation or a tear of considerable extent. The amount of blood in the pericardial sac varies from 200 or 300 cubic centimetres to as much as 1000 c.c. Pericardial adhesions may retard the outflow of blood. As a rule, death occurs suddenly, but there are instances on record in which the patient has lived for hours, or even days. Rupture into the *pleura*, most frequently into the left, is a common mode of termination. There are three situations in which it is met with, one in front on either side as an aneurysm of the arch increases, another behind in the aneurysm of the descending aorta, and a third when the abdominal sac ruptures through the diaphragm.

It may be preceded for some days by a pain in the chest or by signs of pleurisy. The amount of blood lost is usually very large, amounting to three or four pounds, and the patient dies rapidly. Recovery may take place, and cases with recurring pleural haemorrhages are on record (Stokes). The blood may be encysted between the pleura and the lung; it may leak slowly through a small orifice, and form a pleural haematoma. Rupture into the *mediastinal tissues* is also common, but it is not necessarily fatal. Small ruptures may occur with the effusion of a moderate quantity of blood, which gradually becomes absorbed. In other instances a diffuse aneurysm is formed, and the blood may pass up the neck, forming a large tumour. Death is not often directly due to rupture into the mediastinum. Rupture into the *retroperitoneal tissues* is a very common event in aneurysm of the abdominal aorta. There may be repeated small haemorrhages, associated with an increase of the pain in the back. The blood may pass down in front of the psoas muscle and form a tumour in the groin. In other instances large diffuse sacs are formed. Rupture into the *spinal* *canal* was described by Laennec, and a few cases have been recorded. It usually follows signs of compression. Death takes place within a few hours.

Rupture into the *great vessels* and into the heart will be referred to in the section on arterio-venous aneurysm (p. 667).

The relative frequency of the different regions of rupture are given in the statistics of the *Bulletin de la Société anatomique* of Paris from 1826 to 1906 by Boinet. Of 349 aneurysms, 195 terminating in rupture, the more important situations were: into the left pleura 36, the right 10; the pericardium 29, the left lung 13, the left bronchus 15, the trachea 17, the oesophagus 40, spinal canal 3, and externally through the skin 9.

Physical Signs.—*Inspection.*—Patients with aneurysm are usually vigorous-looking subjects, young or middle-aged, often with an appearance of such good health that a suspicion of aneurysm, or at any rate of cardiovascular disease, is aroused when such men are seen in a hospital ward. Marked suffusion of the face, with dusky infiltrated conjunctivae, may be present when the sac compresses the veins near the heart. Occasionally the vessels on one side of the face are much distended. Inequality of the pupils is common, and may at once attract attention. The conditions under which it occurs have already been referred to. The head may jog with each cardiac impulse, particularly when the aortic valves are incompetent. Inspection of the neck may reveal great engorgement on one or both sides, and occasionally there is enormous distension of the right jugular sinus. The carotid may pulsate forcibly on one side, whilst none may be seen on the other. The pulsation of the aneurysmal tumour may itself be seen above the sternum. Visible tracheal tugging, with systolic retraction of the entire box of the larynx, may be seen. In thin subjects lateral deviation of the trachea may be obvious. When the sac reaches the thoracic wall, the diagnosis may, as a rule, be made "at sight." Good light, good eyes, and a certain method of routine are required for successful examination. The patient should be stripped and seated on a stool facing the light, or with a good side light on the chest, and it must be remembered that inspection from the front does not always bring out all that can be seen; a slight heaving impulse of the sternum or moderate pulsation to the right, not seen when looked at directly, may be very evident when looked at from the side with a good light falling on the chest. Aneurysmal pulsation is most common (1) to the right of the sternum in the 2nd and 3rd interspaces, (2) on the manubrium, (3) to the left in the 2nd and 3rd interspaces, (4) above the sternal notch, and (5) at the back in the left interscapular region, or in the infrascapular area. It is well to make the inspection in a routine manner, and not to omit the back after carefully examining the front of the chest. A network of distended veins is not uncommon on the skin of the upper part of the chest, and it may extend over the shoulders and be continuous with the large vessels in the neck. Very great enlargement of the mammary veins is not so often seen in aneurysm as in tumour, but in a few cases with compression of the superior vena cava the whole of the front of the chest is occupied by a large plexus of vessels communicating with the epigastric veins. When looking for pulsation it is well to bear in mind the different types of it as seen in the chest. First, there is a general shock, such as occurs in violent beating of the hypertrophied heart or of an aneurysm. In great enlargement of the heart, particularly when associated with aortic insufficiency, or in acute fever, or in anaemia, there may be remarkable throbbing of the whole front of the chest due to the excited action of the heart. Even without organic disease of the valves, as in Graves' disease, neurasthenia, and severe anaemia, this diffuse throbbing, particularly when associated with marked pulsation of the subclavians, may lead to the diagnosis of aneurysm. The shock may be of such intensity as to jar the entire body, and the pulse may be counted by the movements of the patient's head, or the bed may receive a distinct jarring shock. Secondly, limited to one side of the chest, to the right mammary or subclavian regions, or to the lower axillary region, there may be a diffuse impulse which differs from the general thoracic shock. It is seen in its characteristic form in pulsating pleural effusion, gaseous or liquid, and I saw a case in St. George's Hospital in which a suppurating hydatid cyst in the anterior mediastinum pulsated in this manner. It is remarkable that a limited area of pulsation on one side of the chest may occur without any obvious cause; I have seen chronic mediastinitis accompanied with deceptive pulsation simulating aneurysm. The patient, aged fifty-nine, had increasing dyspnoea, cough, pain in the chest, a cracked voice, and in the 2nd left interspace extending towards the axilla was a diffuse impulse, very definite when the breath was held. The fluoroscope shewed an indefinite shadow to the left of the sternum. There was also slight tracheal tugging, and naturally enough the diagnosis of aneurysm was made; at the necropsy there was a condition of posterior chronic mediastinitis. Sailer has reported a case in a Russian Jew, aged twenty-six, with a normal but not very vigorously beating heart, and with marked throbbing of the abdominal aorta. There was slight, definite, visible systolic pulsation of the whole right side of the thorax, perceptible also on palpation. This type of throbbing may be most deceptive in cases of severe anaemia, and occasionally it is singularly localised, as in the case reported by A. R. Edwards; 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 hand." A systolic bruit was heard over it, and the case was regarded as one of aneurysm of the thoracic aorta, but the necropsy shewed a moderate arteriosclerosis of the aorta. Lafleur has reported a very similar case with pulsation in the same region without aneurysm. Thirdly, the pulsation of aneurysm, which may be of two kinds. In the deep-seated tumour, which does not come in contact with the chest-wall, a shock may be communicated similar to that which is seen and felt in the chest in cases of hypertrophy of the heart. The true aneurysmal impulse is only seen when the sac reaches the chest-wall. When localised, the visible expansile character is readily appreciated. It is usually single, systolic in time, occasionally undulatory or even double. It may be well to state the regions of the chest in which visible impulses may be seen, which must not be mistaken for aneurysm. (1) The throbbing of the conus arteriosus in the 2nd left interspace—very common in young persons and in thin chests, and seen particularly well during expiration. (2) Pulsation of the heart in the 2nd, 3rd, and 4th left interspaces, extending as far out as the nipple line in cases of fibrosis and retraction, from any cause, of the upper lobe of the left lung. (3) Cardiac pulsation in the 2nd, 3rd, and 4th right interspaces in connexion with similar conditions of the right apex. (4) Effusion on 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 anaemia. Sometimes it is unilateral, and when accompanied with a thrill and a murmur it may form a mimic or phantom aneurysm. (6) In the back part of the chest visible pulsation is nearly always aneurysmal; but occasionally, in Broadbent's sign, the tugging may be so limited and localised in one interspace that it simulates pulsation, but palpation easily corrects this.

Inspection of the arms and hands may give valuable information. The radials and brachials may shew visible pulsation, particularly when aortic insufficiency coexists. Swelling of one or both upper extremities may be present when a sac, springing from the ascending aorta, has compressed the superior cava. More commonly, the arm on one side is congested and swollen. Pallor and sweating may be seen in one hand and arm as a result of pressure on the sympathetic. Clubbing of the finger-ends I have seen twice—once on the right side, once on the left. It seems to be associated with peripheral stasis (*vide* Vol. III. p. 66).

Palpation.—Over an aneurysmal sac which has reached the surface there may be felt: (1) The true aneurysmal impulse. To appreciate its character it must be remembered that it is synchronous with the cardiac impulse, and to learn to recognise it, palpation of an actively beating apex should be carefully practised. The remarkable vigour and intensity, the impossibility of resisting it, the proximity to the fingers, and the definite expansile quality, are its important features. Of course, these features can only be recognised when the aneurysm 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 tumour 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 localisation, without any punctuate, heaving quality, and without that sense of forcible expansion directly beneath the fingers which is so characteristic of the cardiac and of the aneurysmal beating. (2) Over the aneurysmal sac near the heart may be felt a shock either of a thudding first sound, or, what is much more common, of the sharp flap of the second sound; sometimes the shock of both. The second is of great diagnostic importance, and at times may be felt, by the slightest application of the finger to the sac, as a short snapping shock, and coincident with it a diastolic impulse may be felt. (3) A marked vibratory thrill may be felt, usually systolic in character, much more rarely diastolic, and not often double. It is not a special feature of aneurysm of the thoracic aorta, and is absent in a great majority of cases. It is relatively more common in aneurysm of the abdominal aorta. A diastolic thrill is exceedingly rare. Forcible compression of the sac should not be attempted on account of the danger of detaching portions of clot, an accident which has been followed by hemiplegia.

Tracheal Tugging.—When adherent to the wind-pipe, the pulsations of the sac may cause visible depression of the box of the larynx, or when the fingers are pressed upon it a downward tug or jar may be felt. In some cases the finger placed upon the box of the larynx appreciates this tracheal tug. In other instances to bring it out the procedure first described by Surgeon-Major Oliver should be carried out: 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 aneurysm exist, the pulsation of the aorta will be distinctly felt transmitted through the trachea to the hand." It is present in a large proportion in all cases of aneurysm of the transverse portion of the arch, and the very great value of the sign is not diminished by its very occasional presence in tumours other than aneurysms.

Palpation of the Arteries.—Changes in the sac or pressure by it upon the large vessels may lead to retardation, feebleness, or obliteration of the pulse in the peripheral arteries. The carotid pulse on one side may be feeble or obliterated. Inequality of the radials is more common. The right is more frequently smaller than the left, and it may occur without any alteration in the carotid pulse on the same side. This may be due to thrombosis within the sac, whereby the orifice of the innominate is narrowed, or the large sac may compress the subclavian. Occasionally the radial pulse may be smaller on the side opposite to that on which the sac is prominent. A feeble pulsation in the left radial, when there is a projecting sac from the ascending aorta on the right side, may be caused by a small secondary aneurysm, or it may be due to atheromatous narrowing of the orifice of the left subclavian. Harvey appears to have been the first to notice this change of pulse in aneurysm, for he describes in Chapter III. of the *De Motu Cordis* the following case:—"A certain person was affected with a large pulsating tumour on the right side of the neck, called an aneurysm, 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 tumour was visibly distended as it received the charge of blood brought to it by the artery with each stroke of the heart; the connexion 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 tumour and so intercepted." The retardation of the radial pulse on one side may be perceptible to the finger. The difference in the character of the pulse in the two radials is very well shewn by the sphygmograph. The tracing of the pulse-wave on the one side may be greatly diminished in amplitude. Simultaneous tracings of the two radials may shew retardation of the pulse on one side by as much as $\frac{5}{100}$ of a second. The capillary pulse is seen when aortic insufficiency coexists.

A very large aneurysm of the transverse arch may cause great feebleness of the pulse in the arteries of the head and extremities. In one instance, in a case of very large aneurysm of the thoracic aorta, no pulse was felt in the abdominal aorta or in the femorals. Gairdner remarks that an aneurysm low down in the course of the aorta has been practically cured by one higher up, the force and impulse of the blood-stream having been so much checked by the latter as to promote firm coagulation and entire cessation of the pulsation originally present in the former.

The arteries in aneurysm are, as a rule, sclerotic, but in a good many young subjects the syphilitic arteritis, upon which the aneurysm depends, is entirely limited to the aorta.

Percussion.—In very small sacs there may be no changes, but when the tumour reaches the thoracic wall the percussion-note is altered, the situation depending upon the point of contact of the aneurysm with the chest. Impairment of resonance, shading to dulness, is common to the right of the sternum, over the manubrium, in the left subclavian and mammary areas, or in the left interscapular region behind. Even when large, the deep-seated sac, entirely surrounded by lung, may cause very little change in the percussion-note. When the lung is compressed on either side various shades of tympanitic resonance may be brought out.

Auscultation.—There are no characteristic aneurysmal sounds or murmurs. The most constant abnormality heard over an aneurysmal sac is the intensification of the heart-sounds—the first dull and thudding, the second clear, ringing, and accentuated; or the latter alone may be heard. This diastolic accentuation, when present, is a valuable diagnostic sign. In perhaps a majority of cases of aneurysm no murmur is audible, or at best a very soft systolic, which is propagated into the vessels of the neck. A to-and-fro murmur is present with insufficiency of the aortic valves. Occasionally a diastolic murmur is heard alone without incompetency of the valves. A continuous humming-top murmur, with systolic intensification, is diagnostic of a communication between the sac and one of the large vessels or one of the chambers of the heart.

Auscultation of the Lungs.—Pressure of the sac upon the lung itself, or more frequently compression of one bronchus, may lead to alteration of the pulmonary sounds. The breathing may be feeble over the whole of one lung, or of one lobe. In one case, with every pressure-symptom of tumour, including paroxysmal dyspnoea of a most aggravated character, the only physical sign was weakened breathing over the lower lobe of the left lung. A small aneurysm from the termination of the arch grew backwards and compressed the bronchus going to this part. Sonorous and sibilant rhonchi and harsh stridulous breath-sounds are common with compression of the trachea. Extreme compression of one bronchus, leading to bronchiectasis or destructive changes in the corresponding lung, may be associated with corresponding physical signs. Dr. David Drummond has called attention to the presence of a blowing sound heard in aneurysm when the stethoscope is placed over the trachea or sometimes at the open mouth. This phenomenon of so-called pulse-breath, when present, is very striking. A whiffing bruit may be heard by the patient himself, and it may be plainly audible when the ear is placed opposite the patient's mouth, or even at some distance from it (Packard).

The Blood-Pressure in Aneurysm.—The careful observations made at the Johns Hopkins Hospital, and by Dr. O. K. Williamson at the Middlesex Hospital, shew that whilst the arterial pressure is normal, or only slightly above the average, there is often a marked difference in the two brachial arteries. In examining 30 cases Dr. Williamson found in a majority a marked difference in the blood-pressure in the two arms, so that a difference of more than 20 mm. suggests aneurysm.

The State of the Heart.—As a rule, the heart is not enlarged Dilatation and hypertrophy occur in cases with aortic insufficiency and in such associated conditions as contracted kidney and widespread arteriosclerosis. Occasionally, without any obvious reason, the heart may be very large. In a man, aged forty, with a big saccular aneurysm of the descending aorta, the signs of hypertrophy were very prominent during life. At the necropsy there was no valvular disease; the organ was greatly enlarged, particularly the left ventricle, which measured from the ring to the apex 12 cm., the walls being from 1·5 to 2 cm. in thickness. Large sacs of the arch dislocate the heart downwards and to the left, and, as is so well seen in the *x*-ray pictures, it assumes a more horizontal position. Occasionally a very large aneurysm growing downwards may gradually occupy the position of the heart, as in a remarkable case reported by Dr. S. Gee. A large sac of the descending aorta growing forward may flatten the heart and give a remarkably diffuse impulse on the front of the chest, or a double pulsation—the double jogging impulse of Hope.

II. **Aneurysm of the Descending Thoracic Aorta.**—No portion of the vessel is so free from aneurysm. The relative frequency is variously given; in the combined statistics of Crisp, Lebert, and Myers the descending aorta was involved in 49 cases out of 404; of 64 cases of aneurysm of the aorta among the first 2060 necropsies at the Johns Hopkins Hospital, this part was affected in 13; in 3 the sac occupied both the arch and the descending vessel, and in 1 the aneurysm sprang from the junction of the thoracic and the abdominal portions. Clinically, it is much the least frequently encountered, in fact it is less common in the wards than in the post-mortem room, owing to the latency of its course. Up to 1903, the first fourteen years of the work of the Johns Hopkins Hospital, only 15 cases were recognised, a number often exceeded in a single year by aneurysm of other parts of the aorta. The tumour may be small, and prove fatal by perforation into the oesophagus before causing any symptoms that attract attention. On the other hand, the slowly-growing sac may reach an enormous size, and, perforating the chest-wall, may form the largest aneurysmal sac met with. The relations of the vessel explain certain features of aneurysm of this part. It is apt to grow backwards and erode the bodies of the vertebrae; of the 14 cases I reported, the spine was involved in 9. One or two bodies, or in some instances almost the entire spine, may form the posterior wall. One or two ribs may be destroyed close to the spine, or portions of four or five are eroded, and the sac perforates the chest-wall, forming a huge subcutaneous tumour. Connected with the erosion of the spine is the distressing symptom of pressure on the nerve-roots with pain of an agonising character. In a few instances the spinal canal is reached, and there is a pressure-paraplegia, or sudden death from rupture of the sac.

The pain may simulate angina, or there may be intercostal neuralgia with marked hyperaesthesia of the skin and points of tenderness at the angles of the ribs. Herpes zoster has been met with. It is remarkable how variable is the pain; one case of my series, a robust healthy fireman, who came in with a huge pulsating tumour of the back, had very little pain, and yet the sac had eroded the 7th and 8th vertebrae, and destroyed large portions of the 6th, 7th, and 8th ribs. In other cases the pain is more severe and persistent than in any other form of aneurysm, and may require enormous doses of morphine; one patient, for example, took as much as 38 grains in the day. In connexion with the erosion of the spine remarkable attitudes are assumed. One patient would sleep for hours bent double upon his knees with a couple of pillows under him; another would rest for hours and even fall asleep leaning upon the window-sill; and another would go to sleep in a chair, bent double, with his hands resting upon his insteps and the trunk on his thighs. From its close relation to the descending aorta the oesophagus is particularly liable to compression. Yet in my series difficulty of swallowing was not often complained of; in fact it was present in only 2 cases, and in only 1 did perforation take place. In several of my cases the oesophagus at the necropsy appeared to be compressed by the sac, and yet the patient had not complained of dysphagia. Perforation of the gullet, with fatal haemorrhage, may occur without any previous symptoms. In a woman, aged thirty-five, who had always been very strong and healthy, death took place suddenly in syncope. In the lower third of a healthy-looking thoracic aorta was a linear slit, 1·5 cm. in extent with clean-cut margins, directly opening into a small aneurysm, 5 by 5 cm., which had perforated the oesophagus. The sac may erode the oesophagus, and weeping of blood may occur for weeks before the final perforation. The vomiting of blood and melaena in aneurysm may not be due to erosion of the gullet. In one of my cases there was vomiting of blood on three occasions, which, of course, was attributed to erosion of the oesophagus, but the necropsy shewed that the bleeding came from an ulcer of the stomach.

Aneurysm of this part of the aorta is specially likely to cause pulmonary symptoms. The sac may grow upwards and forwards into the lung. In a specimen in the M'Gill University Museum the sac is seen to be embedded in the lung tissue. In Case 10 of my series the upper lobe of the left lung was almost entirely occupied by an aneurysm, which was not adherent to the trachea, oesophagus, or other structures. A large sac may compress the lower lobe or a large part of the lung, causing atelectasis with fibroid transformation. In these instances, as Stokes pointed out, there may be retraction of the left side of the chest. By the forward growth of the aneurysm the main bronchus, or the bronchus of one lobe, may be compressed, leading to bronchiectasis or extensive destruction of the lung, as already described under pulmonary symptoms. Rupture into the pleura is common in this form, and occurred in 3 cases of my series. Compression of the thoracic duct occurred in 2 cases of the same series.

Certain special symptoms of aneurysm in this situation may be referred to. Some of the cases are latent—3 in my series. A man, aged thirty-five, had a fracture of the lower jaw, which was wired in the out-patient department under ether. He recovered, and was able to dress himself partially, when he died with profuse haemoptysis. An aneurysm, 7 by 5 cm., projected from the beginning of the descending aorta and opened into the left bronchus. The latent aneurysm of the aged is not infrequently seen in this part of the aorta. It is from this vessel that very large sacs originate, which grow into the lung or the pleura and become consolidated, forming large tumours, the nature of which may be very difficult to recognise.

A man, aged seventy, had for more than fourteen years very anomalous thoracic symptoms—cough, attacks of haemoptysis, and husky voice connected with recurrent laryngeal paralysis. The left back from the spine of the scapula shewed impaired percussion and absence of breath-sounds, but neither pulsation nor bruit. There was slight retraction of that side of the chest, and the case was regarded by Dr. Palmer Howard as one of some obscure pulmonary trouble. At the necropsy there were two aneurysms of the descending aorta; one, the size of a large fist lined with very dense laminae of fibrin, had compressed the left lung, and flattened and almost occluded the left bronchus; the other sac sprang from the vessel just above the diaphragm. The most extraordinary case of this kind in the literature is reported by Sokolowski: "The patient, who held a prominent position in the German Government, had a severe attack of dyspnoea in 1864. A physician, a friend, happened to come in during the attack, made a careful examination, and found, to his astonishment, impaired percussion over the upper right half of the thorax, with absence of the respiratory murmur, the heart's impulse being displaced a little down and to the left. From this time the patient had at irregular intervals severe attacks of dyspnoea of short duration, during which the radial pulse was very often impalpable. In 1869 the attacks became more numerous, and in March of that year he consulted Professor Oppolzer, who diagnosed an aortic aneurysm, and Professor Skoda, who diagnosed a mediastinal tumour. The patient improved during the summer and was worse in the winter. He was able to get about, although he had shortness of breath on exertion. In the winter of 1875-76, for the first time, he had bloody sputum. In the spring of the latter year he had a left-sided pleural exudate. In July 1876 he was in Brehmer's Institution, where he came under the observation of Dr. Sokolowski. He was then forty-three years old, well-built and well-nourished, but was extremely dyspnoeic and slightly cyanotic. The pulse was absent in the left radial, equal in the carotids. The apex-beat was in the seventh intercostal space in the axillary line. There was no heaving impulse in any part of the chest. Extensive absolute dulness was present over the greater part of the left half of the thorax. There was a loud tracheal rhonchus over the whole of the front of the thorax. Nothing was audible over the greater part of the area of dulness, and tactile fremitus was diminished. Behind there was a slight vesicular murmur to be heard. The dyspnoea increased, and he died July 29th, 1876. On opening the thorax the right lung extended to the middle line, but the whole of the rest of the visible field was occupied by a thick mass of connective tissue. The left lung was pushed up from behind, forcibly compressed, and airless. After some difficulty the heart was discovered at the left angle of the large mass, which was found to be a huge aneurysmal tumour of the entire thoracic aorta. The heart was not enlarged, and the valves were normal. The aneurysm lay between the sternum and the vertebral column and the ribs on the left side, filling the greater part of the left chest. The oesophagus and trachea lay in a groove in the back of the tumour. The aneurysmal sac began just 2 cm. above the orifice of the aorta. Its walls were of unequal thickness; the posterior wall was covered with a dense coagulum as thick as the fist, and of the hardness of cartilage and much laminated; the anterior wall was also covered with a dense, thick coagulum. As the cross-section of the sac shewed, the blood passed through the centre of the tumour in a very irregular sinuous channel. Evidently it was the enormous thickness of the laminae of fibrin that prevented the usual characteristic pulsation." It is specifically stated that there was no pulsation in the thorax and no murmur.

These two cases illustrate the chronicity and the great difficulty there may be in recognising the nature of certain cases of aneurysm in this situation. As a rule, the physical signs are fairly definite. In 11 cases of my series pulsation was visible. It may be diffuse, or there may be a definite circumscribed pulsating tumour. The left interscapular region is a favourite site. In large sacs the whole left interscapular region may pulsate. In 1 case there was well-marked pulsation in both interscapular regions. The sac may perforate the chest at the back and form a huge tumour. Anteriorly the pulsation may appear in the second, third, and fourth left interspaces, or in the sixth, seventh, and eighth, when the sac pushes the heart aside. When the sac grows forward, just above the diaphragm, there may be marked pulsation in the epigastrium. With a large sac in this situation the pulsation may be very remarkable. In one of my cases the sac occupied the position of the heart, which was pushed far into the right chest, and there was an extraordinary width of impulse with an undulatory pulsation and a difference in time between the heart impulse and that of the aneurysm. The heart is usually pushed upwards and to the right, but in Sokolowski's case it was displaced downwards and to the left.

Complications of Thoracic Aneurysm.—The broncho-pulmonary features, due to pressure, have already been referred to. *Pneumonia* carries off a few cases. *Tuberculosis* is a not uncommon complication, as pointed out by Stokes. It has nothing to do with pneumogastric compression, but the local conditions favour the development of the tubercle bacilli. The lesions are often latent, and the cough and abundant expectoration are attributed to pressure on the trachea or bronchi. The early haemoptysis, when the sac grows into the lung, may lead to the diagnosis of pulmonary tuberculosis, and the same error is usually made in the cases with high fever, cough, sweating, and the septic state due to bronchiectasis and suppurative bronchopneumonia.

Pleural Effusion is a not uncommon event in aneurysm, and may be due to pressure on the veins, particularly the vena azygos, the associated cardiac conditions, or to an acute pleurisy. An effusion may completely mask the physical signs of aneurysm. The fluid may be blood-tinged. The terminal pleurisy, with exudate coming on abruptly with well-marked signs, or latent, is usually tuberculous. In a few cases the patient gets more and more feeble, wastes, becomes anaemic, and dies in what Stokes called aneurysmal cachexia. *Embolism* (of the cerebral arteries, of the aorta, or of a femoral) is an occasional cause of death. A few cases shew *mental symptoms* with suicidal tendency or a progressive melancholy.

III. Aneurysm of the Abdominal Aorta.—**Incidence.**—The ratio to aneurysm of the thoracic aorta is about 1 to 10. Sixteen cases occurred among 18,000 admissions to my wards at the Johns Hopkins Hospital. At Guy's Hospital between 1854 and 1900, in 18,678 necropsies there were 325 cases of aneurysm of the aorta, of which 54 were of the abdominal portion. Among 2200 necropsies at the Johns Hopkins Hospital there were 49 cases of aneurysm of the thoracic and 11 of the abdominal aorta. The incidence varies extraordinarily in different localities. Among 222 cases of aneurysm in 19,300 necropsies at Vienna there were only 3 of the abdominal aorta. I reported 16 cases in 1905, most of which had been in the wards of the Johns Hopkins

Hospital. J. H. Bryant's large figures indicate that this portion of the aorta is affected in about 16 per cent of the cases.

Sex.—Males are much more liable than females; of my 16 cases 2 only were in females, and of the 54 cases at Guy's Hospital 49 were in men.

Age.—As pointed out by Crisp years ago, the majority of the cases are under forty years of age. Of the Guy's cases there were under twenty years, 2; between twenty-one and thirty, 11; between thirty-one and forty, 23; between forty-one and fifty, 8; above fifty, 10. It is much more common in the labouring classes than in the well-to-do. Syphilis is an all-important factor; and strain and injury are perhaps more important than in aneurysm of the thoracic aorta. Lifting a heavy weight, a fall, a strain in recovering the balance, are common exciting causes, and not infrequently the patient mentions the exact date when the pain in the abdomen or the back began. Soldiers are particularly prone to it; 8 of the 49 males of the Guy's Hospital series had served in the army, and all had had syphilis.

Locality.—As Crisp's figures shew, a large majority are in the upper part, at or near the coeliac axis. Of the 54 Guy's Hospital cases 36 were in the neighbourhood of the coeliac axis, 11 at the orifice, 13 above the orifice, 12 below it, 5 at the orifice of the superior mesenteric artery, 3 at the orifice of one of the renal arteries.

Form.—The saccular is the most common, and may arise from a very small orifice. Dissecting aneurysm rarely starts in the abdominal aorta, but it may extend into it from the thoracic. Diffuse aneurysm is common owing to the frequency with which the saccular form ruptures into the adjacent tissues. Some of the largest blood-tumours known are produced in this way. The fusiform dilatation is rare, but a definite spindle is sometimes met with; in a remarkable specimen in the M'Gill University Museum the tumour is filled with beautifully laminated thrombi. The rarest variety is the arterio-venous, of which there were 2 out of the 54 in the Guy's Hospital series. The sac may arise from any aspect of the vessel, more frequently from the lateral or posterior. Erosion of the spine takes place in from 50 to 60 per cent of all cases.

Mode of Termination.—Rupture is relatively more frequent than in aneurysm of the thoracic aorta. In the Guy's Hospital series of 54 cases it occurred into the retroperitoneal tissues in 19, into the peritoneal cavity in 12, into the pleural cavity in 8, into the mediastinum in 2, into the pericardium in 1, and into the mesentery in 1. In some reported cases rupture has taken place into the stomach, the duodenum, the colon, the pelvis of the kidney, the gall-bladder, the bile-ducts, the urinary bladder, the inferior vena cava, and the spinal canal. Rupture into any of these cavities causes death very quickly. When the sac erodes the colon, stomach, or duodenum there may be weeping of blood and slight haemorrhages for weeks. The rupture into the retroperitoneal tissues, which is the most common, may lead to very remarkable changes, and when it occurs suddenly in a person in whom the condition has been unsuspected, the clinical picture may be that of the acute abdomen. I have known 4 cases operated upon, in 3 under the belief that appendicitis was present, and in one instance for an abscess. The diffuse aneurysm may gradually increase in size until a huge tumour is produced, as shewn in Fig. 85; and when the condition lasts for weeks or months and there is not any pulsation, the condition may be very difficult to diagnose. The pressure features of aneurysm of the abdominal aorta shew great variations. The tumour may compress the lower end of the oesophagus or the pyloric end of the stomach, and give rise to dilatation of the oesophagus or stomach. The ureter may be compressed, causing hydronephrosis; and in one of my cases the left kidney was completely destroyed. Compression of the vena cava may cause great oedema of the lower part of the body. Local peritonitis over the sac is not uncommon.

FIG. 85.—Photograph of an abdominal aneurysm which lifted up the costal margin, and filled the whole of the left side of the abdomen.

Pressure on the nerves causes the most common and constant symptom —the pain.

Special Symptoms.—Pain is perhaps a more dominant feature in abdominal than in thoracic aneurysm. Occasionally there is no pain, but, as a rule, the sac growing forwards or backwards causes most severe pain. According to the situation of the sac it may be referred to the back or extend around the flanks. Very often in the early stages it shoots down the legs, or it may be referred to the hip, the sacro-iliac region, or to the lower part of the sternum. It may be continuous and of a gnawing, tearing character, or it may come on in crises of the most intense agony. The most intense pain is not always dependent on erosion of the spine, for it may be due entirely to stretching of the nerve-fibres over the sac. Nearly every one with large clinical experience can parallel the classical case reported by Beattie, which really first called attention to the importance of aneurysm of the abdominal aorta, and which is given fully by Stokes in his work on the heart.

Among other special features may be mentioned nausea and vomiting, which in two of my cases were so pronounced as to suggest serious disease of the stomach. Dysphagia may be caused by compression of the lower end of the oesophagus, and, as already mentioned, pressure on the duodenum or pylorus may cause great dilatation of the stomach. Haematemesis is not always due to erosion, but may result from embolism of the gastric arteries or possibly from pressure on the vasa brevia. When the sac is high in the abdomen and projects upwards, cardiac embarrassment comes on early, and is manifested by palpitation, shortness of breath, girdle-pains, and sometimes by attacks simulating angina pectoris.

Plugging of the abdominal aorta may lead to gangrene of the legs. Embolism of the arteries of the legs is not common. Embolism of the branches of the abdominal aorta may occur,—of the gastric arteries giving rise to haematemesis, of the mesenteric causing sudden pain, abdominal distension, collapse, melaena, and death; of the renal arteries, causing pain in the back and haematuria. Embolism is not very common; it did not occur in any case in my series. Paraplegia, a rare symptom, may be caused by plugging of the abdominal aorta and anaemia of the cord or by erosion of the spine and direct compression of the cord. Paralysis of one leg may be caused by pressure on the nerves. In aneurysm of the abdominal aorta bronzing of the skin has been described by Pepper and by Jürgens. (For aneurysms of the hepatic artery, see Vol. IV. Part I. p. 153, and of the renal arteries Vol. IV. Part I. p. 650.)

ARTERIO-VENOUS ANEURYSM.—**Definition.**—A communication between an artery and a vein, with or without an intervening sac; the former is called a *varicose aneurysm*, the latter an *aneurysmal varix*.

This is the oldest known variety of aneurysm; there can be no doubt that Galen recognised this form as a sequel of careless venesection, and that he cured a case of it. He had felt the thrill—the "noise" which is experienced when the hand was placed upon the sac. William Hunter gave the first complete modern description in 1757. An admirable account is given in Broca's monograph, which also deals with the older literature. Of the varieties of arterio-venous aneurysm some involve the external arteries and are usually traumatic; others, of the internal vessels, are usually spontaneous. The one follows the simultaneous wounding of an artery and a vein by a sharp instrument or by a bullet; in the other, rupture takes place from an artery into a vein, or erosion may occur from a vein into an artery.

Traumatic Arterio-Venous Aneurysm.—Formerly the common cause was venesection when an unskilful operator opened the artery and the vein at the bend of the elbow, nowadays stab wounds and bullet wounds furnish the largest number of cases. The femoral, brachial, axillary, and popliteal vessels are most often affected. It is stated that with the modern bullet the accident is more common, and this seems to be borne out by the statistics of the South African war and of the Japanese and Russian war recently published by Stevenson and by Siago.

The opening between the artery and the vein may be direct, the two vessels being in contact, but the arterial pressure is so much higher that the veins are gradually dilated and the condition is known as an aneurysmal varix. In other cases, more commonly in the traumatic variety, there is a sac communicating directly with both vessels, and forming an ovoid or globular pulsating tumour. The three distinguishing features of arterio-venous aneurysm are :—(i.) The distension of the veins above and below the lesion. When the deeper vessels of a part are involved they may not be visible externally, but as a rule in arterio-venous aneurysm of the arm or leg the varicose veins are the largest ever seen, standing out as huge convoluted tubes forming great saccular lacunae. In the axillary and subclavian regions there may be great swelling without any visible varicosity. The circumference of the affected limb may be greatly increased, and in some recorded instances the limb has been elongated, and an extra growth of hair is not uncommon. (ii.) On palpation a thrill is felt of maximum intensity at the site of the lesion, but propagated in the course of the vessels, in some instances for a great distance. It is a continuous vibration, but is increased during systole, and is much more intense than in any other condition; in fact the thrill itself is distinctive of arterio-venous aneurysm. The patient may be much inconvenienced by it; one man could never sleep on his left side on account of the noise transmitted from the tumour in the axilla. In a case under my care the thrill could be felt to the toes, and as far as the swelling above Poupart's ligament. Pulsation is felt, and where a sac intervenes an expansile tumour. Sometimes there is only a diffuse impulse without special localisation. Pulsation may be better seen than felt in the larger veins and sinuses. For example, a large tumour in the right iliac fossa had scarcely any palpable impulse, but the throbbing with each systole could be seen at a distance. (iii.) On auscultation a bruit is heard with special characters; it is very loud, in fact the loudest vascular murmur known; it is continuous, with systolic intensification, as if composed of two elements, a deep roaring continuous sound, which is venous and resembles the *bruit de diable* in the neck, and a more sibilant higher-pitched intermittent murmur, which is caused by the blood passing through the opening in the artery.

The *symptoms* of external arterio-venous aneurysm depend entirely upon the situation. In the carotids and in the subclavian vessels there may be little or no inconvenience for years. I have reported the case of a man who at fifteen fell with the result that a lead-pencil pierced both artery and vein high in the axilla. An arterio-venous aneurysm formed with swelling in the axillary and subclavian regions. It caused him no inconvenience, and he became an athlete and rowed in races. I saw him ten years after the accident when the signs were well marked. He served in the South African war, and when last I heard of him, in 1901, twenty-three years after the accident, there was no change in the aneurysm. Rokitansky speaks of a man aged sixty-two who, thirty-three years before, received a bullet wound in the left shoulder, followed by an arterio-venous aneurysm. In the leg and in the forearm the progressive enlargement of the veins may cause great disability, and in reality this is the special danger of the disease. After lasting for many years without change enlargement of the veins may take place rapidly. In the case mentioned by Rokitansky it was not until more than thirty years after the accident that the arm became blue and oedematous.

Internal Arterio-Venous Aneurysm.—Our knowledge of this form dates from the contribution of John Thurnam in 1840, whose paper almost exhausts the subject. The abnormal communication may be the result of a stab wound or of a bullet which penetrated the aorta and the vena cava, but it much more often follows the rupture of an aneurysm into the vena cava and the pulmonary artery. There are three situations in which it may occur:—

I. *The Aorta and Superior Vena Cava.*—In Thurnam's first case a man aged forty-two had a sudden pain in the chest with dyspnoea, and the upper part of his body became swollen and cyanotic. At the same time Thurnam discovered a loud "bruisement" like the vibration of a string to the right of the sternum. After death an aneurysm of the aorta was found to have perforated the superior vena cava. It is a comparatively rare lesion. I have only met with 2 cases. In 1890 Pepper and Griffith collected 28 cases from the literature, and a good many more have been reported since that date. The cases are usually in men, the subjects of aneurysm, often of the small unrecognised variety, but there have usually been pains in the chest, with cardiac distress. A most characteristic group of symptoms occurs with the perforation:—(1) There is a sudden onset with pain in the chest, dyspnoea, and signs of shock, small feeble pulse, and sweating. The shortness of breath increases, and becomes orthopnoea. (2) Within a few hours swelling begins of the face, neck, arms, and upper part of the body with cyanosis, which gradually deepens, so that the combination of swelling and lividity gives a terrible appearance to the patient. The veins of the neck, face, and arms become enlarged, and those of the upper half of the body, particularly the mammary, are greatly distended. At about the level of the diaphragm the swelling and cyanosis cease, so that there is an extraordinary contrast between the appearance of the upper and lower parts of the body. (3) Over the upper part of the sternum and in the right second and third interspaces may be felt a loud thrill with systolic intensification, and on auscultation a whirling murmur is heard of a continuous roaring quality, and intensified with each systole. (4) Evidence of aneurysm may be present. The cases are very characteristic, and with the exception of the sudden cyanosis of the upper part of the body which follows certain crushing accidents there is no other condition which could be mistaken for it.

II. *Aorta and Pulmonary Artery.*—This is a more frequent lesion, and has been studied particularly by Gairdner and Frederick Taylor, and recently Kappis, from Bäumler's clinic, has reviewed the literature of the subject. Usually the signs of aortic aneurysm have been present. The symptoms are practically those just spoken of in the previous section—a sudden onset, cyanosis, orthopnoea, oedema of the upper part of the body (though this has not been so constant), and the characteristic physical signs of a communication between two vessels. When an aneurysm perforates one of the chambers of the heart the physical signs may be identical. An aneurysm growing into the lung may open branches of the pulmonary artery and a murmur of the same character may be heard.

III. *Abdominal Aorta and Inferior Vena Cava.*—This, the rarest form of arterio-venous aneurysm of the internal vessels, occasionally follows a bullet wound, but most of the cases have been in aneurysm. It occurred in one of J. H. Bryant's Guy's Hospital series. The symptoms are quite characteristic—sudden onset of swelling, with cyanosis of the legs and lower half of the body, the presence of a tumour in the abdomen, or the condition has come on after an accident, and the physical signs are those of a communication between an artery and a vein.

Diagnosis of Aneurysm.—**General Remarks.**—In many instances the diagnosis is never made. The patient complains of ill-defined pains in the chest, and there is a fatal attack of angina, or death occurs from rupture. In a majority of all cases, when the sac reaches the thoracic wall, the diagnosis is easy. The small, deep-seated tumour growing upwards from the transverse arch or from the beginning of the ascending aorta may cause symptoms only, which are due to the pressure of the growth. Skoda, indeed, remarked that aneurysm of the thoracic aorta could not be recognised unless it reached the chest-wall, but with the x-rays even a small sac may now be seen, and there is rarely any difficulty in distinguishing between it and a solid tumour.

In doubtful cases there are generally circumstances which must be considered. A majority of all cases are in young or middle-aged males with a history of syphilis or hard work, or both combined. They are robust-looking and of a good colour, with what is spoken of in the hospital wards as the cardiovascular facies.

Special Conditions which simulate Aneurysm.—In two forms of valvular disease certain features suggest aneurysm. In *aortic insufficiency*, as pointed out originally by Corrigan, dynamic dilatation of the arch of the aorta and its branches may be so extreme that the diagnosis of aneurysm seems almost unavoidable. In the young, when the insufficiency has been rapidly produced, and when it is accompanied by high fever or anaemia, the throbbing to the right of the sternum may be so pronounced, or the pulsation above the right sterno-clavicular joint is so definite, that dilatation from organic disease is suspected. Unless the x-rays shew a well-defined saccular tumour, it is well to hesitate as to the diagnosis of aneurysm in the presence of aortic insufficiency. I have seen the pulsation three fingers' breadth to the right of the sternum, and there may be a definite tumour above the right sterno-clavicular articulation. Many cases of this sort have been recorded as aneurysm. A girl, aged seventeen years, after many attacks of rheumatic fever presented aortic insufficiency and a very large, forcibly-beating heart. The diagnosis of aneurysm, made by two or three very skilful men, is not to be wondered at in the light of the following account given by H. A. Hare. "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." In this case, which I saw frequently, the tumour could be grasped very definitely, and was visible and palpable during the diastole. The necropsy which I performed shewed that the condition had been one of simple dynamic dilatation. The heart was enormously enlarged with an extreme degree of insufficiency of the aortic valves, and the arch of the aorta did not admit the index-finger, or the innominate artery the little finger. Many of the cases of so-called rheumatic aortitis and aneurysm in young persons are of this nature. The second condition which may simulate aneurysm is mitral insufficiency with enormous dilatation of the left auricle, stretching of the recurrent laryngeal nerve, and marked pulsation to the left of the sternum. The pulsation, often regarded as of the left auricle, is in reality due to the conus arteriosus. The paralysis of the left vocal cord is due to the stretching and atrophy of the left recurrent laryngeal nerve by the greatly dilated left auricle. The condition is sometimes very puzzling. Of this I have seen three instances, and a number of cases are on record. My first case, diagnosed by one of the most distinguished physicians in Europe as aneurysm, had mitral stenosis for years with paroxysmal dyspnoea, great cyanosis, paralysis of the left recurrent laryngeal nerve, and widespread pulsation in the third and fourth left interspaces. In a recent case the x-rays shewed very definitely that the widespread pulsation to the left of the sternum was not connected with the aorta.

Dynamic Dilatation.—The aorta is remarkably distensile, and there are conditions in which the walls lose their tonus, and during systole dilate and throb in a way to suggest aneurysm. This is seen in aortic insufficiency, of which I have already spoken, in neurasthenia and hysteria, in Graves' disease, and in anaemia. A very interesting case is reported by Dr. Byrom Bramwell: "So marked were the pulsation and dulness in the region of the heart as to lead Dr. W. Murray of Newcastle-on-Tyne to believe that an aneurysm of the ascending portion of the arch of the aorta was probably present." Within a few months these physical signs completely disappeared. It is more particularly in the abdominal aorta that this dynamic throbbing leads to error. The patients are neurotic, sometimes definitely hysterical, with the usual symptoms of nervous exhaustion and pains in different regions, often the subjects of mucous colitis, but the centre of all their unpleasant sensations is the throbbing in the abdomen, which may be severe enough to interfere with sleep or even with the taking of food. Morgagni recognised and gave a very good description of this condition. Allan Burns also refers to it, 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 haemorrhages from the stomach and intestines has been described by Dr. Phillips, but I have not met with any reported case more remarkable than that of Albers. The girl was excessively neurotic, had fainting fits, great palpitation in the abdomen, and an astonishing degree of violent pulsation. She passed blood from the bowels, and the diagnosis of aneurysm was made, but a Dr. Weinhalt, who was called in, said he doubted if the pulsations proceeded from aneurysm, as he had read of similar cases in Morgagni. A positive diagnosis in these cases is not always easy, and the throbbing may be so extreme that the diagnosis of an organic lesion of the vessel seems almost inevitable. This is the view taken by Potain, Teissier, and others who describe the condition as one of acute aortitis, of which, however, there is not any anatomical evidence. The points to be taken into consideration are: (1) that in moderate grades this throbbing is common in nervous women and in thin hypochondriacal men; (2) the aorta is easily palpable and may be grasped with the fingers, sometimes feeling dilated and being very tender. With anaemia a thrill may be felt and a systolic murmur may be heard even without any pressure of the stethoscope; (3) the subjective sensations may be most marked—abdominal distress amounting even to pain, nausea, and in rare instances the vomiting of small quantities of blood or the passage of blood in the stools. It is well to bear in mind that no pulsation however forcible, no thrill however intense, no bruit however loud, together or singly, justify the diagnosis of aneurysm of the abdominal aorta in the absence of a palpable expansile tumour. Another condition associated with dynamic dilatation of the aorta and great vessels is anaemia. In the abdominal aorta the throbbing may be extreme. Sometimes, too, in the thoracic aorta and its branches the pulsations become very forcible in traumatic anaemia, in aortic insufficiency with anaemia, particularly in infective endocarditis, and in cases of Addisonian anaemia. One instance may be quoted, as the pulsation was intense enough to jar the bed:—

A large stout man, aged forty-five, had for some months suffered from dyspepsia and pain in the abdomen. He had become very anaemic, 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, 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 no definite tumour could be felt, the diagnosis of aneurysm was made. The necropsy shewed a duodenal ulcer placed directly upon the pancreas, and a normal abdominal aorta.

In pernicious anaemia the throbbing in the vessels of the neck and in the subclavians may be so violent as to suggest aneurysm.

Diagnosis from other Tumours.—Skiagraphy has been of great assistance in differentiating the pulsatile from the solid intrathoracic tumours. Occasionally subcutaneous tumours over the front of the chest have a communicated throbbing suggestive of aneurysm. Particularly is this the case with a cold tuberculous abscess associated with periostitis of the rib or the sternum. There may then be a definite jarring visible in the tumour, but there is absence of that expansile, forcible characteristic impulse, nor is the shock of the heart-sounds felt, and, as a rule, there is no murmur. There are two forms of pulsating empyema: (*a*) in one there is widespread throbbing of a large area of the chest, not unlike the jarring pulsation communicated by a large hypertrophied heart. It is not the strong heaving impulse of a cardiac or aneurysmal beating. Occasionally the pulsation may be very localised. I saw one instance in which the throbbing was entirely above the third rib on the left side. (*b*) In the other form, *empyema necessitatis*, the projecting tumour between the ribs presents a diffuse throb, not a strong heaving expansile pulsation. The *x*-rays here shew the condition very clearly. If necessary, a small needle may be inserted. It is not often now, I think, that an aneurysm, either in the abdomen or perforating the chest-wall, is opened in mistake for an abscess, as in the instances recorded by Ambroise Paré and Morgagni. One of the most deceptive conditions is the ruptured aneurysm of the abdominal aorta, which may form a very large tumour in the back, or the blood may pass down and reach one iliac fossa, and the tumour may be mistaken for abscess or appendicitis. As already mentioned, I know of four instances in which operation was performed in these circumstances, in one for a supposed abscess, in three cases for appendicitis. In a few instances expansile tumours of the bony wall of the chest are met with growing either from the sternum or from the ribs. As a rule, very little difficulty is experienced in determining the nature of the case.

Internal tumours are much more frequently a cause of difficulty in diagnosis. The small solid growths in the posterior mediastinum, connected either with the bronchial glands or with the oesophagus, may give a picture identical with that of the small aneurysm of the transverse arch, causing cough, severe orthopnoea, and paralysis of the left recurrent laryngeal nerve. Nowadays in good hands even a very small pulsating sac may be recognised by the *x*-rays. In any case, in an adult and a male, when there are no signs of external tumour or enlargement of the glands, such symptoms are much more likely to be caused by aneurysm. The small hard tumour of the oesophagus, just at the bifurcation of the trachea, may cause great difficulty, and even the *x*-rays may not be helpful, as is shewn in a case reported by A. L. Scott at the Pennsylvania Hospital. Quite as frequently the very large intrathoracic tumour growing from the mediastinum, the lung or the pleura, may cause symptoms very like those of aneurysm, as in the following case:—

A fairly well nourished woman of forty years, a patient of Dr. Bolgiano's, decubitus on the right side. Even before the night-dress was removed, pulsation was seen on the left side of the chest. Turned on her back, a visible impulse extended from the left sternal margin in the second, third, and fourth interspaces, lifting the chest-wall with each systole. There was no bulging. On palpation there was a diffuse shock, no punctuate impulse, no thrill; the shock of the second sound was felt over the area of pulsation. On percussion there was dulness over the manubrium and extending from the clavicle to the fourth interspace. On auscultation the breathing was feeble and distant; there was a systolic bruit to the left of the sternum. The apex-beat was in the fifth interspace, a little outside the nipple. There was well-marked tracheal tugging; the left recurrent laryngeal nerve was paralysed, and the voice was cracked. Nothing was lacking in the diagnosis but the definite aneurysmal impulse over the area of shock or pulsation. Had this been my first introduction to the case, I should have been in great doubt, but the conditions had been only too evident. I had seen the patient months before with a small tumour of the left lobe of the thyroid and an enlarged gland above the clavicle. In Europe she consulted Professor Kocher, who diagnosed cancer of the thyroid with mediastinal extension. On her return, Dr. Finney took out a gland in the neighbourhood, which proved to be cancerous. The mediastinal growth extended to the pleura, and probably to the lung on the left side, the left recurrent became involved, brain symptoms came on, with double optic neuritis. There was no question here of aneurysm, but the pulsation, the accentuated second sound, the systolic bruit, the complication of the recurrent laryngeal nerve, and the tracheal tugging gave a picture more suggestive of aneurysm than any I had ever before met with in malignant growth.

Very large thoracic aneurysms may simulate tumour, as in the famous case described on p. 661, in which Oppolzer diagnosed aneurysm and Skoda tumour (*vide* also Vol. V. p. 661). In rare instances aneurysm and sarcoma may coexist; in Virchow's case the two were in direct connexion.

Other Forms of Pulsatile Tumours.—Rapidly-growing sarcomas of bone and the very vascular tumours of the abdomen may present an expansile pulsation and lead to the diagnosis of aneurysm. In the case of the bony tumours the situation is usually so definite, the character of the growth so distinctive, and the *x*-ray picture so well defined, that there is rarely any doubt. More difficulty may arise in the case of a very vascular sarcoma in the abdomen, but the pulsation, though expansile, rarely gives to the hand that sensation of force and strength communicated directly from an aneurysm of the aorta or from one of the larger vessels.

Aneurysms which do not pulsate.—There are two conditions in which an aneurysm does not pulsate: (*a*) When a sac is obliterated with laminated fibrin. Sometimes met with in aneurysm 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 tumour is a sarcoma. Such an instance I saw in Montreal: a very large mass in the popliteal space which had neither pulsation nor bruit, after amputation of the leg, proved on dissection to be an obliterated aneurysmal sac. A remarkable case is reported by Hulke, and the sequel is given by Morrant Baker in his paper "On Aneurysms which do not pulsate." A huge tumour, which proved at the necropsy to be an aneurysm, occupied the left side of the neck from the trachea to the vertebrae, 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 very large aneurysm referred to on p. 661 did not pulsate. (*b*) The second condition in which an aneurysm may not pulsate is when it ruptures into the neighbouring tissues, forming a diffuse tumour. 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 I have reported, the tumour may be of enormous size and present slight or almost imperceptible pulsation. Sometimes no impulse whatever is to be felt. More particularly is this the case when the tumour extends rapidly in the flanks, forming a large solid mass. If the patient survives, as sometimes happens, 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. The cases may present the features of the acute abdomen, and, as already mentioned, 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 aneurysm was present.

Skiagraphy.—With a good instrument in skilful hands, obscure and latent cases of thoracic and abdominal aneurysm are now readily recognised. More particularly is the procedure helpful in the aneurysm of symptoms, the small tumour compressing the mediastinal structures. The extent, the localisation, the shape, the relation of the sac to the other parts may all be determined, and even the solidification in it has been followed. Whether the aneurysm is saccular or fusiform and the direction of its growth may be ascertained. Even in cases in which the sac has begun to perforate the chest-wall useful information may be obtained. The accuracy with which a small tumour can be localised is surprising: a young woman was admitted to my ward in a state of cyanosis and orthopnoea, which was relieved by bleeding. The physical examination was negative, except that less air entered the lower lobe of the left lung. There was a history of possible syphilis, but there was really nothing to determine the nature of the tumour compressing her windpipe. The *x*-ray examination shewed a pulsating shadow in the situation of the descending portion of the arch, and after death it was in this position that the aneurysm was found. Occasionally there may be doubt between a small solid tumour or a carcinoma of the oesophagus and aneurysm. Several examinations should be made, but even practised observers may not be able to decide. These, however, are exceptional cases. From an examination of a large number of cases in my wards, F. H. Baetjer classifies the positions as follows: (1) "Aneurysm 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 localisation would be found nearer the anterior than the posterior wall of the chest; (2) Aneurysm of the transverse arch casts a shadow slightly to the left of the sternum, and the shadow extends upwards, and by localisation would be found nearer the anterior chest-wall; (3) Aneurysm of the descending part of the arch casts a shadow to the left of the sternum, and by localisation would be found nearer to the posterior than the anterior wall of the chest." We have found the *x*-ray examination to be of special help in determining whether a case was suitable for surgical treatment; a tumour which points to the right of the sternum may be a small localised sac growing from the ascending aorta, or it may be only part of a very large aneurysm quite unsuitable for wiring. The diffuse dilatation of the aorta may be distinguished from the dynamic dilatation, as in the latter between the pulsations the shadow disappears, as the aorta contracts and its shadow lies within that cast by the sternum and the spine. Aneurysms of the descending thoracic aorta are not so clearly defined by the *x*-rays except in these patients, and the same may be said of tumours of the abdominal aorta. In several cases, with the most extreme pulsation of the abdominal aorta, no dilatation could be determined. (*Vide* also art. Vol. I. p. 507.)

Prognosis.—In a majority of cases the outlook is hopeless. The following are the important factors:—*Age.*—Post-mortem experience teaches that in the aged many cases recover; every museum contains specimens of healed aneurysms (removed from persons dead of other causes), the presence of which was unsuspected during life. A majority of such come from the aged who have lived quietly and in whom the aneurysm has been latent. I have seen in one aorta three completely obliterated sacs. At this time of life the conditions are favourable to repair in the atheromatous variety. An obliterated aneurysmal sac is not often seen in a man under forty years of age. *Form.*—The saccular aneurysm with a narrow mouth offers the best conditions for lamination. The very small and the very large appear to be most often obliterated. Some of the largest aneurysms on record have been the most chronic. No form of aneurysm heals more perfectly than the dissecting, so perfectly indeed that skilled observers have mistaken it for an anomaly of the aorta, and the patient may live for twenty or thirty years after an accident of the most destructive character (*vide* p. 641).

Early and thorough treatment should be carried out, particularly in the young syphilitic subjects, though it must be confessed that nature does more than art in the cure of aneurysm. For one obliterated sac the result of treatment, medicinal or surgical, there are five or six at least in which the condition has been found accidentally.

The prognosis in individual cases is very difficult to estimate. The average duration after discovery is from eighteen months to two years. The most rapidly fatal cases are those in which there have been neither symptoms nor physical signs—the small aneurysm of the arch which perforates rapidly; almost as many patients die of complications and intercurrent affections as from rupture of the sac. Sudden death, not common in hospital or private practice in patients under observation, is most frequently met with in medico-legal work. In a few cases the physical signs disappear, the symptoms are relieved and a practical cure is effected; in others with a persistence of the physical signs, tumour, and pulsation, there is no progress, and the patient is able to follow his occupation for ten or more years; in others again the chronic course is one of much suffering and discomfort.

The mode of termination in aneurysm is very variable. Sudden death may occur from haemorrhage, syncope, or angina pectoris. Rupture into the air-passages, the pleura, and the peritoneum is less rapidly fatal. Gradual heart-failure, asphyxia, oedema of the lungs, tuberculosis, and a progressive cachexia are responsible for more than a third of the deaths.

TREATMENT.—**Prophylaxis.**—The frequency of aneurysm may be diminished in two ways. The subjects of syphilis should be more thoroughly treated; but it is difficult to induce men to remain under supervision after all trace of secondary symptoms have disappeared. If every luetic patient were looked upon as a prospective candidate for tabes, general paralysis, or aneurysm, we should be more insistent on this point. In the second place, young men who have had syphilis should be warned not to take too much exercise, and particularly not to make powerful muscular efforts which throw a sudden strain on the vascular system.

In a majority of all cases the treatment is symptomatic; curative measures are successful in few cases.

Curative Methods.—These are directed towards the healing of the mes-aortitis and the promotion of coagulation in the sac. Iodide of potassium exerts a powerful influence on mes-aortitis, the primary lesion in a large majority of cases; and although it cannot of course heal a rent of the intima, and probably has very little effect on the sac itself, it relieves pain, promotes cicatrisation of the aortitis, and favours coagulation in the sac by lowering the blood-pressure. Though used before by others, we owe to the late George Balfour of Edinburgh the strong advocacy of this valuable remedy. It is more particularly in young men with a well-marked syphilitic history that good effects are produced by this drug, of which 1 to 2 drams may be given in the 24 hours. When syphilitic infection is recent, or when other visceral lesions are suspected, mercurials may be given at the same time. To promote coagulation in the sac certain methods are followed which, by increasing the coagulability of the blood and slowing the circulation in the sac, favour the natural processes of cure. The oldest is that of Valsalva, reported by Morgagni: "The essence of this treatment was to detain the patient very strictly in bed for forty days, and during this period to subject him to repeated bleedings, while at the same time the diet and drink were carefully ordered, so that the daily allowance, administered in three or four meals, should never be such as to fill up the blood-vessels." "He made it a custom," says Morgagni, "to diminish the quantity of meat and drink more and more every day, till it was brought down to half a pound of pudding in the morning, and in the evening half that quantity, and nothing else except water, and this also within a certain weight. After he had sufficiently reduced the patient by this method, so that, by reason of weakness, he could scarcely raise his hand from the bed in which he lay, the quantity of aliment was increased again by degrees till the necessary strength returned so as to allow of rising up." It is suggested that the pulsation in the aneurysm can be arrested entirely by this method; but even should the arrest be not quite complete at first, the disease may still be in course of cure if the patient will continue to submit to a modified and strict, but not quite so severe, regimen for some time to come. The difficulty in carrying out this treatment effectively, as stated by Morgagni (no doubt on the basis of Valsalva's experience, as well as his own), is that "there will be many to whom this method of cure may seem much more insufferable than the disease itself; especially as the only time when it can be of use (the beginnings of the aneurysm) is when the inconveniences actually felt are slight, so that patients are easily led to delay until continuous and grievous suffering, or even impending death itself, can no longer be avoided by any remedy whatever." The discussion that follows is very interesting, and may perhaps admit of the inference that failures of Valsalva's method were already well known in Morgagni's time, but were attributed (as failures usually are) to the remedy not having been adopted in time. But another inference follows even more clearly from this long discussion by the great pathologist of the eighteenth century, and from the cases submitted in illustration—namely, that with all his respect, amounting almost to veneration, for Valsalva, Morgagni seems to have used the method very tentatively, and with no inconsiderable misgivings (Gairdner). A modification of this was introduced by Bellingham and Tufnell, and is known by the name of the latter surgeon, the omission of blood-letting being the only point of difference from Valsalva's method. The indications are thus stated by Bellingham: "(1) To diminish the distending force of the blood from within (and above all, to diminish the frequency as much as possible of the heart's beats); (2) to favour the deposition of fibrin on the walls of the sac; (3) to maintain this process until the sac is filled up, and thus obliterated; (4) to bring about these results without deteriorating the quality of the blood, or diminishing too much the patient's strength." Tufnell's diet is: "For breakfast, 2 ounces of white bread and butter, with 2 ounces of cocoa or milk; for dinner, 3 ounces of broiled or boiled meat, with 3 ounces of potatoes or bread, and 4 ounces of water or light claret; for supper, 2 ounces of bread and butter, and 2 ounces of milk or tea—making in the aggregate 10 ounces of solid and 8 of fluid food in the twenty-four hours, *and no more*." It is not an easy method to carry out, and requires a good deal of fortitude on the part of the patient. In a young or middle-aged man, with a small aneurysm which the x-rays shew to be saccular, it is worth a trial. Tufnell gives some useful hints as to the arrangements. "A light, cheerful, and airy room; a special attendant always at hand to offer such aid as the patient may require, to read, converse with, or amuse him, are insisted on. The bed must be constructed and arranged so that the evacuations can be withdrawn without disturbance. Upon the bedstead must be placed two hair-mattresses, one upon the other, both full and elastic. Upon these (in proper site to receive the sacrum and hips), a large water-cushion properly but not over-filled; upon this, a double blanket sewn at the corners and sides to the lower mattress, and upon the blanket a fine linen sheet similarly attached, to prevent all wrinkling in the bed and disturbance of the sheet; another linen sheet (folded as after a lithotomy) laid transversely to receive the buttocks, and to be drawn from beneath them from time to time. On this bed, when once comfortably settled, the individual must be content to lie, without changing his position further than to turn from side to side, or occasionally round upon his face, should such movement give relief to the dorsal pain, as it sometimes will."

Rest is the important element in the treatment, and it is remarkable how quickly serious symptoms disappear after a week in bed. As Tufnell points out, the recumbent position reduces the heart-beats by about 43,000 in the twenty-four hours. In suitable cases, particularly in young men, these triple measures—rest, low diet, and iodide of potassium—should be given a thorough trial. In the cases which come under observation late with large sacs a symptomatic plan of treatment should be followed.

Surgical Measures.—For a full discussion surgical treatises must be consulted. Ligation of the aorta for aneurysm of the abdominal aorta has been performed in about a dozen cases, always with fatal results. *Distal ligation* of the carotid and subclavian (Brasdor's operation) has been done in many cases of innominate aneurysm, and often with success. *Compression* has been employed successfully in aneurysm of the abdominal aorta. It is only applicable when there is a space for compression above the sac. A case recorded by Dr. W. Murray, of Newcastle-on-Tyne, illustrates the possibility of cure when the aneurysm is in a favourable situation. "In this case the pressure was applied on two occasions at an interval of three days. On the first occasion of two hours' compression difficulties were experienced, and the results as regards the aneurysm were not important; but it is recorded that the patient passed no urine for nearly thirty hours. On the second occasion five hours were occupied by the pressure, but it was during the last hour only that complete control of the pulsations in the tumour was obtained. This result was evidently of the nature of a surprise. 'To my astonishment,' Dr. Murray says, 'the tumour had now become perfectly pulseless, and every indication of pulsation in the aorta below it had disappeared.' It is certainly very remarkable that the consolidation of the tumour seems to have gone on quite steadily from this moment, and that even the very next day there was 'no pulsation in the tumour, which is now perfectly stationary, hard, resistent, and lessened in size.' The pulse in the femoral arteries was also gone, but the excretion of urine was in this instance uninterrupted, or was quickly re-established. The details are very interesting, but cannot be further cited here. They shew that a complete cure was obtained; certainly not without some severe symptoms, but probably with the minimum amount of danger or inconvenience consistent with the method. It is not, however, irrevelent to remark here that the patient (who had remained well and fit for work in the interval) contracted a second aneurysm near the coeliac axis, of which he died suddenly six years later. The necropsy revealed the complete consolidation of the first aneurysm, which was converted into a fibrous mass; a great shrinking in the trunk of the inferior mesenteric artery ('dwindled to the size of the radial artery'), which arose out of this obliterated aneurysmal sac; the enormous enlargement, on the other hand, of the superior mesenteric ('as large as the aorta'), and a corresponding increase of size in all the vessels entering into the very highly-developed collateral circulation which had been established through the epigastric, internal mammary, intercostal, and circumflex iliac arteries outside the abdomen, and the hepatic, colica media and sinistra, and haemorrhoidal arteries, etc." (Gairdner).

Introduction of Foreign Bodies.—To extend the surface on which the fibrin may coagulate, Charles H. Moore, of the Middlesex Hospital, in 1864, introduced fine iron-wire into the sac, and since this date various substances have been used—horsehair, catgut, Florence silk. It has not been a very successful method; for details of procedure surgical manuals may be consulted. In a few cases cure has resulted. Various irritating liquids—iodine, perchloride of iron, etc.—have been injected into the sac without satisfactory results.

Electrolysis alone, or in combination with wiring of the sac, has given the best results. Hunner has collected 23 cases treated by the latter, the Moore-Conradi method, of which 4 cases were cured. Rosenstern's patient was alive seventeen years after the operation. This method has been extensively used at the Johns Hopkins Hospital; in no case with complete cure, but in several instances life was prolonged. Full details of an improved and safe technique are given by Finney and Hunner.

Needling the Sac.—Sir W. MacEwen very rightly criticises the wiring and electrolytic methods as forming a red thrombus, whereas the natural obliteration of a sac is effected by white thrombi gradually deposited on the wall. To promote their formation he advises needling the sac with one or more pins passed through the cavity, so that the point or points just touch and no more the opposite wall, and with these the internal wall is scratched and irritated. Several successful cases are reported by this method.

To Promote the Coagulability of the Blood.—The calcium salts have been recommended, but they do not seem of much service in aneurysm. Iodide of potassium is believed to favour coagulation in the sac. The gelatin treatment introduced by Lancereaux has had many advocates. He advises the injection subcutaneously every five or six days of 200 c.c. of a

7 per 1000 saline solution containing 5 grams of gelatin. From thirty to forty injections are given. Cures have been reported, and in many cases the sac diminishes in size, and the pain lessens. For several years this method was given a faithful trial at the Johns Hopkins Hospital, but without very favourable results (Futcher). In a few cases relief of the symptoms followed, but no case was cured. From contamination of the gelatin tetanus occurred in 2 cases (Rankin).

Symptomatic Treatment.—The early cough and dyspnoea are promptly relieved by rest. In the robust, full-blooded man, with shortness of breath and signs of venous obstruction, free venesection is most helpful, and may be repeated. In the severe paroxysms of dyspnoea blood should be freely removed, if necessary, from both arms. Morphine may be given, unless there is oedema of the lungs; but in any case, when a patient is suffering, and the orthopnoea is extreme, chloroform or morphine should be used. The question of tracheotomy comes up in these cases. The pressure is usually near the bifurcation of the trachea, and, theoretically, opening the windpipe would seem to be useless, and so it is in many cases, but temporary relief is sometimes given. The passage of an india-rubber tube may be tried. Removal of a portion of the sternum may relieve the pressure, and may be performed when the *x*-rays shew the tumour to be central and compressing the windpipe between the spine and the breast bone. It was done in one of my cases by Halsted, but too late. For the pain the iodide of potassium is helpful in the syphilitic cases. It is remarkable with what promptness the neuralgic pains are relieved by it; indeed, it was in this way that the drug was introduced in the treatment of aneurysm. Local applications—belladonna plasters, hot poultices, and the ice bag—give relief, but in a majority of cases, when the pain is fixed and severe, morphine must be given. It is always distressing to see a man completely under the control of this drug, but when the use becomes a necessity we should try to make a virtue of it, and by judicious management keep the dose at a minimum, and not worry the patient or his relatives with reflections on the disadvantages of the habit. I have known several patients who have lived in comparative comfort, and apparently with some prolongation of life, as a result of a daily dose of from 3 to 6 grains. Terrible cases, indeed, are those of aneurysm of the descending or abdominal aorta with nerve-root pressure, as they may require enormous doses of the drug.

W. OSLER.

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IN MEMORIAM.

DR. JOHN HEWETSON.

1867-1910.

The men of the first few years of the existence of this hos- [357] pital formed a very happy band—young and eager, with a great problem before them, too great, indeed, to be fully appreciated by us. It was a motley group that the gift of a new foundation in medicine had brought together, strangers to each other, strangers in a strange city; yet there was something in the air, and something in the spirit of the place that quickly ripened a mutual trust into good fellowship. The "lead" already given by that great triumvirate, Martin, Remsen and Welch, with Mr. Gilman's strong personality and intense interest in the hospital (which he had opened for the trustees) made the "running" comparatively easy. It has often been remarked that the reputation of the Johns Hopkins Medical School has been made by its young men, to which I may note incidentally my shelves bear weighty testimony in the 12 volumes, with the 500 papers of the graduates of the school during the first 8 years. We were singularly fortunate in the senior assistants with whom the work began, Councilman, Lafleur, Brockway and Robb. I have forgotten how it was that Lafleur came to us from Montreal, probably through my friends Ross and MacDonnell, but it proved a very happy selection, and the "Dane," as we loved to call him, gave a certain *cachet* to the position, which his successors have been keen to appreciate. In the first year we had for house physicians Toulmin from Philadelphia, Reese from Baltimore, and "Al" Scott from Philadelphia, all congenial spirits and enthusiastic workers. Reese was cut off by tuberculosis at the

[357] very outset of a brilliant career; while his many friends had to lament Scott's untimely death last year. As the work grew the following year Simon and Hoch came into the house. Then, in the summer of 1891, Thayer joined the staff, and in October succeeded Lafleur as first assistant. In 1890 there came to us, probably through the influence of Lafleur, John Hewetson from McGill, who had just finished a term of residence at the Montreal General Hospital. I have just had the sad news of his death, and wish to pay a brief tribute to his memory. Long practice has given me a fair control of my vaso-motors, but my grip has never been sure when a letter or some incident brought suddenly to my mind the tragedy of the life of "Jack" Hewetson. As I write there comes the far-away vision of a young face, frank and open, with the grey-blue eyes that looked so true, and a voice to match, with a merry laugh—no wonder that everyone loved him! Three happy years he lived with us, growing into a strong, earnest worker, and contributing with Dr. Thayer an important monograph on malaria, and many minor papers. Frank Smith and Barker, who joined the staff about the same time, became his devoted friends. The purveyor, Mr. Winder Emery, at once fell under his spell, and it was touching to see the affection with which the stern old martinet regarded the younger man. In 1894 Dr. Hewetson went to Germany, and in Leipzig appeared the signs of pulmonary tuberculosis. He had had a pleurisy in Montreal, and the disease made rapid progress. He returned to California, where his father lived, and began to fight the long and losing battle which has just ended. Brave and cheerful, never repining, even in his broken life, much happiness—happiness that comes with a devoted wife and faithful friends. We who loved him in those early days have never recovered from the tragedy of the wreck of a career of such peculiar promise. W. O.

Dr. John Hewetson, the eldest son of the late James Hewetson, of Riverside, California, was born in Bruce County, Ontario, in 1867. He was educated in Canadian schools,
[358] spending several years at Upper Canada College in Toronto.

Entering the Medical Department of McGill University, Montreal, in 1887, he was given the degree of M. D., after the regular course of study, by that institution in 1891. During his undergraduate days he was a member of the Zeta Psi Fraternity, and was elected to the highest office in the local chapter. [358]

In 1890 he was appointed assistant resident physician in the Johns Hopkins Hospital, and in 1892 became the first assistant to the resident physician. During his service on Professor Osler's staff, in addition to his routine work, he undertook special studies, including pathological courses in Professor Welch's laboratory, and analyses of the typhoid statistics of the hospital. With Dr. Thayer, who was then resident physician, he made special investigations on malaria; the results were published in the monograph by Thayer and Hewetson entitled "The Malarial Fevers of Baltimore."

The International Medical Congress was held in Rome in 1894; Dr. Hewetson went to Italy to attend the meeting as the delegate of the Johns Hopkins Hospital.

He began his European post-graduate studies in 1894, when he settled in Leipzig and took up work in the Anatomical Institute of Prof. Wilhelm His. After following the course in human embryology he became especially interested in the development of the human nervous system, and under Hans Held prepared several series of exquisite preparations of the medulla, pons and mid-brain of new-born babes, stained after Weigert's method. Stimulated by the lectures of His and Held, and also by the demonstrations of Paul Flechsig, it was his intention to make exact studies of the series he had prepared with the hope of throwing fresh light upon the development of the conduction paths in this portion of the central nervous system. His plans were suddenly interfered with by his discovery of tubercle bacilli in his own sputum in the summer of 1895, while actively engaged in laboratory work. He had suspected the possibility of the disease from some symptoms which had recently developed, especially as he had suffered from an attack of pleurisy in Montreal, and because he knew himself to be predisposed, since his mother and sister had suffered from pulmonary tuberculosis.

[358] Interrupting his work in the anatomical laboratory he set out at once for the hills of Southern Bavaria, where he began his long fight against his malady in Partenkirchen-Garmisch. Later on he spent some time at Les Avants (above Montreux). Subsequently he made a voyage to Australia. In 1897, somewhat improved, he returned to Riverside, California, where he afterward lived, spending the summers in British Columbia, until his death in St. Joseph Hospital, Victoria, B. C., September 22 of this year. His death was doubtless hastened by the loss of his devoted wife (née Susan Bacon of Boston) in the preceding year.

The preparations on the nervous system which Dr. Hewetson prepared, though they could not be used by himself, were turned over to Professor Mall's laboratory in Baltimore, and served as the basis for a number of studies in that institute. The illustrations of transverse sections and horizontal sections of the medulla, pons and mid-brain in my book on "The Nervous System and its Constituent Neurones" were drawn by Louis Schmidt from these specimens, and the wax model made by Ziegler, of Freiburg, after the reconstruction of Dr. Florence Sabin, also had its origin in Hewetson's sections. A number of under-graduate and graduate students who have worked in the anatomical laboratory in Baltimore on the structure of the nervous system have had the opportunity of studying the original preparations.

Important as the medical work of Dr. Hewetson was, it was over-shadowed by the character and personality of the man, and by his peculiar power of inspiring respect, friendship and affection, as is well shown by the tribute paid to him by Professor Osler in this number of the BULLETIN.

LEWELLYS F. BARKER.

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An Address

ON

THE HOSPITAL UNIT IN UNIVERSITY WORK

Delivered before the Northumberland and Durham Medical Society

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An Address

ON

THE HOSPITAL UNIT IN UNIVERSITY WORK.

GENTLEMEN,—I offer no apology for bringing before you an academic subject. Though the society has no direct university affiliation, as individual members you are interested in the development of the profession, and you take a pride in the rapid growth of the provincial universities, among which that of Durham, the northern sister of Oxford and Cambridge, takes precedence. What is university work? What is a hospital unit? What connexion have they with each other? And what interest have they for us, and for the community at large?

THE FUNCTIONS OF A UNIVERSITY.

All are agreed that a university has a dual function—to learn and to advance learning. I use the word "learn" in the old sense—met with in the Bible and still used colloquially—as it expresses the mental attitude of the student towards his *alma mater*, "*totius litteratorii studii altrix prima.*" In mind, manners, and morals the young man seeks life's equipment when he says to his *alma mater* in the words of the Psalmist, "O learn me true understanding and knowledge." To learn the use of his mind, to learn good manners, and to learn to drive Plato's horses, form the marrow of an education within the reach of every citizen, but to which universities minister in a very special way; and it should be comprehensive, fitting a man in Milton's words "to perform all the offices, private and public, of peace or of war." The other great function of a university is to advance learning, to increase man's knowledge of man and of nature. Looking over the lecture list of any modern university one is impressed with the bewildering complexity of subjects taught, from Homer to Victor Hugo, from Tamil to internal secretions; but they may be roughly grouped into those dealing with man and those dealing with the cosmos about him. At any time these 800 years this division has been recognised, and though we have travelled a long way from the seven liberal arts which once comprised the whole range of study, it is not so much the nature of the subjects or their division that characterises modern education as a new spirit, a new attitude of mind towards them. No real progress was made until we returned to the Greek method—the pursuit of knowledge for its own sake. Out of the laboratories, as the result of work done by men absorbed in study and usually without the slightest bearing upon practical problems, came the three great revolutions of the nineteenth century—the annihilation of time, the substitution of the machine for the hand, and the conquest of disease. Physics, chemistry, and biology have given us control of the forces of nature. Faraday has harnessed Niagara, the power of which is now transmitted hundreds of miles away; the Curies have found the magic vril of Bulwer Lytton's "Coming Race"; and Pasteur has revealed one of the greatest secrets of life. It is characteristic of modern conditions that, hovering on the borders of the charmed circle of pure science, are those keen to turn every discovery to practical use. What good is knowledge unless it can be utilised in the service of man, asks a utilitarian age? The university of to-day, while ministering to the advancement of learning, is ready to teach how to make the learning profitable, so that everything in practical science, from household economy to aviation, finds its place. Schools specially adapted to special needs stand out as dominant features in the new programme, and Oxford and Cambridge, as well as Newcastle, Leeds, and Bristol, have felt the strong impulsion to develop the science which deals with human well-being. Of the old faculties which made up the *studium generale* medicine has been the one most profoundly affected by growth of modern science. What a revolution in our generation! Anatomy, physiology, and pathology, with their subdivisions of histology, embryology, physiological chemistry, and pharmacology, are now in laboratories controlled by specialists, whose ideals and work differ in no respect from those of their colleagues in the departments of physics, chemistry, and biology; and in many places large separate institutes are devoted to these subjects. The urgent need to-day is to extend this type of university work into our medical schools, so that *all* branches of the curriculum are included—medicine as well as pathology, surgery as well as anatomy, midwifery and gynæcology as well as chemistry. But here comes a difficulty—the practical schools which deal with these important subjects and their subdivisions are not under the control of the university, or at best have a very feeble affiliation. In this country the hospitals are either independent corporations, as here, or the medical school has evolved from the hospital, as in London, or there exists a mutual arrangement between the university and the hospital, as in Edinburgh. The difficulty is not insuperable—the same public-spirited citizens support both institutions; the hospital staff includes the teachers in the medical school. It only needs a rearrangement of responsibility, financial and educational.

The Hospital Unit.

What is a hospital unit, and how can it be brought into line with university work? First a word on what a hospital stands for in the community. Primarily for the cure of the sick and the relief of suffering; secondly, for the study of the problems of disease; and thirdly, for the training of men and of women to serve the public as doctors and nurses. A majority of hospitals deal only with the first of these objects, and incidentally with the third. All agree that a study of the problems of disease and the training of men and women in the technique of the art come within the sphere of the university. England has suffered sadly from an absence of great medical faculties, such as exist on the Continent; and nowhere is this more evident than in the dissociation of the hospital from the university. One consequence has been that the hospitals have been built by men who had no idea whatever of their scientific needs, and too often staffed by men who knew little and cared less for anything beyond their primary function. The present plan of hospital administration is a legacy from a period when university ideals had not reached the practical side of our medical schools. I need not do more than to refer to the arrangement of the staff which exists everywhere—three or four physicians, two or three surgeons, one or two gynæcologists, other specialists, and a group of juniors who serve as out-patient assistants, waiting for promotion to the wards. The pathological department, often only a dead-house so far as the hospital is concerned, is in no way coördinate with the others. Laboratories of bacteriology, clinical chemistry, microscopy, and of clinical physiology may or may not exist. This English system, which has spread to the United States and to the Dominions, has worked well in some ways, and is responsible for the general excellence of the hospitals, large and small. Go where you may, from the cottage hospital to the big city infirmary, the internal economy, so far as cleanliness, general care of the patients, and nursing, is admirable. Speaking from a comparatively wide experience of hospitals, I say unhesitatingly that the average level of comfort and care is nowhere so high as in this country, and in no small measure is this a tribute to the character and training of the women connected with them. But there are very glaring defects, foremost among which is the absence of proper laboratory accommodation in pathology, bacteriology, clinical chemistry, and microscopy. Time and again in large well-arranged hospitals I have asked for the pathological laboratory, and have been shown a dead-house; for the clinical laboratory, and have been told that it did not exist; and have been chagrined to find that even in so simple a matter as the determination of the nature of a tumour, or the bacteriological examination of a fluid, the institution had to depend upon the excellent clinical research laboratories of London. But an equally grave defect is in the internal organisation. The general hospitals, even those connected with medical schools, are as a rule overstaffed, four physicians or three, where there should be but one or two, and the same with the surgeons. On the other hand, in many the resident staff is miserably inadequate, and their time so taken up with routine that any scientific study of cases is impossible. A keenly interested physician has a capable house physician in good training—off he goes at the end of six months! and the same weary process begins of putting a fresh man into harness. In the very best hospitals, with medical school affiliation, the arrangements are on old and very unsatisfactory lines. In long, uphill years the ambitious young man goes through the position of resident physician, medical registrar, assistant physician, and at 40 (if he is lucky!) gets wards. Then a visit two or three times in the week with a house physician, a certain amount of teaching, and possibly some laboratory work, but he has a living to get and practice becomes the first consideration. He has precious little pay, if any; there are no paid assistants; there is no continuity in the organisation; in fact, there is no organisation on modern lines. This can be changed if we can convince the authorities that the subjects of clinical work come directly within the sphere of the university, and that certain hospitals must be adapted to meet the demands of the scientific study of disease and the scientific training of students. The problem is how to place a dozen or more teachers in every medical school in the same relation with the university as the professors of physiology and of physics—how to give to each one of them a department organised on university lines, in which the three functions of a hospital may be utilised and coördinated. The hospital unit meets the condition—a department under the complete control of the university, or under the joint control of hospital and university. Take a medical faculty with, say, 300 students, for which the necessary hospital accommodation would be about 500–600 beds, a unit would represent a clinique in the continental sense, of which there would be five or six major, and as many minor—the former including medicine, surgery, midwifery and gynæcology, pyschiatry and neurology, pædiatrics, and ophthalmology; the latter, dermatology, dentistry, laryngology, otology, syphilis, and genito-urinary diseases. There might be, as at Berlin and Vienna, two or three medical and the same number of surgical units. In Vienna, for example, there are three completely equipped midwifery and gynæcological units, each with lecture rooms, laboratories, rooms for students, and the whole paraphernalia for teaching and research.

THE ORGANISATION OF THE UNIT.

Let us take medicine, the one with which I am familiar. The components are the professor or director, 60 or more beds, an out-patient department, four or five laboratory rooms, and a staff. Let us deal with these in detail.

The *Professor* has three duties—to see that the patients are well treated, to investigate disease, and to teach students and nurses. He should be a man with wide sympathies and of trinocular vision. He should have a comprehensive and thoroughly scientific training, and should enter clinical medicine through one of three portals—physiology, chemistry, or bacteriology and pathology. He must be keenly practical, keenly scientific, fond of his patients, fond of his work, and devoted to his students. He should live as much in his wards and laboratories as do his colleagues in their laboratories of anatomy, physiology, chemistry, or physics. The question at once comes up, Is this possible? Can we expect surgeons, physicians, obstetricians, and specialists to devote themselves entirely to University work, and to carry out the three functions of the hospital, without regard to the public outside? Theoretically it sounds feasible, but in practice I do not believe it to be possible. In the case of a successful teacher with a widespread reputation, the public, to say nothing of the profession, could not be kept away from him. But it would not be unreasonable to ask such a man to devote at least one-half, or even more, of his time to the hospital duties. For the heads of the different units the university would go into the open market and seek the best men available. Under our present system the university choice of professors in the practical departments of the faculty of medicine is, as a rule, limited to men who hold hospital positions in a town. It is encouraging to see that the provincial universities are departing from this old practice, and I am very glad that you lost your distinguished townsman, Dr. George Murray, who was appointed to the chair of medicine in Manchester.

But it may be urged—have we not heard that the day of the pure clinician is over?—did not our *Opsonator maximus*, Sir Almroth Wright, pronounce his funeral oration a few months ago at the Royal Society of Medicine? Do not listen to him—*Clinicus perniciosus*, to quote Mindererus, with vision so myopic that he can see only applied bacteriology in clinical medicine. As is the twig, so is the tree, and with his upbringing such opinions are perhaps natural; and it is not for me to abuse an old friend, of whose good work no one has a higher appreciation. But in these days so winged are Sir Almroth Wright's words that they fly far and need a protest from one who has been keenly alive to every bacteriological advance in medicine. Think of what would have happened if a man of Sir William Broadbent's wide sympathies, clear judgment, and enthusiasm had had a great modern clinique at St. Mary's Hospital, such as those of Leyden or of Kraus at Berlin—do you suppose the bacteriological tail would have wagged the clinical dog? Far from it! Sir Almroth would have done just as good work as director of the bacteriological laboratory of the clinique, and vaccine therapy would not have received such tardy recognition, and would have been in just as satisfactory, or possibly in a more satisfactory position. A striking comment, too, on Sir Almroth's claims is the fact that the medical and surgical staff at St. Mary's are still on duty!

Patients.—In the case of the medical clinique the number will depend upon the size of the medical school. In a hospital to which many acute cases are admitted a male and a female ward with about 30 beds each, and with a few small extra rooms, would furnish ample clinical work for a senior class. There are continental cliniques in which double this number of patients are treated, and the matter is one for organisation. To make the teaching and the work of the unit effective, it is essential to give the professor control of an out-patient department, with proper arrangements for the study of the cases and for the teaching of the junior students. In how many out-patient departments is the university side of the hospital problem considered?

Laboratories.—It is a characteristic of modern medicine that every available science is pressed into her service in the study and treatment of disease. Any sort of rooms will do for laboratories. The very best of work has been done with the meanest sort of equipment. The ideal plan is that followed in certain hospitals, the new cliniques, for example, of the Cochin in Paris, in which each unit consists of two wards on either side of a central building, the lower floor of which is devoted to administration, and the upper to laboratory purposes. In every way it is a convenience to have the laboratory rooms in close proximity to the wards, and when feasible they should form an essential part of the unit, but for the sake of economy they may be merged, and all the pathological work concentrated in one building. Nowadays provision should be made for (1) cardio-respiratory physics and physiology: (2) bacteriology and vaccine therapy; (3) chemistry; (4) microscopy; (5) X ray and electrical work; and (6) a general laboratory for the students. From the standpoint of the teacher the most important of these is the large laboratory for the students, in which the subject of clinical microscopy is systematically taught to the juniors, each man having his own place and his own microscope, and in which the seniors work while acting as clinical clerks. No benefaction to the Johns Hopkins Hospital was more helpful to the medical school than that in which some kind friends gave the necessary money for a clinical laboratory. The best general clinical and pathological laboratory I have seen lately is that newly opened at the hospital which gave me my start in life, the Montreal General. The arrangements for students are admirable.

The staff.—The present arrangement existing in almost all English, American, and Dominion hospitals is antiquated, and in every way ill-adapted to modern conditions. A man is given a house physicianship for six months, or possibly a year; there is a senior resident physician, and there are laboratory assistants, who may or may not be at the disposal of the professor. Gradation, permanency, and specialisation should prevail as in any other university department. There should be four groups. First, the senior assistants nominated by the professor, holding university as well as hospital appointments, and who should be prepared to remain for an indefinite number of years. In a clinique of moderate size three such could be utilised. The first assistant, a man of some maturity, should be in full charge of the department in the absence of the professor. The position should be made attractive and ample opportunities should be given for original work and for teaching. From this group the professoriate throughout the country would be recruited. Secondly, the junior assistants, house physicians, appointed annually and by competition from the members of the senior class. Thirdly, laboratory chiefs, who need not be resident; but it is a good plan to have one of the senior assistants in charge of the laboratories, and one who is at the same time responsible for the laboratory teaching of the students. The arrangements vary greatly at different cliniques in accordance with the leanings of the professor towards chemistry, physiology and physics, or bacteriology. Fourthly, an out-patient staff made up of assistant professors in the department, as a rule men in private practice, and who are in charge of the junior teaching. At the Johns Hopkins Hospital we had three men in charge of the medical out-patients, each of whom took two days in the week, each with his own staff of assistants and a group of students assigned as clinical clerks. Special out-patient departments may be managed by the clinique; for example, the Tuberculosis Dispensary, which at the Johns Hopkins Hospital, under the care of Dr. Hamman, has grown to be one of the most important departments of the hospital.

Teaching.—Entering one of the clinical units, a student should be made to feel a part of it, having his share in caring for the patients and in studying the disease, and even in the teaching. He should be made to feel that the hospital is his home. This has been one of the special boons enjoyed by the British medical student in his senior years; the hospital has been in reality the medical school, and there has not been that disassociation between the two which exists too frequently elsewhere. The teaching should be entirely practical. In a few systematic lectures some of the more rare affections may be considered. Brought into daily contact with disease, the students gradually learn to recognise it, and are taught the management of patients. In clinical lessons and in demonstrations the professor and the assistants would in the course of a year cover the ground very thoroughly. In amphitheatre cliniques it is easy to keep all senior students in touch with the department, while the special group, acting as clinical clerks, spend the greater part of their time in the wards. The five years of the curriculum should be divided equally, and the 30 months given to the hospital would enable a man to go the rounds of the departments and get a very full insight into the work. Hospitals have no vacations, and the old-time vacations should be done away with, and the school year divided into quarters, during which the work would proceed continuously. A man could take a week or so of vacation when he felt it was necessary, but it is high time a stop was put to an atrocious waste of time on the part of the students. The professor and his assistants should keep in mind the fact that the men entrusted to their care are to become practitioners, and as far as possible the practical work of the wards should be done by them. Upon one thing I would insist—that every assistant connected with the clinique taught. A few exceptional men, like the distinguished physicist, the late Professor Rowland, are really too good to teach; but for the majority, daily contact with students, and a little of the routine of teaching, keep us in touch with the common clay and are the best preservatives against that staleness so apt to come as a blight upon the pure researcher.

Research work.—Just as the big chemical laboratory of the university exists for research, so should the clinical units help to advance our knowledge of the causes of disease and of its treatment. The problems are innumerable, and in a well-organised clinique there will be men working at them in almost every department. A few of the better students may always be utilised for this purpose. The important thing is to keep one section at least of the clinique well in the fighting line, battling with the problems of to-day, in metabolism, immunity, cardio-respiratory physics, &c.

The other units would be organised in the same way, and, as I remarked, in large schools there could be three, or even four, medical and surgical cliniques. The important thing is to organise each unit on university lines. For example, the professor of psychiatry should be *ex-officio* in charge of the city asylum, managed as one of the departments of the university, and into which, as a matter of routine, each medical student would pass for one of his ten hospital trimestres.

The truth is, we need an active invasion of the hospitals by the universities. But—and here comes the rub—the universities must be willing to undertake their share of the expenses, and the men in charge of the units must be paid salaries sufficient to enable them to devote one half at least of their time to hospital work—to give it the first place in their lives. At present in many places, indeed one may say everywhere, the university does not pay enough for its hospital privileges. How much, I would like to know, does the University of Durham pay to the Royal Victoria Infirmary? Nowadays the physicians and surgeons give their time, but the public, through university channels, should pay this group of men, not only to care for their sick poor, but to train their doctors and nurses, and to study for them the problems of disease. It is impossible to separate the three primary functions of a large hospital, of the machinery of which the medical student is just as much a part as the nurse, and so involved are the new methods of diagnosis, of laboratory treatment, and of research with the utilisation of skilled scientific assistants that it would puzzle anyone to assign the proportion of cost to A, B, or C. A good rule is that followed at the Johns Hopkins Medical School—the University paid half of the salaries of those members of the staff who were directly engaged in teaching and one half, I think it was, of the laboratory expenses.

As the old order changes new developments must be met, and here in the provinces, less hampered by traditions and not tied in the chains of vested rights, you can reorganise the hospitals on these lines through the universities. I have not been discussing Utopia; it is being done elsewhere. In the United States and the Dominions these changes are rapidly progressing, and the hospitals, for example as in Toronto, are being built on a modern plan, with units such as I have described. It will take time and much money, but it can be done; in fact, it has to be done if British medicine is to adjust itself to the new conditions, and so maintain its splendid traditions. Nor is it a matter which concerns the mother country alone. In former days the over-seas students came here for all their work; now the majority of them take their qualifying studies at home and come abroad for post-graduate work. The students from various parts of the Empire should come to our universities and hospitals and find thoroughly organised departments, with laboratories as well equipped for the study of the problems of disease as are those of chemistry and of physics for the study of these subjects.

Prof. W. OSLER

Università di Oxford

SULLE TELANGIECTASIE EMORRAGICHE EREDITARIE

Estratto della " Riforma Medica ,, Napoli, 1911 - N. 3

NAPOLI
COOPERATIVA TIPOGRAFICA
Sezione " Riforma Medica ,,
Largo de' Bianchi allo Spirito Santo. Num. 1 a 6.
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A partire dal 1901, epoca in cui io riferii, nel Bollettino dell' Ospedale Johns Hopkins, intorno ad una forma familiare di epistassi ricorrente, con telangiectasie multiple della pelle e delle mucose, numerose comunicazioni sono state fatte su questa malattia, la quale sembra, perciò, non essere molto rara. Essa era stata segnalata anche prima, da varii osservatori. È quasi certo che i casi di epistassi ricorrente in cinque generazioni, riferiti da Babington *(Lancet,* 1865), appartengono a questo gruppo. Nel 1876, Wickham Legg riferì, nel *Lancet,* l' osservazione di casi di epistassi in tre generazioni, in individui che presentavano delle telangiectasie sulla faccia e sul corpo. Nel 1887, Chiari *(Erfahrungen auf dem Gebiete der Hals und Nasenkrankheiten, Wien)* riferì intorno a casi di epistassi ricorrente, con telangiectasie multiple della pelle e delle mucose, in tre generazioni di una famiglia, ed in quattro di un'altra. Nel 1896, Chauffard *(Bull. et Mém. de la Société Médicale des Hôpitaux de Paris,* 1896, Tome XIII) descrisse un caso in cui producevansi non soltanto delle epistassi, ma anche altre emorragie ricorrenti, da telangiectasie cutanee e mucose. Nello stesso anno, Rendu *(Gaz. des Hôpitaux,* 1896), descrisse un caso di epistassi, con numerose telangiectasie delle membrane mucose e della pelle.

In tutti questi casi, la malattia fu ritenuta associata, in qualche modo, all'emofilia. Chauffard propose, per essa, il nome di emofilia cutanea. Rendu la chiama « pseudo-emofilia ».

I primi casi da me osservati furono due fratelli, nella cui famiglia erano stati affetti sette membri. I pazienti avevano sofferto di epistassi sin dalla fanciullezza, ed oltre a ciò erano andati soggetti ripetutamente ad emorragie da numerosi piccoli angiomi cutanei. Nel terzo caso da me riferito, trattavasi di un uomo di 49 anni, il quale, sin dal suo decimo anno d'età, andava soggetto di quando in quando ad epistassi, ed oltre a ciò ad altre emorragie, da telangiectasie della lingua, delle labbra, della faccia e delle mani. Le emorragie nasali provenivano da numerosi angiomi disseminati. All'epoca in cui pubblicai questo caso, io riferii, giusta le informazioni avute, che nessun altro membro della famiglia era affetto ; appresi però posteriormente, che uno dei figli del paziente presentava dei nevi vascolari. Il quarto caso da me osservato, concerneva un uomo di 53 anni, nella cui famiglia avevansi delle epistassi e delle telangiectasie già da tre generazioni. Questi quattro casi trovansi riferiti per esteso nel *Quarterly Journal of Medicine,* Oxford 1907.

La malattia in parola ha attirato l'attenzione di molti osservatori, e parecchi casi sono stati riferiti da Kelly *(Glasgow Medical Journal,* 1906) Hawthorne *(Lancet,* 1906), Parkes Weber *(Lancet,* 1907), Sydney Phillipps *(Royal Society of Medicine Proceedings,* Vol. I), Kelly *(Royal Society of Medicine,* Vol. I), Balantyne *(Glasgow Medical Journal,* 1908), Waggett *(Royal Society of Medicine,* Vol. I), Hanes *(Johns Hopkins Bulletin,* 1909).

Recentemente ho osservato un altro caso, in cui erano affetti un padre ed una figlia.

Quest' ultima era una signora trentacinqnenne, la quale fu da me osservata insieme col D.r Anderson, di Londra. Il padre della paziente soffriva già da molti anni di gravi epistassi ricorrenti, ed avea la faccia coperta di telangiectasie. Oltre a lui, non vi fu nella famiglia alcun altro caso, se non quello di sua figlia. Questa soffre, sin dall' infanzia, di epistassi ricorrenti, e non è passato quasi mai un intero mese, senza che essa vi sia andata soggetta. La paziente ha presentato, sin dall' infanzia, alcune telangiectasie ; ma il numero di queste è considerevolmente aumentato negli ultimi sei anni, massime sulle labbra. Essa è stata sottoposta, con notevole vantaggio, alla cauterizzazione delle telangiectasie nasali e delle linguali. Oltrechè da queste due sedi, la paziente ha presentato emorragie anche dalle labbra.

L' inferma è una donna di statura media, con viso spiccatamente pallido. Essa presenta piccole telangiectasie disseminate sulle due guancie, ed una di circa 3 millimetri di diametro sul dorso del naso. Sulle labbra si osservano molte piccole telangiectasie di color rosso vivo, di 2-4 millimetri di larghezza, ed oltre a ciò, tre o quattro angiomi più grandi, rosso-bluastri, di 10-15 millimetri d' estensione, che sporgono come tumoretti emisferici. Questi erano da prima assai più piccoli, e sono man mano aumentati di volume negli ultimi anni. Sulla lingua vi sono una mezza dozzina di nevi, due dei quali di 5 millimetri di diametro, e forse più. Nessuno se ne osserva alle guance, nè alla faringe. Sulle dita vi sono alcune telangiectasie puntiformi disseminate, una delle quali sotto l'unghia dell' indice sinistro. La pelle del resto del corpo ne è libera. La mucosa del setto nasale è coperta d'una spessa crosta di sangue, per effetto d'un'emorragia verificatasi due giorni prima.

Il solo fattore etiologico di qualche importanza è l'eredità. Nella letteratura son ricordate, sinora, 14 o 15 famiglie, nelle quali la malattia occorse per due a cinque generazioni. L'affezione sembra manifestarsi con ugual frequenza nei due sessi. Talvolta essa incomincia sin dall'infanzia, tal'altra le telangiectasie non appaiono che nell'età adulta. La pelle della faccia e la mucosa del naso, delle labbra e della bocca, sono prevalentemente affette ; meno spesso la pelle delle mani ; di rado quella delle altre parti del corpo.

Le emorragie provengono sempre dalle telangiectasie, ed il più spesso dal naso. Esse possono essere gravissime. Uno dei miei pazienti ebbe delle epistassi ricorrenti per più di 40 anni. Non poche volte l'emorragia era di estrema gravezza, ed in parecchie di tali occasioni l' infermo fu ricevuto nell'ospedale in uno stato di profonda anemia. Le emorragie possono anche prodursi da telangiectasie delle labbra, della faccia, della lingua. In uno dei miei casi, l'infermo aveva frequenti emorragie da nevi vascolari delle mani ; in un altro caso, producevansi emorragie da un nevo dell'avambraccio.

La malattia è molto facilmente riconoscibile, nè esiste alcun' altra affezione con la quale la si possa confondere. Alcuni dei casi meno recenti furono riferiti come casi di emofilia. Anatomicamente, la lesione è costituita da una dilatazione dei capillari e delle piccole vene, per lo più sotto forma di caratteristici nevi vascolari. Spesso si osserva un nodulo centrale, leggermente sporgente. Col progredire dell'affezione, possono aversi sulla faccia angiomi solidi disseminati. In alcuni casi, come in quello che or ora ho riferito, si hanno formazioni angiomatose abbastanza grandi.

Molto può farsi per la cura della malattia, distruggendo le piccole telangiectasie con la cauterizzazione. Solo così può sperarsi di ottenere una cessazione od un' attenuazione delle epistassi ricorrenti. In un caso riferito da C o e, si ricavò gran giovamento dalla somministrazione di lattato di calcio. Allorchè si tratta di angiomi di una certa grandezza, come quelli delle labbra nel caso su riferito, è consigliabile di sperimentare il radio.

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WHOLE-TIME CLINICAL PROFESSORS

A LETTER TO PRESIDENT REMSEN

JOHNS HOPKINS UNIVERSITY

FROM

WILLIAM OSLER

NOT FOR PUBLICATION

OXFORD: HORACE HART
PRINTER TO THE UNIVERSITY

WHOLE-TIME CLINICAL PROFESSORS

To the President, Johns Hopkins University

DEAR REMSEN,

The subject of whole-time clinical teachers, on which I send you the promised note, is one of great importance, not only to Universities, but to the profession and to the public at large. It is a big question, with two sides. I have tried to see both, as I have lived both, and as much, perhaps, as any one can appreciate both. Let me thank you, first, for Mr. Flexner's Report. As an Angel of Bethesda he has done much good in troubling our fish-pond, as well as the general pool. The Report as a whole shows the advantage of approaching a problem with an unbiased mind, but there are many mistakes from which a man who knows the profession from the outside only could not possibly escape. It is a pity the Report was allowed to go out in its present form, as his remarks show a very feeble grasp of the clinical situation at the Johns Hopkins Hospital; but this is not surprising, and perhaps is not

This is a family letter, strictly confidential and *not for publication.* It is sent only to the President and the Trustees of the University, the President and Trustees of the Hospital, to Mr. Abraham Flexner, to Dr. Hurd, Dr. Winford Smith and Dr. Norton of the Hospital, and to the Professors in the Medical School. Other copies are not to be had.

his fault, since he has not had the necessary training, nor, from the outside, could he get the knowledge to understand it. To say, for example, p. 14, as contrasted with the instructors in the Laboratory side the clinical staff has been on the whole less productive and less devoted is simply not true. I deny the statement *in toto*—they have been more productive and quite as devoted. It is singularly unfortunate that he should not have been able to appreciate the work of the very men who have done as much, or more, than any others to build up the reputation of the school and to advance the best interests of the profession. To mention, out of many, only five names—the most stable on the staff!—Finney, Thayer, Bloodgood, Cushing, and Cullen. It is not too much to say that these men have done scientific work of a standard equal to that of the highest of any laboratory men connected with the University; and in addition work which in practical import, in the translation of Science into the Art, no pure laboratory men could have done. To speak as Mr. Flexner does (p. 15 of the Report) of these men as blocking the line and preventing the complete development of a race or school is perhaps pardonable ignorance, but again it certainly is not true. Take away the share of the reputation of the Johns Hopkins Medical School—particularly in Europe, which knows chiefly the Hospital Bulletin and the Reports—contributed from the clinical side, and by the junior staff, and you leave it, in comparison, poor indeed! 'By their fruits ye shall know them!' After showing the treasures of my library, it is my custom to take an intelligent bibliophile to a shelf on which stand twelve handsomely bound quarto volumes, and say, 'But this is my chief treasure—the 500 contributions to scientific medicine from the graduates of the first eight years of our medical school.' It is a splendid record, but much more brilliant from the clinical than from the laboratory side; and a great part of the work has been directly inspired by this younger group of men. In the development of the school it was a great advantage that the local conditions in the country were not favorable, as at present—and as they have been all along on the laboratory side—to the rapid migration of assistants. It is hard to say which is the more prevalent on pp. 14 and 15 of the Report—unfairness or ignorance; but in either case gross injustice is done to the men who have made the Johns Hopkins Clinical School.

But I must confine myself to the question, and, I take it, the special advantage claimed for the whole-time system is that the Professors will be better able to promote research. Fruitful research in medicine, which, by the way, depends entirely on the *man*, may be done in private, in Research Institutes, or at the Universities.

Some of the most revolutionary researches of modern medicine have come from private laboratories, and when thoroughly trained in methods, there is no reason why the very best work should not be done by practitioners.

The Research Institutes are destined to play an ever-increasing part. In the Pasteur Institute, Paris, Ehrlich's Institute, Frankfurt, the Lister Institute, London, the Rockefeller Institute, New York, and the Carnegie Laboratory, Boston, the most advanced researches are prosecuted; and in the development of a Hospital side, as at the Pasteur and Rockefeller Institutes, will be found ample scope for the men who desire to be whole-time clinical researchers.

The University Hospital is in a very different position. The care and cure of patients and the teaching of young men the art of medicine are functions co-ordinate with the advancement of knowledge. Provision for all three must be made in the modern clinic. There is something very attractive in the parallel between the problems of the Laboratories and those of the Hospital, and at first sight it may seem strange that the suggestion has not been made earlier that men should devote all their time to the clinics. It is not altogether a new departure, and it would not be hard to name clinicians—usually of the quiet studious habit, not built for battle,—who have been content to work solely at the problems of disease.

A pure researcher, as at the clinical hospital of an Institute, has but two points of contact, the patient and the laboratory problem; the Director of the Clinic of a medical school has the student as well; and whether it will be to our advantage to cut off his affiliation with the profession and the public, which he has heretofore enjoyed, is the question at issue. Conditions to-day make it impossible to have one man thoroughly charged at all these points of contact. In a big clinic, as in a Department Store, the importance of the head is not to be able to conduct each division separately, but to have sense enough to train, or pick, men who can; men who know their 'job' and who trust a chief, whose saving gift is in co-ordinating the different departments. So in a clinic the greater part of the work must be done by the juniors. To be safe the chief must always have about men who know more than he does of certain subjects. The most sterile professor may have the most fruitful laboratory. The two most productive physiological laboratories of the latter half of the last century were presided over by men who did little or nothing themselves but suggest and direct. A man at forty, in charge of a clinic, who aspires to contribute from all its departments is sure to degenerate into an exploiter of other men's work. An overseer, a director, a teacher, a commutator, he must make his personality felt in every corner of the 'business', but if he has not a big enough mind to grasp the art of successful delegation he either becomes a scientific vampire, sucking the blood of his assistants, or the clinic degenerates into a one-sided organization for the study of a few problems or for the cure of all maladies by some special method.

Problems and patients suffice for the men in charge of the clinical side of Research Institutes, but only a very narrow view regards the Director of a University clinic as chiefly an agent for research. He stands for other things of equal importance. In life, in work, in word, and in deed he is an exemplar to the young men about him, students and assistants. 'Cabined, cribbed, confined' within the four walls of a hospital, practising the fugitive and cloistered virtues of a clinical monk, how shall he, forsooth, train men for a race the dust and heat of which he knows nothing and—this is a possibility!—cares less? I cannot imagine anything more subversive to the highest ideal of a *clinical* school than to hand over young men who are to be our best practitioners to a group of teachers who are *ex officio* out of touch with the conditions under which these young men will live. The clinical teachers belong to the fighting line of the profession, whose ambitions and activities they should share and direct. Do you imagine for a moment that men whose interests are mainly in the research aspects of medicine, and who have no touch with the rank and file—the men behind the guns—do you suppose they would get into the arena and share the struggle of their brethren? A few with Welch's broad spirit would—a majority would live lives apart, with other thoughts and other ways.

As students of the wider problems of social reform so closely associated with disease, the clinical men should come into contact with the public, whose foibles they should know, and whose advisers they should be. To seclude the ablest men in their respective departments from this contact would not be possible in the United States, where the profession lives so much in the 'open'; and the attempt would, I believe, defeat itself. Those best fitted as teachers in the medical schools, the men with larger outlook, would soon kick over the traces and leave the positions to the quiet student-recluses, keen at research, but as little fitted to train medical students for the hurly-burly of life as I would be to direct your laboratory.

I cannot bear to think that any successor of mine should grow up deprived of those delightful associations which I enjoyed with the profession and the public. How barren would I feel my life without these memories! And a great gap would be left in the education of a clinical teacher who had not known that inner life of the public which we meet in our ministry of health. To some extent seen in hospital work, but not in the same way, it helps to develop the side of a teacher's character very precious in his influence upon young men.

The danger would be the evolution throughout the country of a set of clinical prigs, the boundary of whose horizon would be the laboratory, and whose only human interest was research, forgetful of the wider claims of a clinical professor as a trainer of the young, a leader in the multiform activities of the profession, an interpreter of science to his generation, and a counsellor in public and in private of the people, in whose interests after all the school exists. And, remember, what we do to-day the other schools will try to do to-morrow. Rather than see the rise of a caste of clinical Brahmins, I would prefer a return to the French system—still in part effective —which ensures that each and every professor in a medical school—whether chemist, anatomist, pathologist, or physiologist—is kept in touch with the profession by giving him a hospital service! The Trustees of the

Hospital will do well to hesitate before handing over their magnificent 'plant' to a group of men to 'run' on the narrow lines of a Research Institute, and risk the termination of that close affiliation with the profession and the public which has made their clinical school the most potent distributor of scientific medicine in the United States.

On the question of private practice and of fees I can speak freely. To the enormous value of the outside work in one's personal and professional development I can bear strong testimony. In looking over my writings for this specific purpose I am surprised to see how much of my very best material came from this source. The difficulty is to keep practice within bounds, but it should not be impossible to frame regulations to ensure that the major part of the time of the clinical professors is given to the clinics. It is not so much consultations in the city, but the long distance calls—which alone in my case can I reproach myself as having interrupted my hospital work—that are disturbing. One cannot do a very large practice if private patients are not seen until 2 p.m., which was my rule. In a nutshell, the point at issue is this—After a morning spent in teaching, in the laboratories, and in seeing the public and private patients, not all every day, at 2 p.m. should the clinical professor go home and see patients with their doctors or should he finish the day in one of his laboratories? I maintain that an able director with a well-organized staff can do all that should be demanded in four or five hours daily, and that he is a very much better man as a teacher and as a worker if he spends the rest of the day in the service of the profession and the public. I am speaking only for the subject of medicine; but before the school is committed finally to a whole-time policy you and Judge Harlan, as representatives of the two institutions concerned, would do well to consult the men who know—two or three selected in each country. And my opinion is not worth much, as I am naturally biased in favour of the delightful conditions under which I grew up, and I am now a clinician, not a laboratory man. It is not fair to ask Barker and Thayer. In medicine consult F. Müller and Krehl in Germany, Chauffard and Widal in Paris, Hale White and Bradford in England, Dock and Janeway in the United States—all laboratory clinicians. Do not be led away by the opinions of the pure laboratory men, who have no knowledge of the clinical situation and its needs. I believe an overwhelming majority of all the active workers at clinical medicine would oppose the plan. Professor F. Müller, who represents the most advanced thought in medicine in Germany, has expressed himself strongly against the whole-time system, as directly prejudicial to the teacher and to the school.

Against the sin of prosperity, which looms large in Mr. Flexner's Report (p. 17), the clinical professor must battle hard. I was myself believed to be addicted to it; but you will be interested to know, and I would like the Trustees of the Hospital to know, that I took out of Baltimore not one cent of all the fees—none of which came from hospital patients—I received in the sixteen years of my work. The truth is, there is much misunderstanding in the minds, and not a little nonsense on the tongues, of the people about the large fortunes made by members of the clinical staff. At any rate, let the University and Hospital always remember with gratitude the work of one 'prosperous' surgeon, whose department is so irritatingly misunderstood by Mr. Flexner. I do not believe the history of medicine presents a parallel to the munificence of our colleague Kelly to his clinic. Equal in bulk, in quality, and in far-reaching practical value to the work from any department of the University, small wonder that his clinic became the Mecca for surgeons from all parts of the world, and that his laboratory methods, perfected by Drs. Cullen and Hurdon, have become general models, while through the inspiration of Mr. Max Brödel a new school of artistic illustration in medical works has developed in the United States. And, shades of Marion Sims, Goodell and Gaillard Thomas! this is the department which the 'Angel of Bethesda', in the fullness of his ignorance, suggests should be, if not wiped out, at any rate merged with that of Obstetrics!

There are other points which I should like to discuss, but this letter is already too long. To one I must refer. If there is to be a New Model and a Self-denying Ordinance, under which the clinical teachers are to live laborious days and scorn the delights of the larger life, let them come in on a University basis. If a man's value in the open market is to be considered, do not insult him by offering $7,500, as suggested in Alternative Scheme I, but, as laboratory men, let them be content with salaries which are thought good enough for men just as good.

We are all for sale, dear Remsen. You and I have been in the market for years, and have loved to buy and sell our wares in brains and books—it has been our life. So with institutions. It is always pleasant to be bought, when the purchase price does not involve the sacrifice of an essential—as was the case in that happy purchase of us by the Women's Educational Association—but in Alternative Scheme I we chance the sacrifice of something that is really vital, the existence of a great clinical school organically united with the profession and with the public. These are some of the reasons why I am opposed to the plan as likely to spell ruin to the type of school I have always felt the Hospital should be and which we tried to make it—a place of refuge for the sick poor of the city—a place where the best that is known is taught to a group of the best students—a place where new thought is materialized in research—a school where men are encouraged to base the art upon the science of medicine—a fountain to which teachers in every subject would come for inspiration—a place with a hearty welcome to every practitioner who seeks help—a consulting centre for the whole country in cases of obscurity. And it may be said, all these are possible with whole-time clinical professors. I doubt it. The ideals would change, and I fear lest the broad open spirit which has characterized the school should narrow, as teacher and student chased each other down the fascinating road of research, forgetful of those wider interests to which a great hospital must minister.

Take the money by all means, but use it :—

(1) To reduce the number of students.

(2) To re-arrange the laboratories in accordance with Alternative Scheme II.

But, lastly and chiefly, divert the ardent souls who wish to be whole-time clinical professors from the medical school in which they are not at home to the Research Institutes to which they properly belong, and in which they can do their best work.

Believe me, my dear Remsen,

Sincerely yours,

WILLIAM OSLER.

OXFORD,
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TRANSIENT ATTACKS OF APHASIA AND PARALYSES IN STATES OF HIGH BLOOD PRESSURE AND ARTERIO-SCLEROSIS

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HEADACHE, vertigo, convulsions, aphasia, paralyses, and a progressive dementia are among the cerebral manifestations of arterio-sclerosis. Death "at the top" may be slow, as in the old oak with which Dean Swift compared himself; or it may be sudden, when a vessel ruptures; or more gradual, if thrombosis occurs. These may be called the major manifestations, but there are others less serious though of great importance, as their significance may be overlooked or misinterpreted. To headache and vertigo I shall not refer, since every one now recognizes how common they are as early symptoms of arterio-sclerosis in the young, and more constant features in the aged. It is more particularly to the transient aphasias and paralyses, cerebral crises as they have been called, occurring in states of high blood pressure and in arterio-sclerosis, to which I wish to call attention. Within a few weeks of each other I have recently seen two cases which illustrate the character of the attacks, and the first case is unusual since, so far as could be determined, only high blood pressure existed.

A well-built, active man of forty-three, who had driven his engines at a maximum speed for twenty-five years—keenly occupied in business, using tobacco freely, and intensely devoted to Bacchus, Venus, and Vulcan,—returned on the afternoon of March 1st, 1910, to his hotel, rang the bell for the servant and found that he could not speak. Perfectly conscious, he could not say a word, and was very much upset, and still more so when he found he could not write. He was a little dazed mentally, as he could not tell the time. He became emotional, and the doctor found him crying and still unable to speak. In a few hours he could say a few words, but incoherently. The next day he could talk, but not quite freely. There was no paralysis, no disturbance of vision, and no headache. Within three or four days he was quite well, and could talk perfectly. The blood pressure was found to be 212 mm., and the attack was regarded as possibly a slight hæmorrhage. I saw him on May 18th, 1911, nearly fifteen months after the attack. Very well, except that he has become very nervous and apprehensive, he has given up work, and has wandered about, and has been under the care of a great many doctors.

On examination he was a very healthy-looking man of good colour and good physique. The radial arteries, with the blood current flowing, could easily be rolled under the fingers. The pulse was recurrent, with practically no difference in the fulness of pulsation beyond the point where the artery was compressed. In a section of the emptied radial, no arterial wall could be differentiated with the finger. It was the same with the temporals and the brachials. With the blood current flowing they could be rolled under the fingers. Emptied they were not palpable. Neither the brachials nor the femorals were sclerotic. The retinal arteries looked prominent. The apex beat was inside the nipple line. There was no evidence of enlargement of the heart; the second aortic sound was ringing. The blood pressure was 220 mm. in spite of the fact that he had been taking for more than a year nitrites and potassium iodide. He has had no other cerebral attack. His general condition was very good, but he was morbidly apprehensive about his condition.

A very different picture was presented by Mr. ———, aged sixty-two, seen June 6th, 1911; a man who had worked hard in many parts of the world, but had not been a heavy drinker. A wiry, tough-fibred man, he had always kept himself in very good condition, but had used tobacco to excess. One afternoon, just a year ago, while waiting for tea, he went out to say something to the gardener, and to his surprise found it impossible. He did not feel giddy or dazed, and five minutes later he could speak quite well. He returned to the house, and about an hour afterwards some people came in, and to his surprise he could not say how-do-you-do, could only nod and give a grimace. He could see the people were very much upset, and he was mortified to feel that perhaps they thought he had been drinking. He was greatly embarrassed as he could not say a word. The gentlemen urged him to see a doctor at once.

He walked out to the garden gate with them but could not say good-bye. He then went across the road to the doctor, but could tell him nothing. He had no headache and he felt quite clear in his mind. In the course of ten to fifteen minutes he began to say a few words, though not quite clearly; in a day or two he could say everything. He remained in bed for a couple of days on low diet. His blood pressure was found to be 200 mm., and for the first time it was found that his arteries were sclerosed. He was a healthy-looking man of good colour. He had lost more than twenty-five pounds in weight, and had been very much worried about the high blood pressure. There was an extreme degree of arterio-sclerosis. Brachials, radials, and ulnars were visible in their entire course, with forcible pulsation. The pulse was recurrent; the radial wall, very much thickened. There was not much difference in the sensation given to the finger between the vessel full and empty. Blood pressure, 130 mm. He had worried incessantly about the high blood pressure and had become greatly depressed. This is not the first instance in which I have known worry and loss in weight to be the most effective means of lowering high tension.

My introduction to this condition occurred under peculiar circumstances: As a young man in Montreal there were two doors I never passed,—47 and 49 Union Avenue; going up I called on Dr. Palmer Howard, and if he was not in or was engaged I called on Dr. George Ross; going down, the reverse. Any growth in virtue as a practical clinician I owe to an intimate association with these two men, in whom were combined in rare measure enthusiasm and clear vision. One morning I had a shock, the first of the kind I had ever felt—I realized that my dear friend George Ross was seriously ill. He had always seemed well and strong, though one hot day, in 1878, at the old Savile Club in London, he had an attack of shortness of breath. This day he told a strange story: he had been awakened by the night bell, and, attempting to put out his right hand to get the match-box, he found he had lost power in it. With his left hand he struck a match and rang the bell. When the servant came he could not speak. He realized perfectly what had happened—that he had had a stroke; but to his surprise in a few hours power had returned to his arm, and he could speak, but not quite clearly. When I saw him he was quite himself—no trace of paralysis, and the speech was clear. Arteries like whip-cord—apex beat out—the usual story that we now know so well. This was the first of a series of transient attacks of aphasia, monoplegia, and hemiplegia extending over four or five years, with intervals of good health during which he lectured and carried on his practice. Once, on his return from Europe with Dr. Roddick and Dr. Alloway, he had an attack of partial paraplegia and had to be helped off the steamer, but it disappeared in the course of a couple of days.

These not uncommon features of arterio-sclerosis have had an abiding interest ever since. In the first edition of my textbook, 1892, I mentioned that: "transient hemiplegia, monoplegia, or aphasia may occur in advanced arterio-sclerosis. Recovery may be perfect. It is difficult to say upon what these attacks depend. Spasm of the arteries has been suggested, but the condition of the smaller arteries is not very favourable to this view. Peabody has recently called attention to these cases, which are more common than indicated in the literature." The subject had been brought before the Association of American Physicians by Dr. George Peabody at our meeting in 1891, in a very thorough study of the relation of arterial and visceral changes (Transactions of the Association of American Physicians, Vol. VI, p. 170). In one of his cases a man aged fifty-six, with well-marked arterio-sclerosis had an attack of transient hemiplegia without loss of consciousness. Then, in the course of ten days, he had four or five attacks in which he lost the power of speech, and had incomplete paralysis of the right side. He died in a very severe attack in which he had complete right hemiplegia with unconsciousness. Extensive arterio-sclerosis was found in the cerebral vessels, but there was no local lesion, no areas of special œdema, or any foci of hæmorrhage or softening. So far as I know Dr. Peabody was the first to offer a reasonable explanation of the condition:

"It seemed to me that there might perhaps have been a spasmodic contraction of the muscular coat of the middle cerebral artery, or of several of its branches; which, in addition to the encroachment upon its lumen, produced by the new growth, was sufficient to cut off blood supply to the parts to which it was distributed; that this had occurred several times, causing each time temporary ischæmia of important brain centres; and that in the final attack it had lasted long enough to produce death, but that it was not complete enough, or of long enough duration, to cause softening."

Peabody urged that as spasm could be seen in the retinal vessels, with transient loss of vision, the same very probably occurred in local vascular areas in the brain causing ischæmia and loss of function. No one has stated the case more clearly, and I am glad to refer to this important, initial bit of work which has not received recognition except in my text-book. Since then I have seen a score or more cases, which fall into three categories: (a) Healthy individuals with high blood pressure, but without signs of arterial disease. The first case mentioned in this paper had no obvious sclerosis of the palpable or visible arteries. I have seen only two other patients in which hyperpiesis existed alone—one a man aged fifty-one, who had numbness of the left side and hemianopia, which passed away in the course of a day; the other a young man aged thirty-one, who had not had syphilis but who had high pressure and angina and in several attacks loss of power in the left hand with numbness. (b) Patients with well-marked arterio-sclerosis, in whom the cerebral attacks have come on without warning, sometimes as the signal symptom. A majority of my cases come in this group. (c) In advanced sclerosis with cerebral changes, manifested by progressive mental and muscular weakness, all possible types of these transient seizures, including convulsions, may occur. The attacks are most frequent in the aged, but men in the fifth and sixth decades are also affected.

The symptoms are extraordinarily varied, but tend in individual cases to repeat themselves in the attacks. *Transient aphasia* is one of the most common. The account given by the two patients whose cases are here reported is singularly accurate—inability to talk, consciousness of it, no paralysis, emotional disturbance, and, within a few hours, complete recovery. One patient had at least twenty attacks, all of very much the same type. Loss of the power to write and hemianopia may be present.

Sensory disturbances rarely occur alone, but one patient had day-long attacks of numbness of the face and right hand with loss of the finer movements of the fingers. Paræsthesiæ may exist with the aphasia.

Motor paralysis is the most common symptom, and may be hemiplegia, or only the face and hand or arm may be involved. The paralysis, rarely complete, has a transient character, which with the recurrences gives it a peculiar stamp. Complete recovery is of course seen in monoplegias and hemiplegias of organic origin, but not in a few hours or in a day. I have had a letter in the evening from a man who at 9 a.m. could not button his shirt collar. In one instance paraplegia of brief duration occurred.

The *mental features* are interesting. Confusion of thought is common and emotional disturbances, which are very natural under the circumstances. The transient attacks of mental aberration—forgetfulness or slight delirium—seen sometimes in arterio-sclerosis, may be the psychical counterparts of the motor attacks, and cases have been reported by Edgeworth and William Russell. Loss of consciousness has not been common in my experience. I saw a patient in Washington whose attacks were always ushered in by a short cry, followed by fainting, and on recovery the right arm and face were paretic and there was transient loss of the power of speech. He had a pulse of sixty, and the question of Stokes-Adams disease was considered.

The mode of origin of these cerebral crises in arterio-sclerosis has been much discussed of late years by William Russell in his work on Arterial Hypertonus, etc., (1907); by Edgeworth,[1] Parker,[2] Langwill[3] and Heard,[4] Allan[5], and others.

An interesting discussion in the *British Medical Journal*, 1909, II, followed a paper by William Russell on "Intermittent Closing of the Cerebral Arteries." When Peabody brought forward the view that in these cases a transient arterial spasm occurred, I was doubtful how far this was possible in sclerotic vessels; but I have since come round to his view, and I do not think any other explanation is more plausible than that these attacks represent vascular crises.

We have plenty of evidence that arteries may pass into a state of spasm with obliteration of the lumen and loss of function in the parts supplied. In the peripheral arteries in Raynaud's disease we can sometimes feel the spastic, cord-like vessel; in the retina we can sometimes see the arteries contracted. Both in Raynaud's disease and in the remarkable thrombo-angitis described by Buerger the obliteration may persist until necrosis occurs, but in many instances it is only transient and the circulation is restored. A case of Raynaud's disease,[6] with recurring attacks of aphasia, hemiplegia, and loss of consciousness, some occurring coincidently with the local asphyxia and necrosis, convinced me that intermittent closing of the cerebral vessels could occur, and the transient nature of the attacks with the complete recovery seems to offer no other explanation so satisfactory. And we know now that there are neither anatomical nor physiological objections to this view as applied to the cerebral arteries.

Transient paralyses in uræmia may be due to œdema, as suggested by Traube (*Gesammelte Beitrage*, Bd. 2, p. 551); but the condition is rarely transient and is more often a terminal event. It is possible that there are cerebro-spinal manifestations in angio-neurotic œdema, as in the extraordinary case which I reported[7] of a physician aged twenty-nine, who had right hemiplegia and aphasia at the age of nine, and, within a year, five or six attacks of transient hemiplegia, subsequently migraine, and well-marked attacks of angio-neurotic œdema. Howland[8] has recorded a case of this disease with spinal symptoms. The association of migraine with cerebral symptoms is well known, and Mitchell Clarke[9] has reported a familial form with which hemiplegia occurred in three generations.

The *diagnosis*, usually easy, is based on the existing conditions of high tension or sclerosis or both, the slight and transient character of the attacks, and the recurrences. Slight paralyses due to hæmorrhage or softening rarely pass away so quickly, and it may be weeks before a patient speaks clearly or uses the hand freely. Numbness, tingling, and slight weakness of one side with headache may be precursors of a "stroke" in which case the symptoms are not transient but progressive. In sclerosis of the cerebral arteries small foci of softening are not rare and some of these may produce symptoms. An artist friend motoring in the neighbourhood of Oxford felt so badly in his head that his wife insisted upon coming at once to my house. He was a bit dazed and could not sit at luncheon, but there did not seem very much the matter. He said, however, that he felt "queer in his head," and could not see properly. I could find nothing wrong with the retinæ but I did not take the fields. Two days later he consulted Mr. Lawford who found a quadrantic hemianopia, which has never cleared up. Here no doubt was a definite lesion.

The *prognosis* is largely that of the sclerosis. Patients may live for years and be very comfortable in the intervals. While writing this I had a visit from my old friend, Dr. Litchfield, of Pittsburg, who happened to mention the case of a Mr. L., whom I had seen with him eleven years ago with transient attacks of what Dr. L. called "mutism," often associated with numbness and tingling on the right side. The patient had arterio-sclerosis, and I remember we discussed the possibility of the condition being due to angiospasm. He has had in all ten or twelve of such attacks: they pass off in a few days; associated with the feeling of fulness and headache. Once or twice he has had a transient diplopia. In the intervals he is pretty well, though it is difficult to keep down his blood pressure. An interesting point of which Dr. Litchfield reminded me was that this man's father had had similar attacks, beginning when he was a comparatively young man, and lasting until he was over seventy. Of considerable moment, as illustrating the necessity for a more widespread recognition of this condition, is the fact that Mr. L. a few years ago consulted a well-known heart specialist, who said that he had chronic meningitis, gave him bromides, and his friends a hopeless prognosis.

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THE PATHOLOGICAL INSTITUTE OF A GENERAL HOSPITAL.

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

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THE PATHOLOGICAL INSTITUTE OF A GENERAL HOSPITAL.[1]

By Sir WILLIAM OSLER, Bart., M.D., F.R.S.,
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I WONDER if you appreciate in Glasgow the delightful memories that crowd the mind of a man familiar with the story of medicine in Great Britain, when the name of your Royal Infirmary is mentioned—memories of men who, by their life and doctrine, have set forth not alone the very best the profession has had to offer, but the very best that man has ever offered to his fellowmen. I am fully aware of the presence of those who will regard my memories as illustrating how slight and imperfect my knowledge is of this old foundation; but I have an abiding faith in the general ignorance of an audience, and I know that I know many things that many of you know that you should know, but don't know, about the men who have made the Royal Infirmary famous. In any case I am going to use this knowledge, imperfect as it may be, as a setting for the main theme of my address—the place of the pathological institute in a general hospital.

I am glad you have adopted the name institute—for the first time, I believe, in Scotland. Plato made the curious remark that while it was a slow and arduous process to get men to change their ideas, it was an easy matter to get them to accept new names, and under these gradually to bring about wished-for changes. I am sure that the name indicates that you feel the infirmary should bear its share with the University in advancing scientific medicine; for an institute is something more than a dead-house, and very much more than an ordinary pathological laboratory. It is the cerebrum of the infirmary, the place where the thinking

[1] An address at the opening of the new Pathological Institute of the Royal Infirmary, Glasgow, 4th October, 1911.

is done, where ideas are nurtured, where men dream dreams, and thoughts are materialised into researches upon the one great problem that confronts the profession in each generation —*the nature of disease.*

Ask the editors of the hundreds of archives, journals, annals, magazines, bulletins, Comptes Rendus, Centralblätter, Zeitschrifts, devoted to the service of medicine, what is their chief aim—their *raison d'être?* Ask the professors of all the medical schools of Europe and America, the directors of all the laboratories, what is their chief problem? Go back in history and ask Hippocrates, Galen, and all the great students of medicine down to Cullen and the Hunters, what one thing influenced their lifework? Ask the surgeon why, a few minutes ago, he removed an appendix in the operating-room near by, or the doctor why he has just given a doze of antitoxin to an infant with diphtheria? From all come the one monotonous answer—*the nature of the disease.* There is not a page of this month's number of the *Glasgow Medical Journal* but reflects this all-powerful, all-pervading influence; the whole life of the profession, whether moving in the units or expressed in its great institutions, is controlled to-day, as it ever has been controlled, by what we think of the nature of disease. Why is a right judgment on this one point the aim of medical education and of research—the be-all and the end-all of our efforts? Because upon correct knowledge depends the possibility of the control of disease, and upon our views of its nature the measures for its prevention or cure.

This institute itself is a witness to the wonderful transformation in our knowledge of the nature of disease, in which this old infirmary has played a splendid part. Let me indicate briefly the steps in this transformation. Hippocrates looked at patients with keen eyes and a clear brain, and, as a product of his period, when the nature of nature began to be recognised, he could not but deduce from his observations the naturalness of disease—that it was not an entity apart from man, but a part of man himself. And this was the great contribution of the Greeks, who first taught us to look with the seeing eye at disease. Observation *plus* thinking has given us the vast stores of knowledge we now possess of the structure of the bodies of living creatures in health and disease. There have been two inherent difficulties—to get men to see straight and to get men to think clearly: but in spite of the frailty of the instrument, the method has been one of the most powerful ever placed in the hands of man. It gave us Vesalius and the new anatomy, Newton and a new universe, Morgagni and the new morbid anatomy, Laennec and the new medicine, Virchow and the new pathology, Darwin and a new outlook for man on the world.

Let me give you an illustration of the application of this method and of its limitation. The ancients knew aneurysm of the external vessels, and if I had my choice in time of witnessing an operation I would ask to see Antyllus in the third century tackle a femoral aneurysm. Vesalius and Fernelius, Lancisi, John and William Hunter, Scarpa, and some hundreds of keen observers have taught us the structure of aneurysm and the means by which it may be recognised. Take the work of Allan Burns on *The Heart*, published in 1809, one of the best contributions to clinical medicine of the Glasgow school, and by the best, the very best member of one of your best families, distinguished alike in science and commerce. Read his chapters on the arteries, and you will see how far a shrewd observer could go in the recognition of anatomical changes and clinical features. And no Scotsman ever used his favourite instrument to better effect than did Allan Burns in the clear logical reasoning with which he lays down what is now known as the intermittent claudication theory of angina pectoris. Or take a work of another famous Glasgow teacher, whom I was proud to know as a friend, Professor Gairdner, whose *Clinical Medicine* is a storehouse of valuable facts. Turn to the chapter on aneurysm, and see how the art of observation may be made to lighten the dark corners of disease, in the wards and in the dead-house. These two men may be taken as types of the workers who, between Morgagni and Virchow, revealed to us the seats of disease. You remember the title of the great Morgagni's work, *De sedibus et causis morborum*, and while he did illumine the structure of disease and correlate the symptoms in life with the appearances after death, the work had the limitation expressed by the sub-title, *per anatomen indagatis*. This was the *organon* with which was built the broad and deep foundations of clinical medicine and morbid anatomy. Observation alone could give a complete knowledge *de sedibus*, but never *de causis morborum*. Other men with other minds and other methods had to give us this through the long and painful experience of many centuries. Seeing and thinking have done much for human progress; in the sphere of mind and morals everything, and could the world have been saved by armchair philosophy, the Greeks would have done it; but only a *novum organon* could do this, the powerful possibilities of which were only revealed when man began to search out the secrets of nature by way of experiment, to use the words of Harvey.

The ancients thought as clearly as we do, had greater skill in the arts and in architecture, but they had never learned the use of the great instrument which has given man control over nature—experiment. Dumas, in a letter to Pasteur, made a clear statement of the two methods: "The art of observation and that of experiment are very distinct. In the first case, the fact may either proceed from logical reasons or be mere good fortune; it is sufficient to have some penetration and the sense of truth in order to profit by it. But the art of experimentation leads from the first to the last link of the chain, without hesitation and without a blank, making successive use of Reason, which suggests an alternative, and of Experience, which decides on it, until, starting from a faint glimmer, the full blaze of light is reached." There is not one of us to-day who has not benefited by the countless thousands of experiments which have made modern life what it is; the physical sciences, with the practical application of which you have had so much to do, have re-made Glasgow as they have re-made the world. And there has not been a single advance of the first importance which is not a fruit of this scientific modernism. This institute which we open to-day is a manifestation of the new spirit. We did not get very far in our knowledge of the workings of the animal body in health and in disease until we began to use experiment. A few of the old Greeks appreciated its value, Galen in particular, but it was not until the Renaissance, until the advent of Galileo and of Sanctorius, that men realised how powerful it might be. Harvey made use of it in a golden discovery, and his monograph, *Exercitatio anatomica de motu cordis*, is the first great product of the experimental method applied to medicine. Thousands of men with keen eyes had watched the heart beat, had seen arteries spurt red blood, had seen the black blood flow from the veins, and they had thought and thought and thought of how the heart beat and how the blood flowed, but all in vain until, in a few simple experiments, the problem of its circulation was demonstrated. Since the days of Harvey we have gained extraordinary insight into the processes of the animal body, and in almost every department by the use of his methods. Take, for example, the work of one of your infirmary surgeons, in which I was always deeply interested. From the days of Cain man had seen that "ganz besonderer Saft," the blood clot, and from Galen on speculation had been rife as to its cause. Much had been demonstrated by John Hunter, and much more by Hewson, but it was not until 1831 that the problem was approached in a productive way by Andrew Buchanan, a young surgeon, for long years connected with this infirmary, and for thirty-seven years Professor of the Institutes of Medicine in the University. By a series of ingenious experiments he showed that the act of coagulation was not the effect of any spontaneous property existing in the fibrin, but that it only occurred under the influence of suitable re-agents, and he compared it very properly with the action of rennet in effecting the coagulation of milk. We have travelled far from Buchanan's "washed blood-clot," with which we older teachers of physiology used to work and do our class experiments, but the fundamental facts as demonstrated by him remain, fully substantiated by the subsequent work of Schmidt, Hammarstin, and others. Buried in the new terminology you students may find it hard to recognise the merit of the old Glasgow physiologist and surgeon, and I doubt if he himself could make very much of the following definition of the nature of coagulation which I quote from a recently issued work on *Physiology*:—"The activator thrombokinase, in the presence of free calcium ions, activates the thrombogen, or prothrombin, with the result that the active thrombin-thrombosin, fibrin enzyme, is formed. Fibrin enzyme so produced acts upon soluble fibrinogen and converts it into insoluble fibrin."

What, you may ask, has all this to do with the nature of disease? The new method has at last put in our hands a means to obtain certain knowledge of the nature of some of the most important of diseases; and what is more important, the methods for their effective control. Morgagni to-day would make the title of his book *De sedibus et causis morborum per anatomen et experimentum indagatis.* At the middle of the last century we did not know much more of the actual causes of the great scourges of the race—the plagues, the fever, and the pestilences—than did the Greeks. The facts that fevers were catching, that epidemics spread, that infection could remain attached to particles of clothing, &c., all gave support to the view that the actual cause was something alive—a *contagium vivum.* This was really a very old view, the germs of which may be found in the

Fathers, but which was first clearly expressed, so far as I know, by Fracastorius, a Veronese physician in the sixteenth century, who spoke of the seeds of contagion passing from one person to another; and he first drew a parallel between the processes of contagion and the fermentation of wine. This was more than one hundred years before Kircher, Leeuwenhoek, and others began to use the microscope and to see animalcula, &c., in water, and so gave a basis for the "infinitely little" view of the nature of disease germs.

It was a shrewd, but very characteristic, remark of Robert Boyle that he who could discover the nature of ferments would be able to explain the nature of certain diseases. In August, 1857, a young teacher of the University of Lille read a paper at the Scientific Society on "Sour Milk Fermentation." Louis Pasteur was a chemist, accustomed to accurate observation and careful experiment. At Lille the opportunity offered to study the problems of fermentation in the making of beetroot alcohol, and this led to a comprehensive study of the whole question, from which he concluded that the transformation of sugar into alcohol, and carbonic acid, the souring of milk—in fact, all the processes which we know as fermentation—are co-relevant to a phenomenon of life. A parallel between fermentation and an acute infection had been drawn centuries before, but it came practically home to Pasteur's mind with the suggestion, in his own words, "what would be most desirable would be to push those studies far enough to prepare the road for a serious research into the origin of various diseases." If the changes in fermentation are due to minute living organisms, why should not the same tiny creatures make the changes which occur in the body in putrid or suppurative diseases? And the great Frenchman took an early opportunity that offered to test the truth of this suggestion, and the unravelling of the nature of the silkworm disease was the first great victory of the experimental method applied to a biological problem of disease.

Judging from the history of science, it could scarcely have been expected that these brilliant studies of Pasteur would have borne fruit so soon; but the spirit of research was abroad, and there were keen men everywhere trying to solve the ever present problem of the nature of disease.

You had the singular good fortune in 1860 to appoint to your Chair of Surgery a young Englishman, named Joseph Lister, already with, for his age, a reputation as a strong surgeon; but he was much more than this, he was a trained experimental physiologist and a good microscopist. His early important studies were on inflammation, on various disturbances of the circulation, and on the coagulation of the blood. In this infirmary, as early as 1865, his attention was turned to the question which, above all others, disturbed the practical surgeon—how to prevent the appalling mortality in surgical cases after wounds and operations. It had long been recognised that now and again a wound healed without the formation of pus, that is, without suppuration, but both spontaneous and operative wounds were almost invariably associated with that change; and, moreover, they frequently became putrid (as it was then called—infected, as we should say), the general system became involved, and the patient died of blood poisoning. So common was this, particularly in old, ill-equipped hospitals, that many surgeons feared to operate, and the general mortality in all surgical cases was very high.

Believing that from outside the germs came which caused the decomposition of wound, just as from the atmosphere the sugar solution got the germs which caused the fermentation, Professor Lister applied the principles of Pasteur's experiments to their treatment. It may be well here to quote from his original paper in the *Lancet*, 1867 :—"Turning now to the question how the atmosphere produces decomposition of organic substances, we find that a flood of light has been thrown upon this most important subject by the philosophic researches of M. Pasteur, who has demonstrated by thoroughly convincing evidence that it is not to its oxygen or to any of its gaseous constituents that the air owes this property, but to minute particles suspended in it, which are the germs of various low forms of life, long since revealed by the microscope, and regarded as merely accidental concomitants of putrescence, but now shown by Pasteur to be its essential cause, resolving the now complex compounds into substances of simpler chemical constitution, just as the yeast plant converts sugar into alcohol and carbonic acid."

From these beginnings modern surgery took its rise, and the whole subject of wound infection, not only in relation to surgical diseases, but to childbed fever, forms one of the most brilliant chapters in the history of preventive medicine. Brilliant researches, helpful to our fellows, and a source of pride to your city, will come from the University laboratories and the hospitals, but it is difficult to imagine the possibility of another such revolution as that which Joseph Lister effected from the wards of the old infirmary—a revolution so far-reaching that we, blessed still by the presence of the

Master, while keenly appreciating can scarcely realise its true greatness.

The institute, an integral part of the infirmary, the director and staff co-ordinate with the physicians and surgeons and their staffs, the other departments should be dovetailed in such a way that every member has an interest in its work. I have often remarked that the secret of the success of the Johns Hopkins Hospital lay in the dominating influence of the pathological department. Everything depends upon the organisation. With two modern hospitals the problem of the relation of their pathological departments to the pathological department of the University has been settled in the only way. In the interest of both institutions the union has been made organic, and the professors of the subject at the University have the same relation to the pathological laboratories of the hospital as the professors of surgery have to their wards in the infirmaries. Only with this type of organisation can a great institute as a university unit fulfil its threefold mission, to the students, to the staff, and to the public. Here, after passing the Vesalian stage in anatomy and the Harveian in physiology, the student learns with Morgagni and Laennec the structural changes wrought by disease. Here he recognises the correlation between the symptoms in life and the *post-mortem* appearances, which is the bed-rock in the art of diagnosis. And here he reaches the stage in which Virchow and Koch teach the true nature of the intimate processes of disease, *de causis* as well as *de sedibus morborum*. All this before in the final stage he sees in the wards the marvellous benefits which have followed the practical application by Pasteur and Lister of the methods of science. Just as the embryo passes through life of lower grade, before resulting in the thinking man—the ontogeny reproducing the phylogeny—so the career of the medical student follows the evolution of the marvellous knowledge that has made our profession the most helpful of all to humanity. And do let him feel that he is at home in the institute, a part of it in work and in teaching. Let me urge you not to neglect the Morgagni side, not that it is likely in a thoroughly practical school like this: but so deep may be the absorption in the problems of disease that the virtue of teaching, the labour of drilling the students in the technique of *post-mortems*, the patient line-upon-line, precept-upon-precept method becomes a burden, and the priceless lessons of the dead-house are not enforced by the voice of a master. Only in one way lies redemption for the director of any institute or laboratory, he must have associates who know more about certain subjects than he does himself. An Admirable Crichton in these days is a quack, and in the art of delegation, in the subdivision of labour, in specialisation among his subordinates, the director will find safety. The patient demonstrator who spends two hours with a group of students at a section has a place of equal importance with the man who is chasing the secret of anaphylaxis. In the hurly-burly of to-day, when the competition is so keen, and there are so many seeking the bubble reputation at the eye-piece and the test-tube, it is well for young men to remember that no bubble is so iridescent or floats longer than that blown by the successful teacher. A man who is not fond of students and who does not suffer their foibles gladly misses the greatest zest in life; and the teacher who wraps himself in the cloak of his researches, and lives apart from the bright spirits of the coming generation, is very apt to find his garment the shirt of Nessus. Encourage the students to help in the teaching, and arrange the time of sections not for your own convenience, but for the students and staff. I had a practice of making the clinical clerk tell the story of the case, not read an abstract, but speak it out and tell its difficulties and the diagnosis, right or wrong. It was good for us all, the teacher and the taught, and we met on the same levels as seekers for truth. How far should students be encouraged to do original work? As much as possible, though in the present congested state of the curriculum the possibility is not a very big one. A keen man who has had a good chemical training may find time to work out a small problem in metabolism suggested by one of his cases in the ward. A student in physics may have ideas on blood-pressure, an advanced student in physiology may wish to test the teaching of the laboratory in a problem suggested by a cardiac case. A laboratory without a few undergraduate research students is scarcely fulfilling its mission. There are difficulties, I know, but let them be on the side of the student, not on the part of the institute.

I said the institute of pathology was the cerebrum of the infirmary, the thought-centre for the staff; but let it be remembered that the institute exists for the infirmary, not *vice versa*. In many ways it may be helpful to every man working in the wards and in the out-patient departments. The best doctor, like the successful general, is the one who makes the fewest mistakes. In the dead-house, by the contemplation of the mistakes of nature and of our own, we glean a wisdom which enables us to correct the one and to avoid the other. No man becomes a sound physician or a good surgeon who does not frequent the dead-house. Fortunately the infirmary has splendid traditions of the co-operation between the laboratory and the wards. At my first visit to Glasgow in 1872 I recall with pleasure the acquaintance I then made with Joseph Coats, whom I saw at work in the dead-house, and whose studies in pathology brought so much credit to the Glasgow school. And Professor Macewen's masterly researches upon *Infective Diseases of the Brain and Spinal Cord*, a *magnum opus* worthy of a successor of Lister, tells on every page of the benefits a surgeon may derive from an intimate association with pathological laboratory. Every one of the young men on the staff should be workers in the institute, each with his place, each with his problem. Even the older men when not over-burdened with practice will find mental refreshment and stimulation in a few hours of laboratory work. It is a sad day when the world is so much with the clinician that he cannot spend part of it in the pathological or the clinical laboratory. Here comes the question of the relation which should exist between these two important parts of a hospital. Often they may be combined, but a special advantage of a separate clinical laboratory is that each student in his senior years can have his own place to work, his own microscope and apparatus, a place at which he can keep up the laboratory habit acquired in the medical school. Then, too, we must look forward in this country to the organisation of our cliniques on University lines, when the professors are not simply attending physicians but directors of hospital units which have the same relation to the University as the other scientific departments, with subdivisions in the clinical laboratory of bio-chemistry, cardo-respiratory physics, and bacteriology, each under the guidance of a skilled assistant. When this can be carried out the pathological institute does not suffice, and other arrangements must be made. Here, too, the practical man comes for inspiration, for new ideas, and here he finds the touchstone by which he can tell the true in the new. That is to say, if he has sense. A very practical man, dependent for his large *clientèle* on a winning smile and a smooth tongue, reported to a medical society a new tip which, he said, was derived from a visit to a well-known pathological laboratory. He had seen brains hardened in bichromate of potash and chloric acid. Happy idea! He began the treatment of cases of softening of the brain with these drugs with, he assured us, the most excellent results!

Oliver Wendell Holmes remarked that knowledge and timber should not be used until they are seasoned, and here should be found for the staff and for all members of the profession in the city and district that seasoned knowledge which alone can make us wise unto the salvation of our fellowmen.

And, lastly, this institute exists for the benefit of the public. There is not a patient in the wards who will not be helped by the work done here. Nowadays laboratory methods of treatment and diagnosis are more and more in vogue. This will be the routine of service, but the larger public that pays the piper has the right to call the tune; and the demand which they make, and with just right, is that the resources of the institute should be requisitioned in the fight which science is making against unnecessary disease and untimely death. From laboratories have come not alone the war cries of modern medicine, but the chief weapons against the acute infections. The incentive, the intense conviction of the necessity of the fight, and of its hopefulness, has come from the men who realised that the general infections, whether endemic in cities or widespread epidemics, were preventible could we but get a knowledge of their causes, could we but know their nature. Even before this knowledge was complete we had recognised the association of disease with dirt, and of fevers with overcrowding and with poverty. And Glasgow was early in the field. The sanitary story of your city in the last half century is one of which you may be justly proud. Under the intelligent direction of Professor Gairdner, Dr. Russell, and of your present efficient health officer, Dr. Chalmers, from the worst, or one of the very worst, you have become the best, or one of the very best. To wipe out typhus, to have made typhoid a last ditcher, to have cut in half the mortality from tuberculosis, are among the peace victories in which you citizens have shared. Given to pessimism, the Briton loves to look on the dark side of things. There is no such medicine for the malady as a study of the health records of our great towns—a story of marvellous progress, better housing, better feeding, better drinking, better health, and, as a consequence, better citizens.

Two problems remain. First, to make effective the knowledge we now possess, and this is largely a question of intelligent organisation. When the public awaken, what has been done for typhus and typhoid will be done for tuberculosis, malaria and plague, as well as for a host of minor maladies, the causes of which we know.

But in a vast field we need new knowledge and seasoned knowledge, and this the other great problem directly concerns the institute. Four riddles of the first rank await solution. Cancer killed in this city, in 1910, 845; in 1909, 34,053 in England and Wales. Literally thousands of workers are struggling to unravel its mystery, and while much has been done, its heart has not been unlocked—the nature of the disease is unknown. The key may be in other hands; and so interlaced are these biological problems, so conditioned by our knowledge of chemistry and physics, that some young Pasteur at Lille or a young Helmholz at Königsberg may be twirling it in his fingers all unconscious of its use. The exanthems are still with us, still killing thousands, and we await the researches which will reveal the causes of measles, scarlet fever, and small-pox. Perversions of metabolism are every day yielding up their fascinating secrets, but we lack the sure and certain studies that alone can give us control of such common diseases as diabetes, gout, and arthritis.

And, fourthly, we are entering a new chapter in the researches upon the internal secretions, on the functions of those mysterious glands, so insignificant anatomically but so potent in their influence upon growth and nutrition. These and scores of minor problems are to be solved by this generation, and there is much knowledge to be seasoned before it can be used to the best advantage. For example, the whole vaccine problem is being kiln-dried; and the rapid seasoning of Professor Ehrlich's great discovery will give an immense impetus to the study of specifics, torpedo-remedies, as Huxley called them, agents that will kill the enemy and spare the host. I told you in illustration of the value of observation the story of aneurysm, how we had known the external from since the days of Galen, and the internal from Vesalius. Twenty years ago we felt we had a very full knowledge of the subject, and even ten years ago had any one suggested that we might some day be able to prevent aneurysm he would have been thought a dreamer. The clear vision of Francis Welch had given an inspiration *de causis*, but it was not till the demonstration by Schaudrim of the germ of syphilis that we recognised fully its enormous importance in the causation of arterial disease in general, and aneurysm in particular. And now Ehrlich comes forward with a remedy which, widely and carefully used, should prevent these specific lesions of blood-vessels, and cut in half the incidence of aneurysm in the community.

The most vivid recollections of my boyhood in Canada cluster about the happy spring days when we went off to the bush to make maple sugar—the bright sunny days, the delicious cold nights, the camp fires, the log cabins, and the fascinating work tapping trees, putting in the birch-bark spouts, arranging the troughs, and then going from tree to tree collecting in pails the clear, sweet sap. One memory stands out above all others, the astonishment that so little sugar was left after boiling down so great a cauldron of liquid. And yet the sap was so abundant and so sweet. The workers of my generation in the bush of science have collected a vaster quantity of sap than ever before known; much has already been boiled down, and it is for you of the younger generation while completing the job to tap your own trees. Considering the enormous quantity of sap we have collected, you may feel disappointed at the comparatively small bulk of sugar left after complete boiling, but sweeter or better sugar has never been tasted than that of our making; and among all samples in the market, no brand ranks higher than that from the old Glasgow Royal Infirmary. It is for you in this new infirmary and in this splendid institute to see that the quality is maintained.

GLASGOW: PRINTED BY ALEX. MACDOUGALL.

FOREWORD

TO

LIFE OF PASTEUR

L'œuvre de Pasteur est admirable ; elle montre son génie, mais il faut avoir vécu dans son intimité pour connaître toute la bonté de son cœur.—Dr. Roux.

PASTEUR

AN INTRODUCTION TO A NEW EDITION OF RENÉ VALLERY-RADOT'S LIFE

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FOREWORD

L'homme en ce siècle a pris une connaissance toute nouvelle des ressources de la nature et, par l'application de son intelligence il a commencé à les faire fructifier. Il a refait, par la géologie et la paléontologie, l'histoire de la terre, entraînée elle-même par la grande loi de l'évolution. Il connaît mieux, grâce à Pasteur surtout, les conditions d'existence de son propre organisme et peut entreprendre d'y combattre les causes de destruction.—Monod *L'Europe Contemporaine.*

WHETHER to admire more the man or his method, the life or the work, I leave for the readers of this well-told story to decide. At the request of my friend, Mr. Henry Phipps, a munificent supporter of science, and a man with a keen appreciation of its value in the progress of humanity, I write an introduction to this edition of Mrs. Devonshire's translation of Radot's *Life*. Among the researches that have made the name of Pasteur a household word in the civilised world, three are of the first importance—a knowledge of the true nature of the processes in fermentation—a knowledge of the chief maladies which have scourged man and animals—a knowledge of the measures by which either the body may be protected against these diseases, or the poison neutralised when once within the body.

I.

Our knowledge of disease has advanced in a curiously uniform way. The objective features, the symptoms, naturally first attracted attention. The Greek physicians, Hippocrates, Galen, and Aretaeus, gave excellent accounts of many diseases; for example, the forms of malaria. They knew, too, very well, their modes of termination, and the art of prognosis was studied carefully. But of the actual causes of disease they knew little or nothing, and any glimmerings of truth were obscured in a cloud of theory. The treatment was haphazard, partly the outcome of experience, partly based upon false theories of the cause of the disease. This may be said to have been the sort of knowledge possessed by the profession until men began to study the "seats and causes" of disease, and to search out the changes *inside* the body, corresponding to the outward symptoms and the external appearances. Morbid anatomy began to be studied, and in the hundred years from 1750 to 1850 such colossal strides were made that we knew well the post-mortem appearances of the more common diseases; the recognition of which was greatly helped by a study of the relation of the pathological appearances with the signs and symptoms. The 19th century may be said to have given us an extraordinarily full knowledge of the changes which disease produces in the solids and fluids of the body. Great advances, too, were made in the treatment of disease. We learned to trust Nature more and drugs less; we got rid (in part) of treatment by theory, and we ceased to have a drug for every symptom. But much treatment was, and still is, irrational, not based on a knowledge of the cause of the disease. In a blundering way many important advances were made, and even specifics were discovered—cinchona, for example, had cured malaria for a hundred and fifty years before Laveran found the cause. At the middle of the last century we did not know much more of the actual causes of the great scourges of the race, the plagues, the fevers and the pestilences, than did the Greeks. Here comes in Pasteur's great work. Before him Egyptian darkness; with his advent a light that brightens more and more as the years give us ever fuller knowledge. The facts that fevers were catching, that epidemics spread, that infection could remain attached to particles of clothing, etc., all gave support to the view that the actual cause was something alive, a *contagium vivum*. It was really a very old view, the germs of which may be found in the Fathers, but which was first clearly expressed—so far as I know—by Frascastorius, a Veronese physician in the 16th century, who spoke of the seeds of contagion passing from one person to another; and he first drew a parallel between the processes of contagion and the fermentation of wine. This was more than one hundred years before Kircher, Leeuwenhoek, and others, began to use the microscope and to see animalculæ, etc., in water, and so gave a basis for the "infinitely little" view of the nature of disease germs. And it was a study of the processes of fermentation that led Pasteur to the sure ground on which we now stand. Starting as a pure chemist, and becoming interested in the science of crystallography, it was not until his life at Lille, a town with important brewing industries, that Pasteur became interested in the biological side of chemical problems. Many years before it had been noted by Cagniard-Latour that yeast was composed of cells capable of reproducing themselves by a sort of budding, and he made the keen suggestion that it was possibly through some effect of their vegetation that the sugar was transformed. But Liebig's view everywhere prevailed that the ferment was an alterable, organic substance which exercised a catalytic force, transforming the sugar. It was in August, 1857, that Pasteur sent his famous paper on *Lactic Acid Fermentation* to the Lille Scientific Society; and in December of the same year he presented to the Academy of Sciences a paper on *Alcoholic Fermentation*, in which he concluded that the deduplication of sugar into alcohol and carbonic acid is correlevant to a phenomena of life. These studies had the signal effect of diverting the man from the course of his previous more strictly chemical studies. It is interesting to note how slowly these views dislocated the dominant theories of Liebig. More than ten years after their announcement I remember that we had in our chemical lectures the catalytic theory very fully presented.

Out of these researches arose a famous battle which kept Pasteur hard at work for four or five years—the struggle over spontaneous generation. It was an old warfare, but the microscope had revealed a new world, and the experiments on fermentation had lent great weight to the *omne vivum ex ovo* doctrine. The famous Italians, Redi and Spallanzani, had led the way in their experiments, and the latter had reached the conclusion that there is no vegetable and no animal that has not its own germ. But heterogenesis became the burning question, and Pouchet in France, and Bastian in England, led the opposition to Pasteur. The many famous experiments carried conviction to the minds of scientific men, and destroyed for ever the old belief in spontaneous generation. All along the analogy between disease and fermentation must have been in Pasteur's mind; and then came the suggestion: "What would be most desirable would be to push those studies far enough to prepare the road for a serious research into the origin of various diseases." If the changes in lactic, alcohol and butyric fermentations are due to minute living organisms, why should not the same tiny creatures make the changes which occur in the body in the putrid and suppurative diseases. With an accurate training as a chemist, having been diverted in his studies upon fermentation into the realm of biology, and nourishing a strong conviction of the identity between putrefactive changes of the body and fermentation, Pasteur was well prepared to undertake investigations, which had hitherto been confined to physicians alone.

The first outcome of the researches of Pasteur upon fermentation and spontaneous generation represents a transformation in the practice of surgery, which, it is not too much to say, has been one of the greatest boons ever conferred upon humanity. It had long been recognised that now and again a wound healed without the formation of pus, that is without suppuration, but both spontaneous and operative wounds were almost invariably associated with that change; and, moreover, they frequently became putrid, as it was then called—infected, as we should say; the general system became involved, and the patient died of blood poisoning. So common was this, particularly in old, ill-equipped hospitals, that many surgeons feared to operate, and the general mortality in all surgical cases was very high. Believing that from outside the germs came which caused the decomposition of wounds, just as from the atmosphere the sugar solution got the germs which caused the fermentation, a young surgeon at Glasgow, Joseph Lister, applied the principles of Pasteur's experiments to their treatment. It may be well here to quote from Lister's original paper in the *Lancet*, 1867 :—"Turning now to the question how the atmosphere produces decomposition of organic substances, we find that a flood of light has been thrown upon this most important subject by the philosophic researches of M. Pasteur, who has demonstrated by thoroughly convincing evidence that it is not to its oxygen or to any of its gaseous constituents that the air owes this property, but to minute particles suspended in it, which are the germs of various low forms of life, long since revealed by the microscope, and regarded as merely accidental concomitants of putrescence, but now shown by Pasteur to be its essential cause, resolving the complex organic compounds into substances of simpler chemical constitution, just as the yeast plant converts sugar into alcohol and carbonic acid." From these beginnings modern surgery took its rise, and the whole subject of wound infection, not only in relation to surgical diseases, but to child-bed fever, forms now one of the most brilliant chapters in the history of Preventive Medicine.

II.

Pasteur was early impressed with the analogies between fermentation and putrefaction and the infectious diseases, and in 1863 he assured the French Emperor that his ambition was "to arrive at the knowledge of the causes of putrid and contagious diseases." After a study upon the diseases of wines, which has had most important practical bearings, an opportunity came of the very first importance, which not only changed the whole course of his career, but had great influence in the development of medical science. A disease of the silkworm had, for some years, ruined one of the most important industries of France, and in 1865 the Government asked Pasteur to give up the laboratory work and teaching, and to devote his whole energies to the task of investigating it. The story of the brilliant success which followed years of application to the problem will be read with deep interest by every student of science. It was the first of his victories in the application of the experimental methods of a trained chemist to the problems of biology, and it placed his name high in the group of the most illustrious benefactors of practical industries.

The national tragedy of 1870–2 nearly killed Pasteur. He had a terrible pilgrimage to make in search of his son, a sergeant in Bourbaki's force. "The retreat from Moscow cannot have been worse than this," said the *savant*. In October, 1868, he had had a stroke of paralysis, from which he recovered in a most exceptional way, as it seemed to have diminished neither his enthusiasm nor his energy. In a series of studies on the diseases of beer, and on the mode of production of vinegar, he became more and more convinced that these studies on fermentation had given him the key to the nature of the infectious diseases. It is a remarkable fact that the distinguished English philosopher of the seventeenth century, the man who more than anyone else of his century appreciated the importance of the experimental method, Robert Boyle, had said that he who could discover the nature of ferments and fermentation, would be more capable than anyone else of explaining the nature of certain diseases. The studies on spontaneous generation, and Lister's application of the germ theory to the treatment of wounds, had aroused the greatest interest in the medical world, and Villemin, in a series of most brilliant experiments, had demonstrated the infectivity of tuberculosis. An extraordinary opportunity now offered for the study of a widespread epidemic disease, known as anthrax, which in many parts of France killed from 25 to 30 per cent. of the sheep and cattle, and which in parts of Europe had been pandemic, attacking both man and beast. As far back as 1838 minute rods had been noted in the blood of animals which had died from the disease; and in 1863 Devaine thought that these little bodies, which he called bacteridia, were the cause of the disease. In 1876 a young German district physician, Robert Koch, began a career, which in interest and importance rivals that of the subject of this memoir. Koch confirmed in every point the old researches of Devaine; but he did much more, and for the first time isolated the organism in pure culture outside the body, grew successive generations, showed the remarkable spore formation, and produced the disease artificially in animals by inoculating with the cultures. Pasteur confirmed these results, and in the face of extraordinary opposition succeeded in convincing his opponents. Out of this study came a still more important discovery, namely, that it was possible so to attenuate or weaken the virus or poison that the animal could be inoculated, and have a slight attack, recover, and be protected against the disease. More than eighty years had passed since, on May 14th, 1796, Jenner, with a small bit of virus taken from a cow-pox on the hand of the milkmaid, Sarah Newlme, had vaccinated a child, and thus proved that a slight attack of one disease would protect the body from disease of a similar character. It was an occasion famous in the history of medicine, when, in the spring of 1881, at Melun, at the farmyard of Pouilly le Fort, the final test case was determined, and the flock of vaccinated sheep remained well, while every one of the unvaccinated, inoculated from the same material, had died. It was indeed a great triumph.

The studies on chicken cholera, yellow fever, and on swine plague helped to further the general acceptance of the germ theory. I well remember at the great meeting of the International Congress in 1881, the splendid reception accorded to the distinguished Frenchman, who divided with Virchow the honours of the meeting. Finally came the work upon one of the most dreaded of all diseases—hydrophobia, an infection of a most remarkable character, the germ of which remains undiscovered. The practical results of Pasteur's researches have given us a prophylactic treatment of great efficacy. Before its introduction the only means of preventing the development of the disease was a thorough cauterisation of the disease wound within half an hour after its infliction. Pasteur showed that animals could be made immune to the poison, and devised a method by which the infection conveyed by the bite could be neutralised. Pasteur Institutes for the treatment of hydrophobia have been established in different countries, and where the disease is widely prevalent have been of the greatest benefit. Except at the London Congress, the only occasion on which I saw the great master was in 1891 or 1892, when he demonstrated at the Institute to a group of us the technique of the procedure, and then superintended the inoculations of the day. A large number of persons are treated in the course of the year; a good many, of course, have not been bitten by mad dogs; but a very careful classification is made :—

(*a*) Includes persons bitten by dogs proved experimentally to have been mad.

(*b*) Persons bitten by dogs declared to be mad by competent veterinary surgeons.

(*c*) All other cases.

The mortality even in Class A is very slight, though many patients are not brought until late. Incidentally it may be remarked the lesson of this country in its treatment of hydrophobia is one of the most important ever presented in connection with an infectious disease. There are no Pasteur Institutes; there are no cases. Why? The simple muzzling order has prevented the transmission of the disease from dog to dog, and once exterminated in the dog, the possibility of the infection in man had gone. In 1888 the crowning work of Pasteur's life was the establishment of an Institute to serve as a centre of study on contagious disease, and a dispensary for the treatment of hydrophobia, which is to-day the most important single centre of research in the world. The closing years of his life were full of interest in the work of his colleagues and assistants, and he had the great satisfaction of participating, with his assistant Roux, in another great victory over the dread scourge, diphtheria. Before his death in 1895 he had seen his work prosper in a way never before granted to any great discoverer. To no one man has it ever been given to accomplish work of such great importance for the well-being of humanity. As Paul Bert expressed it in the report to the French Government, Pasteur's work constitutes three great discoveries, which may be thus formulated. 1. Each fermentation is produced by the development of a special microbe.

2. Each infectious disease is produced by the development within the organism of a special microbe.

3. The microbe of an infectious disease culture, under certain detrimental conditions is attenuated in its pathogenic activity; from a virus it has become a vaccine.

In an address delivered in Edinburgh by Sir James Simpson in 1853, in which he extolled the recent advancement of physic, occur these words:—"I do not believe, that, at the present moment, any individual in the profession, who, in surgery or in midwifery, could point out some means of curing —or some prophylactic means of averting by antecedent treatment—the liability to these analogous or identical diseases—viz., surgical or puerperal fever—such a fortunate individual would, I say, make, in relation to surgery and midwifery, a greater and more important discovery than could possibly be attained by any other subject of investigation. Nor does such a result seem hopelessly unattainable." Little did he think that the fulfilment of these words was in the possession of a young Englishman who had just gone to Edinburgh as an assistant to his colleague, Professor Syme. Lister's recognition of the importance of Pasteur's studies led to the fulfilment within this generation of the pious hope expressed by Simpson. In Institutions and Hospitals surgical infection and puerperal fever are things of the past, and for this achievement if for nothing else, the names of Louis Pasteur and Joseph Lister will go down to posterity among those of the greatest benefactors of humanity.

III.

In his growth the man kept pace with the scientist—heart and head held even sway in his life. To many whose estimate of French character is gained from "yellow" literature this story will reveal the true side of a great people, in whom filial piety, brotherly solicitude, generosity, and self-sacrifice are combined with a rare devotion to country. Was there ever a more charming picture than that of the family at Dôle! Napoleon's old sergeant, Joseph Pasteur, is almost as interesting a character as his illustrious son; and we follow the joys and sorrows of the home with unflagging attention. Rarely has a great man been able to pay such a tribute to his father as that paid by Pasteur:—"For thirty years I have been his constant care, I owe everything to him."

This is a biography for young men of science, and for others who wish to learn what science has done, and may do, for humanity. From it may be gleaned three lessons.

The value of method, of technique, in the hands of a great master has never been better illustrated. Just as Harvey, searching out Nature by way of experiment, opened the way for a study of the functions of the body in health, so did Pasteur, bringing to the problems of biology the same great *organon*, shed a light upon processes the nature of which had defied the analysis of the keenest minds. From Dumas's letter to Pasteur, quoted in Chapter VI., a paragraph may be given in illustration:—"The art of observation and that of experiment are very distinct. In the first case, the fact may either proceed from logical reasons or be mere good fortune; it is sufficient to have some penetration and the sense of truth in order to profit by it. But the art of experimentation leads from the first to the last link of the chain, without hesitation and without a blank, making successive use of Reason, which suggests an alternative, and of Experience, which decides on it, until, starting from a faint glimmer, the full blaze of light is reached." Pasteur had the good fortune to begin with chemistry, and with the science of crystallography, which demanded extraordinary accuracy, and developed that patient persistence so characteristic of all his researches.

In the life of a young man the most essential thing for happiness is the gift of friendship. And here is the second great lesson. As a Frenchman, Pasteur had the devotion that marks the students of that nation to their masters, living and dead. Not the least interesting parts of this work are the glimpses we get of the great teachers with whom he came in contact. What a model of a scientific man is shown in the character of Biot, so keenly alive to the interests of his young friend, whose brilliant career he followed with the devotion of a second father. One of the most touching incidents recorded in the book relates to Pasteur's election to the Academy of Sciences:—"The next morning when the gates of the Montparnasse cemetery were opened, a woman walked towards Biot's grave with her hands full of flowers. It was Mme. Pasteur who was bringing them to him . . . who had loved Pasteur with so deep an affection." Pasteur looked upon the cult of great men as a great principle in national education. As he said to the students of the University of Edinburgh:—"Worship great men";* and this reverence for the illustrious dead was a dominant element in his character, though the doctrines of Positivism seemed never to have had any attraction for him. A dark shadow in the scientific life is often thrown by a spirit of jealousy, and the habit of suspicious, carping criticism. The hall-mark of a small mind, this spirit should never be allowed to influence our judgment of a man's work, and to young men a splendid example is here offered of a man devoted to his friends, just and generous to his rivals, and patient under many trying contradictions and vexatious oppositions.

And the last great lesson is humility before the unsolved problems of the Universe. Any convictions that might be a comfort in the sufferings of human life had his respectful sympathy. His own creed was beautifully expressed in his eulogy upon *Littré*:—"He who proclaims the existence of the Infinite, and none can avoid it—accumulates in that affirmation more of the supernatural than is to be found in all the miracles of all the religions; for the notion of the Infinite presents that double character that it forces itself upon us and yet is incomprehensible. When this notion seizes upon our understanding, we can but kneel. . . . I see everywhere the inevitable expression of the Infinite in the world; through it,

* A great nation, said Disraeli, is a nation which produces great men.

the supernatural is at the bottom of every heart. The idea of God is a form of the idea of the Infinite. As long as the mystery of the Infinite weighs on human thought, temples will be erected for the worship of the Infinite, whether God is called Brahma, Allah, Jehovah, or Jesus; and on the pavement of those temples, men will be seen kneeling, prostrated, annihilated in the thought of the Infinite." And modern Pantheism has never had a greater disciple, whose life and work set forth the devotion to an ideal—that service to humanity is service to God:—"Blessed is he who carries within himself a God, an ideal, and who obeys it: ideal of art, ideal of science, ideal of the gospel virtues, therein lie the springs of great thoughts and great actions; they all reflect light from the Infinite."

The future belongs to Science. More and more she will control the destinies of the nations. Already she has them in her crucible and on her balances. In her new mission to humanity she preaches a new gospel. In the nineteenth century renaissance she has had great apostles, Darwin, for example, whose gifts of heart and head were in equal measure, but after re-reading for the third or fourth time the *Life of Louis Pasteur*, I am of the opinion, expressed recently by the anonymous writer of a beautiful tribute in the *Spectator*, "that he was the most perfect man who has ever entered the Kingdom of Science."

WILLIAM OSLER.

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An Address

ON

HIGH BLOOD PRESSURE:

ITS ASSOCIATIONS, ADVANTAGES, AND DISADVANTAGES.

DELIVERED AT THE GLASGOW SOUTHERN MEDICAL SOCIETY.

BY

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LIFE is correlated in every way with tension of a certain quality—with a force, a pressure that keeps the atoms whirling in organic circles. Lower, beyond a certain point, the pressure with which the blood flows in the medulla, changes the surface tension of the fluid in which a leucocyte swims, or an amoeba crawls, and the atoms of the man, of the leucocyte, and of the amoeba soon cease to swing in organic rhythm, and change to that to which all inorganic matter has been attuned since, in the words of Lucretius, "the atoms fell into such a disposition as those whereby our world of things created holds together."

Blood pressure—the force with which the blood circulates—maintains in organic activity every part of the body. With the five factors concerned in its maintenance I need not detain you. The heart pump supplies a force which the elastic coats of the large arteries store to convert an intermittent into a continuous stream. The small arteries act as sluices or taps regulating the supply to different parts. Over the capillary bed the nutritive fluid is distributed. And there is a drainage system of veins and lymph channels. Life depends on the maintenance of a due pressure in the irrigation fields, to the canals of which Galen first likened the blood vessels: "So it is with the animal body. Many canals dispersed through all its parts convey to them blood, as those of a garden convey moisture, and the intervals separating those canals are wonderfully disposed by Nature in such a way that they should neither lack a sufficient quantity of blood for absorption, nor be overloaded at any time with an excessive supply." On a huge scale, one sees this in a land like Egypt, the very life of which depends on the height of the pressure of water, whether in the annual rise of the Nile, or as it is dammed and stored artificially.

A man's life may be said to be a gift of his blood pressure, just as Egypt is a gift of the Nile (Herodotus). It is interesting to see at first hand how this pressure is kept up in Egypt by the big dams at the Delta, at Assiut, at Esna, and the monster one at Assouan. When raised 15 ft., the last named will give life to another one and a half million acres of dead sand. Along the Nile big steam pumping stations keep certain canals and reservoirs full. For thousands of years, long before dams were built, the patient fellaheen have baled the water from level to level with a bucket at one end of a crossbeam, counterpoised with a weight at the other. Of the three forces which now keep Egypt watered, gravity, steam, and human muscle, the first is the most important. In the human irrigation scheme there is nothing to correspond with this—indeed, gravity in the circulation of all living things is a great obstacle, to overcome which the pump had, in animals at least, to be introduced. The man with the shadoof working on the banks of the Nile, the immediate agent in the old-fashioned plan of irrigation, represents rather the living capillary cell. And the Nile mud itself is alive, not alone in the magic potency which gave man his earliest civilization, but in plastic qualities which enable the fellaheen to build the dykes and dams with canals and rivulets, making every acre a miniature of Egypt itself. In the fields, as in the body, are schemes for distributing the vital fluid, for varying the pressure in different parts, and two all-important things are arranged—the final channels of distribution between the cotton rows or the corn are kept free from weeds and obstructions, and provision is made for drainage, for carrying off the surplus water, to prevent dropsy of the soil.

The whole question of blood pressure is too vast for me to do more than touch upon two points essential to my purpose this evening. The smaller arteries act as stopcocks—taps which regulate the flow to the vascular areas according to requirements. Under the control of various stimuli—vasomotor, hormonic, physical, and postural—they are sluice-gates to be open or shut. The mean pressure in them depends less on the forces of the pump than on the distribution of the blood bulk, the state of the arterial walls, and the state of the capillary bed. So important is distribution that a person may bleed to death into his own vessels, splanchnic or systemic. Hold a hutch rabbit up by the ears, and so much blood accumulates in its splanchnic reservoir that the pressure falls in the smaller arteries of other regions, and the animal dies. The average pressure in the various territories to be irrigated is regulated from the vasomotor centres, just as a man in charge of a big irrigation plant controls the sluices, often nowadays raising or lowering them by simply touching an electric button. In man a mean arterial pressure is maintained—about 125 to 130 mm. of Hg, and 140 to 160 mm. in persons over 50. A permanent pressure above 160 mm. may be called high, but we must not forget the great regional variations pointed out by Leonard Findlay and others.

In the capillary lake into which the arterial stream widens the current slows and the pressure lessens, though on the latter point authorities are not agreed. There are probably great variations. The Nile, when in low water, takes ninety days to flow from Lake Victoria Nyanza to the sea. Between Gondokoro and Khartoum it passes through the great capillary lake known as the Sud, and more than one-half of the time—forty-six days—is taken to pass this short region. But when in flood it takes only fifty days from Lake Victoria Nyanza to the sea, twenty-eight of which are occupied in passing through the Sud. But it is not merely a matter of rate-flow and pressure in the capillary bed; there are two other factors of prime importance. In the brief fraction of a second, and in a short quarter to three-quarters of a millimetre of space, the business of life is transacted, for here is the mart or exchange in which the raw and the manufactured articles from the intestinal and hepatic shops are spread out for sale. The endothelial capillary cell is not a simple dead membrane under the laws of diffusion, but has an active selective power. Playing the part of a middleman, it is everywhere a free trader in the bread stuff of life, oxygen, but a strong protectionist in certain commodities. Thus the renal capillary cell trades in water, salts, urea, and uric acid, but has a high tariff wall against proteins and sugars. In the secretory glands the selective capacity of the capillary wall must be of the first importance, as here the middleman and the retailer are cheek by jowl, and their shops abut, back to back, opening to different streets. These retail shops, represented by the gland and body cells of the capillary areas, do a roaring trade, partly in common commodities—water, oxygen, salts—and partly in special goods made up on the spot for the use of the body. Each cell, factory as well as shop, collects a great deal of dust and rubbish, and special provision is made for getting rid of this, part being dumped back into the common river, and part into a special lymphatic drainage system, which keeps the irrigation fields free from weeds and dirt. The transactions which take place between the middleman (the capillary cell), the factory and shop-people (in the gland or body cell), and the sanitary department (represented by the lymph circulation), are regulated in part by the laws of diffusion and osmosis, and partly by the cell specialists (enzymes of various sorts), some of which, for example, enable the liver cells to make bile, others to make glycogen. All this activity is associated with movement. The force taking the protein molecule through a capillary cell, through the furnace of a muscle cell to make it appear in the lymph space as sarcolactic acid and other organic compounds, is not simple osmosis;

but in its working currents caused by the machinery of the cell must set from blood to lymph stream. Though we know very little about it in the animal body, this *vis a fronte*, which Galen compared very aptly to a magnet, is not a negligible quantity. We know of its immense power in plants, and I believe botanists agree that the force which may lift water to a height of 300 feet or more in a tree is a *vis a fronte*, and not a *vis a tergo*. All this is preliminary to the main topic of my address, the associations advantages, and disadvantages of a high blood pressure.

Some years ago I wrote a short paper with a somewhat paradoxical title: "The advantages of a trace of albumen and a few tube casts in the urine of men over 50 years of age." It was written with the specific object of allaying the unnecessary fears of physicians obsessed with the old idea that the presence of these bodies in the urine always indicated serious and progressive disease of the kidneys. This bogey has been to a large extent replaced by that of high blood pressure, a knowledge of which has filtered to the laity with the usual disastrous results. A good many people are unnecessarily alarmed, and much needless worry and anxiety has been caused. For example, a robust, full-blooded country girl was taken to a physician for some menstrual disturbance, and was told that her blood pressure was 140, and that the outlook for her was serious. The poor girl, very much depressed, regarded her condition as hopeless, particularly in so far as a married life was concerned. She was a strongly built, plethoric, muscular girl, who only needed the reassurance that with her physique such a pressure was as natural as one of 90 would be in a thin, pale delicate girl.

What are the conditions in which we see permanent high pressure, and what are its advantages and disadvantages? For practical purposes we may consider three groups of cases: Simple high tension, hyperpiesis, without signs of arterial or renal disease; arterio-sclerosis, with the associated high tension, renal, and heart changes; and chronic nephritis, with secondary high pressure, arterio-sclerosis, and heart changes.

I. Hyperpiesis.

Hyperpiesis signifies simple high pressure without signs of cardio-vascular disease. We have learnt to recognize an average pressure, as taken with ordinary instruments, and the figures given are usually accepted. There are, of course, great variations, usually temporary, but now and again we meet with individuals whose pressure is permanently high—above 180—without, so far as can be ascertained, arterial, cardiac, or renal disease. Of course the difficulty is to exclude internal, not discernible, alterations in the splanchnic and other vessels, since, as is well known, vascular disease may be very localized, but, clinically, the group, well defined and very important, has been carefully studied by Allbutt and others. We see the condition most often in men who work hard, drink hard, and smoke hard, particularly in keen business men with heavy responsibilities, and we see it now and then in neurasthenic and gouty persons. Let me give a few illustrative cases:

A man just over 40 years of age, 13 st. 7 lb. in weight, of excellent family history and no syphilis, had lived a business life of the greatest possible intensity. Early successful, he began to speculate, and made and lost several fortunes, lived "high," as the saying is, smoked eight to ten cigars and several cigarettes in the day, took a dozen drinks of Scotch whisky, always champagne at dinner, and with it all found time for a moderate amount of exercise, chiefly riding. In short, he lived the "hustling" life of Wall Street. He regarded himself as "hard as nails," nothing could hurt him. The ill effects of the night disappeared with the morning cold bath. He was always ready for his breakfast, and sharp as a hawk for business at 9 o'clock in the morning. Suddenly one day, without warning, after a heavy dinner, he lost the power of speech, and for nearly three days was confused in his head and could not express himself intelligently. There was no paralysis of face or arm, and at the end of a week he was quite himself again. A trace of albumen and a few tube casts were found in the urine, and he had a blood pressure of 212. Of course this was a terrible shock. He gave up business, went to Carlsbad and various health resorts. I saw him just a year after the attack. He was still very apprehensive and worried, and had had a few attacks of pain about his heart after exertion. He was a big, healthy-looking man, of good colour and good physique. Careful examination showed no alteration in any of his viscera. The pulse was 80. Both the radials and temporals could be rolled under the finger, and the pulse could be felt just as well on the distal side of the pressure. Compressing a section of the radial at a distance of 2 in. apart, the intervening portion of the vessel full of blood felt firm, and could be readily rolled under the finger. If, however, with gentle pressure, the blood column was forced out of about 2 in. of the radial, its wall could not be felt or differentiated in any way from the tissues about it. The same held good for the temporal. With a similar experiment it was not easy to feel the wall of a brachial artery. The retinal arteries looked large and full, but they did not compress the veins specially. The apex beat was not outside the nipple line. The cardiac flatness was not increased, but there was a snapping, valvular aortic second sound. The systolic blood pressure was 235. No difference in the recumbent position and after exertion. The specific gravity of the urine was 1020, and at times there had been a slight trace of albumen. There was none when I first saw him. There were no tube casts.

Here was a man whose arteries, as far as one could make out, had not thickened palpably, certainly not beyond his age. His heart was not hypertrophied, but he had a very high blood pressure, and he had had one of those peculiar but not very uncommon attacks of aphasia in connexion with it.

It is interesting, sometimes distressing, to see a man of great vigour, in the prime of life, full of work and energy, in the first shock of the realization that he is a machine, with the works of which there is something radically wrong.

A fine strapping fellow of 48, a lawyer of distinction, and among his friends a boon companion, full of work, public and private, suddenly noticed a slight obscurity of vision. As he was going off for his holiday in Europe he consulted an ophthalmic friend, who told him he had retinal haemorrhages and disease of his arteries. To a man who had never realized that his body was a mechanism it was a great shock to find himself "out of gear," and as he said pathetically, "it did not seem the same world when I had to give up cigars, champagne and Scotch whisky, and pleasant evenings at the club." I saw him in July, 1909, the picture of health, and with the frame of a prize-fighter, but self-centred, nervous, apprehensive, worrying all the time lest another blood vessel might break. He had had a permanent blood pressure above 220, records taken by a dozen different doctors, and he had copies of the analysis of his urine, and had provided himself with Theodore Janeway's book.

It is not always possible to suggest the factors causing the high blood pressure. It may be met with unexpectedly and determined only by the apparatus; indeed one may feel a keen sense of disappointment that the educated finger should be so far astray. It may sometimes be the initial event in an inherited bias towards cardio-vascular mischief, without the occurrence of any of the usual factors.

I saw this year, with Dr. Lichfield of Pittsburg, a healthy looking woman, aged 46, whose father, mother, several brothers, and a sister had died comparatively young of heart or arterial disease, and in whose family there was marked gout. She had herself been very healthy, except for occasional "nervous attacks." She is stated to have had congenital syphilis. She had had some pains in the muscles, rheumatic or gouty, and Dr. Lichfield was astonished to find that her blood pressure was above 200. She was a well nourished, healthy looking woman, without luetic stigmata. The peripheral arteries were nowhere sclerotic. The empty radial artery could not be felt. The temporals were not palpable. The heart impulse was not forcible, and the aortic second sound was not specially accentuated. To the touch I could not determine that the pressure was high in the peripheral arteries, but it was above 200 mm. The urine was of low specific gravity; no casts.

Where is the change in these cases? Not, so far as one can say, in the heart, not in the mains, not in the supply pipes, but to keep up a normal irrigation in the capillary beds there has to be a widespread increase of pressure in the smaller arteries. Where is the first link in the chain? In an altered condition of the vessels in the splanchnic area? In a toxaemia from the bowels? In an over-secretion of pressor substances by renals and adrenals? More likely the block is in the irrigation fields. If the director of a large irrigation plant found the pressure rising in the supply pipes of the third and fourth dimensions, and there was nothing wrong in the pump or the sluices, he would go directly to the fields to see if the channels were free, and to see that the drainage was proportionate to the supply. I believe that in these cases the primary mischief lies between the capillary cell and the lymph spaces, in the working area of the body—a row between the middle man, the manufacturers, and the sanitary authorities—a sort of general strike, to overcome which the Government has to intervene. Remember, as I mentioned, vegetable physiology teaches plainly that the *vis a fronte* is a powerful factor in the metabolism of the cell, and it may be disturbances in this sphere that necessitate, as a conservative action, an increase in the pressure with which the blood flows in the supply pipes. Or there is a difficulty in clearing of ashes and cinder the furnaces which keep up the fires of life in every unit of the bodily frame. The engines are stoked for the Glasgow express on the London and North-Western Railway, but put to work shunting empty trucks in the station yard!

Cannon and others have shown that in emotional states there is an increase in the adrenal flow, and this is a factor which has to be considered in the high pressure of modern life. Understand one thing clearly—this high pressure is not itself the disease, but a compensatory, salutary state, if not for the man, at any rate for his circulation. That this is so, try to reduce it below a certain point. You may, for a time, but up it goes again, and the man only feels comfortable when you allow him to live at a certain high level. By diet, a change in the mode of life, etc., the pressure may be kept at a reasonable rate, but in my experience, never again does it fall to the normal. The first patient illustrates how difficult or impossible it may be to permanently keep down the blood pressure. He had been at spas for special treatment; he had taken nitrites and potassium iodide; he had had "high frequency" treatment and a special course of sterilization of his colon—but all of no avail, as the pressure kept up. As he had become morbidly apprehensive and self-centred, I urged him to resume his business, lead a rational life, and stop taking "cures."

The disadvantages are: (1) Just such transient cerebral attacks as the first patient had, or headache, vertigo, flushings, or an anginal attack, or transient bouts of dyspnoea with palpitations. But more serious still is (2) the certainty that sooner or later sclerosis of the arteries will follow. And this brings me to the consideration of group II.

II. Arterio-sclerosis with High Tension and Associated Cardiac and Renal Changes.

There are two essential factors in arterio-sclerosis—the quality of the tubing and the way in which it is treated. The marvel is that any set of pipes could be constructed to stand the continuous strain to which for years the human blood vessels are subjected. To use a well-worn simile—very different qualities of rubber are used in the make up of our tubing, and longevity is very much a matter of its quality, whether good Para or not. There is, too, that curious and inexplicable element which brings such uncertainty into our calculations. Take two 1910 motor cars turned out from the same shops and by the same workmen and with the same parts. The one may give no trouble, the other may be half the time in the repair shops. Of a dozen blades of a Gillette safety razor, all identical in appearance and in fineness of edge, some may be used for weeks, even months; others may have to be cast aside in a few days. So it is with man and his blood vessels. The contract calls for from sixty to eighty years of usage. Some hold out well, and even after ninety years are still fairly good, but the personal equation has always to be considered. The ordinary wear and tear of life may bring about arterial degeneration in a temperate man of 40 years; on the other hand, who has not seen lusty octogenarians with untouched hearts and arteries?

The commoner causes of arterio-sclerosis need not detain us, toxic agents, chiefly, exogenous or endogenous, some of them acting directly on the vessels, others by disturbing the circulation in the cell factories, calling for higher pressure in the supply pipes, and so leading indirectly to sclerosis.

I should like to refer to two other causes, one of which has a note of personal appeal. There is an old motto, "It is the pace that kills," and nothing is more certain than that the pace of modern life kills many prematurely through the complications of arterio-sclerosis. The keen, sharp business or professional man, year in, year out giving his engines no rest, leading a life of high pressure, though a teetotaler and temperate in his diet, and a non-smoker, may have so driven his machine that at 50 it is only fit to be scrapped. These tragedies of life are only too common among us. It is not only a great leader like William Pepper, who died an arterial death at 55, but we see it in the men who live the hard, unselfish lives of general practice. I have notes of at least a score of physicians wrecks before 50—men, too, who had enjoyed their work, untiring, unsparing of themselves and of their time—sensible fellows in everything but in the care of their machine. Some were victims of angina pectoris, some of myocarditis, others of progressive cardiac failure, many more of the complications of arterio-sclerosis—all of the high-pressure life too often nowadays the necessary accompaniment—the penalty—of success. And I think we must recognize another factor—prolonged overuse of the muscles. That athletes die early is well recognized, but it is not easy to determine always how far the cardio-vascular changes are due to muscular effort alone. Take a not uncommon picture:

An exceedingly vigorous man, aged 50, spare, weighing only 10 st., with a good family and a good personal history. He had never had syphilis, but at 28 he had had a bad attack of typhoid fever. He had lived an out-of-door life, and had used his muscles incessantly in sports as a young man, at cricket and hunting, and when at college as a long-distance runner; no gout in his family. He had been a moderate user of alcohol and had smoked cigars and cigarettes, but not in excess. Four or five years ago he began to have headaches, which have bothered him at intervals ever since; but he has kept at work, has played tennis and golf, and it was only a few months ago that he consulted his doctor for the headaches. A very healthy-looking fellow, strong and muscular; his pulse was 80—the vessel rolled easily under the fingers. The pulse was recurrent, and there was practically no difference as one felt the vessel with the blood current in or when it was pressed out. The arteries were like whipcord. The temporals could be easily felt. The walls of the retinal arteries looked thick and they compressed the veins. The apex beat bulged the fifth inter-space an inch and a half outside the nipple line—a strong, forcible, and visible beat, localized in the one interspace. The shock of both sounds was palpable, and the shock of the aortic second sound so intense that it could be heard six or seven inches away from the chest wall. The first sound at the apex was booming, a little murmurish. The urine had a specific gravity of 1020, and he did not pass an excessive amount; it showed a few hyaline casts. The blood pressure was 212.

It is true the man had had typhoid fever, and a bad attack, but the arterial changes of the acute infections rarely take the form of a widespread sclerosis. I have notes of cases of angina pectoris in comparatively young men, not syphilitic, in whom the sole factor leading to coronary artery degeneration was persistent over-exertion.

As a rule men under 60 years of age with primary arterio-sclerosis have high blood pressure, indeed the highest known records are in this condition.

In this group of cases it is well to recognize that the extra pressure is a necessity—as purely a mechanical affair as in any great irrigation system with old encrusted mains and weedy channels. Yet the victims are often robust, energetic men of great vitality. Get it out of your heads, if possible, that the high pressure is the primary feature, and particularly the feature to treat. We tied up one evening near a big pumping station on the Nile, and in conversation the Scottish engineer in charge told me that the two essential factors in maintaining uniformity in irrigation were keeping the terminal channels free between the rows of cane, and maintaining the drainage. Obstruction in the fields could be overcome by increasing the pressure, to a certain point, but it was cheaper and safer to clear out the weeds. The difficulty, I believe, is to keep the human irrigation plant free from weeds, the sud that chokes the capillary bed, through which it takes a greater force to drive the fluids. We too often tinker at the pump and the mains, instead of looking for the real seat of trouble in the fields.

It is alarming to find that a patient may only be comfortable with a pressure about 200 mm., but, as a rule, do not take too gloomy a view of the condition, which is often not so bad as it looks. For years a man may enjoy good health and do hard work with high-pressure, whipcord arteries and a hypertrophied heart. Take warning, pessimists, from this story:

I saw on June 21st, 1901, a judge, aged 46, a man of good habits, except that he had been a very heavy eater. He had been very moderate in alcohol and tobacco, and had not had syphilis. He had taken a great deal of exercise, and had always regarded himself as in the pink of condition. A year before I saw him he began to have a little shortness of breath, particularly if he played too much golf or went uphill rapidly. He consulted Dr. Delafield, who told him he had sclerosis of the arteries and enlargement of the heart, and who urged him to change his habits of life. He presented the usual picture—markedly sclerotic arteries, very high blood pressure, a strong, forcible apex beat *3 in. by measurement* outside the nipple line. The aortic second sound at the base was much accentuated. The specific gravity of the urine was high; no albumen, no tube casts. Now that did not look a very satisfactory condition in a comparatively young man who had never had syphilis nor any serious infections. He was a sensible fellow—cut down the intake of fuel, lived an easy life, attended to his duties, and has got on very comfortably. He called on me last summer; unfortunately I was away, but a message on his card read: "Am feeling very fit"!

"Judgement is difficult," says Hippocrates; but I never knew a man with so marked hypertrophy of the left ventricle to have an extension of life even beyond that granted to Hezekiah. I do not think even the most optimistic would have given him five years; Nature gave him twenty!*

High tension is not always associated with arterio-sclerosis, though present in a large majority of all patients under 60. Normal or low pressures may occur in three conditions: (1) In elderly persons with extensive sclerosis of the aorta and its chief branches; (2) with a general failure of health and strength; and (3) in the late stages with the failing, dilated heart.

What is the condition of the kidneys in these cases? This important question is not always easy to decide. In many instances the urine presents no abnormalities. There may be a trace of albumen, particularly in the morning, and a few tube casts, but the output is up to the mark, and certainly patients may for years have extreme arterio-sclerosis without serious kidney disease. And *post-mortem* studies show this to be the case. With permanent high tension alone, or with high tension *plus* arterio-sclerosis, the kidneys have been found in a few cases practically normal. We must remember that no one at 50 has kidneys completely normal histologically. In the cases of chronic arterio-sclerosis which came to necropsy from my wards in the Johns Hopkins Hospital three types of kidneys were found.

1. The full-sized, hard, beefy organ, often with a smooth surface, sometimes with slight adhesion of the capsule, but an organ obviously not contracted. When I lived in Philadelphia a remarkable man was demonstrator of morbid anatomy at the university, and coroner's physician, the late Dr. Formad. He had had a rich experience in medico-legal cases. I remember he brought before us the results of the study of the kidneys in some 250 cases of sudden death in alcoholics—176 men and 74 women—the great majority of them above the middle period of life. Accurate figures were not given of the causes of death, but the interesting feature is that nearly all of these patients had somewhat enlarged, hard kidneys, frequently, too, of the rounded, sausage-like or pig-backed form. Emerson's analysis of our cases of patients dying with features of general arterio-sclerosis showed that in 60 per cent. the combined weight of the kidneys was above 300 grams. The general experience is that in a very considerable proportion of all middle-aged persons with arterio-sclerosis the kidneys are not contracted.

* Since giving this lecture, Dr. McCrae tells me of his death—the usual way, gradual heart failure, with the distressing mental symptoms so often seen.

2. The patchy arterio-sclerotic kidney, which presents atrophy of surface areas, or sometimes an extensive section of the end of one kidney, and everywhere showing the effects of irregular vascular sclerosis.

3. The small, red, granular kidney, the final outcome in a limited number of cases of renal arterio-sclerosis.

I need not dwell upon this side of the question further than to ask you to bear in mind that conditions of chronic hypertension and of advanced arterio-sclerosis may exist without serious interference with the renal function.

Many of these patients have been condemned as cases of incurable Bright's disease without full knowledge. Fully fifteen years ago I saw an old friend with slight swelling of the feet, cardiac weakness, retinal haemorrhages, traces of albumen in the urine, and tube casts. In a man of 60 who had worked very hard such a state certainly looked serious. He had stiff arteries and an accentuated aortic second sound. Though urged to retire, like a wise man he decided to slow the engines but to continue the voyage. I saw him a few weeks ago, now a man of 75, who meanwhile has travelled much, organized new departments of his work, and has been an active, though not a vigorous man. On and off his ankles have swollen and he has been short of breath on stairs and hills; but, like the ship in Kipling's *Devil and the Deep Sea*, with patched machinery he has been able to keep up an 8 to 10 knot rate. I was interested to examine him carefully, and found his blood pressure above 180; cardiac impulse outside the nipple line and diffuse; the pulse regular, moderately stiff vessels, a small amount of albumen with tube casts in the urine, and in one eye a fading retinal haemorrhage.

III. Chronic Nephritis with Arterio-sclerosis and High Pressure.

Only a man of brazen boldness will speak dogmatically on this last, long and much-discussed group. That hyperpiesis may lead to arterio-sclerosis, that arterio-sclerosis in turn may lead to sclerosis of the kidneys, that there are primary lesions of the kidney associated with fibrosis, which lead secondarily to high blood pressure, sclerosis of the arteries, and hypertrophy of the heart—these are points upon which most of us are agreed. Here, of the two important divisions—the chronic nephritis of the infections, and the nephritis of the intoxications, gout, lead, alcohol—the end-product in both may be the small, hard, contracted kidneys. In a large proportion of all cases there are associated gradually hypertension, arterio-sclerosis, and hypertrophy of the heart. To distinguish between the two sets of cases, the primary arterio-sclerotic and the primary nephritic, is not often difficult. In the infectious group the history is generally very distinct, the patients are younger, and they rarely have the general vigour of the arterio-sclerotic form. In the lead and gout toxaemias one is rarely in doubt, though in the latter the etiology is often overlooked. On the other hand, the urinary changes in both differ from the arterio-sclerotic form in the persistent low specific gravity, the lower nitrogen output, the more constant presence of albumen (though in slight amount) and the persistence of granular casts. The symptoms, too, are renal and cerebral in the nephritic group, cardiac in the arterio-sclerotic. Uraemic features, progressive pallor, headaches, and marked ocular changes are very much more common in the primary nephritic form, and the retinal changes are degenerative, not simply haemorrhagic. There are transitional stages, and the end of the arterio-sclerotic kidney may be small, red and granular. Intercurrent acute or subacute attacks of nephritis may at any time blur the picture. I have not infrequently been mistaken, led astray usually by the robustness of the patient, and forgetting that chronic interstitial nephritis leading to extreme contraction of the organ may be consistent with good health up to the very onset of fatal uraemic convulsions. In this nephritic class we see remarkable variations in the arterial tension, persistently high in some cases, in others quite moderate, though with extreme arterio-sclerosis and hypertrophy of the left ventricle. The hypertension, doubtless compensatory, and so far as it goes salutary, is caused possibly by increased discharge of pressor substance, and in any case is imperative in the irrigation fields of kidneys choked with débris and overgrown with the weeds of connective tissue growth. The disadvantages are obvious when the chronic hypertension leads to arterial degeneration and renders the patient liable to rupture of the cerebral vessels—a common mode of death in these cases. Careful study of the blood pressure is demanded in the form in which we see hypertensive crises associated with severe headache, often the precursor of uraemia or of transient aphasia with or without paralysis, attacks which a timely bleeding, or purge, or a sweat may ward off.

Lastly, a few words on the care of these cases. Differing as they do so much in etiology and symptoms, a thorough study of each patient is required. At the same time do not lay too much stress upon the hypertension, particularly in nervous patients. When the first intimation comes in the form of an angina, or of a cerebral attack, a man naturally becomes very apprehensive. Patients easily become hipped on the subject of blood pressure; one man had his records carefully charted for eighteen months, and talked like a lay Marey on the various methods. I am not sure whether he was consoled or disappointed to be assured that it was a very good thing for him that his engines had kept up a pressure of about 180 mm.

I.

The first thing is to determine the nature of the case whether simple hypertension, arterio-sclerosis, or chronic nephritis, or all combined. In the case of the active, driving, business man, who has unconsciously damaged the machine, let him reduce the speed from the twenty-four knots of a *Lusitania* to the ten knots of the ocean tramp.

It is interesting to note that the worry and apprehension associated with the first shock of the discovery that something is wrong may cause loss of weight and with it reduction in the blood pressure. A man of 62, whose first indication of trouble was an attack of transient aphasia, lost 2 st. in weight in a year, and his blood pressure sank from 200 to 150. He has been better since he has taken a philosophical view of the situation, and his blood pressure has risen to 180.

II.

The second thing is to lessen the intake. We all eat too much, and in no age was the saying more true that "the platter kills more than the sword." Time and again I have been impressed with this as a possible factor in obscure forms of hypertension and arterio-sclerosis in persons otherwise temperate. Largely a matter of habit, the amount of food taken should be just enough to keep the engines going at a steady speed. A diet of low protein content is best, and fairly large quantities of liquid should be taken.

III.

Thirdly, elimination should be promoted in every way, by making the action of the kidneys, bowels, and skin thoroughly efficient.

IV.

Fourthly, of drugs none are entirely satisfactory in chronic hypertension. Nitrites in various forms may be used, and are often of temporary benefit, but I think the general opinion now is that neither the nitrites nor potassium iodide are of permanent benefit; though now and again one meets with an instance in which the prolonged used of potassium iodide is followed by marked lowering of the pressure. A preparation of mistletoe has also been much lauded, but it, too, is very variable in its effects. Be careful in this point—if the patient does not feel so well, and begins to get thin and look badly, stop all drugs, trust to general measures, and let the pressure rise. In the robust man of full habit in the hypertensive crises with headaches, dyspnoea, or angina, a free venesection is indicated, to be followed by mercurial and saline purges.

The clinical picture which I have thus briefly sketched of chronic hypertension with its associations, advantages, and disadvantages, may not have all the outlines or full details which an artist with more pains and greater skill would put on his canvas, but it is a fair presentation of the subject as I have seen it, and you cannot expect more. The colours, necessarily a bit sombre, have been brightened when possible. And I believe Candide to be wrong—life at the best is not a bad bargain. Even the victim of high tension may find it useful and enjoyable if, following the rest of the moral, he will *cultivate his garden*—weeding the irrigation channels, and keeping free the drainage.

Syphilis of the Liver with the Picture of Banti's Disease

BY

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

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Syphilis of the Liver with the Picture of Banti's Disease.

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

FROM the tangled skein of splenic pathology we have for years been trying to unravel one definite thread, and it looks as if, at least, the attempt had been successful. There is now recognized a disease of splenic origin characterized by:—

(1) Progressive enlargement of the organ, lasting for many years, and not necessarily impairing the health.

(2) Anæmia of a secondary type, with leukopænia, which may come on acutely and recur at long intervals.

(3) A final stage, with cirrhosis of the liver, jaundice and ascites.

That permanent cure follows the removal of the organ, even in long-standing cases and after the jaundice has supervened, is a strong warrant for the belief that the primary lesion is in the spleen itself.

It is a serious difficulty that a motley group of maladies is associated with big spleen and anæmia. From the form just described, which may be called Banti's disease, we have gradually separated off other conditions, such as splenomegaly with acholuric jaundice, splenomegaly of the Gaucher type, splenomegaly with primary pylethrombosis, and certain forms of tropical splenomegaly. Then in a few cases of chronic infectious endocarditis the early history suggests splenic anæmia. Parkes Weber has reported such a case with enlargement of the spleen, and a red blood count of 1,700,000 and a leucocyte count of 1,900. I have recorded a very similar one, in which the picture of the spleen and the low blood count led to the diagnosis at first of splenic anæmia.[1] No condition is more apt to cause confusion than splenomegaly associated with various forms of cirrhosis of the liver. Occasionally in the ordinary Laennec type the spleen is greatly enlarged, and the anæmia is pronounced. More than once I have been deceived by this picture.

[1] *Interstate Med. Journ.*, St. Louis, 1912, xix, p. 103.

In this brief paper I wish to call attention to a group of cases of syphilis of the liver in which the splenomegaly and anæmia are so dominant that splenic anæmia or Banti's disease is diagnosed. The first case of this kind which I saw was in a girl, aged 22, admitted to my wards in November, 1890,[1] with ascites. She had been a delicate child; had not walked until the fourth year. When aged about 15 she had an obscure illness with trouble in the abdomen, with which she was confined to bed for six months. Ever since the abdomen had been somewhat enlarged. For the past three years she had been fairly well. Her present illness dates from two weeks ago, when she had a chill, headache, and pain in the left side, with fever. She has been at work until two weeks ago.

Condition on admission: The patient was a small, delicately built, anæmic girl, with a very sallow facies. She sat up in bed; was unable to lie down on account of pain. The temperature was 103·5° F., the pulse 120, respirations 36. There was marked deformity of the chest, owing to a flattening of the right side from old disease. The left side of the chest was large and moved very freely. There was a marked curvature of the spine due to the old contraction, following the chronic pleurisy. The abdomen was distended, measuring 78 cm. at the level of the navel. The enlargement was not symmetrical, but was more marked in the left flank and in the hypochondrium. There was also a distinct protuberance in the right hypochondrium. The superficial veins were slightly enlarged. On palpation the abdomen was sensitive, particularly on the left side, and at the edge of the ribs there could be felt a firm mass, which extended nearly to the left inguinal region. Towards the right a sharp edge could be distinctly felt. It was movable on bimanual palpation. There was no question that this was an enlarged spleen. On the right side, occupying the epigastric and hypochondriac regions and the upper umbilical region, there was an irregular firm mass which extended a little below the level of the navel. The edge was rounded and hard. Deep in the right flank and apparently connected with it there were two smaller masses to be felt. These descended with inspiration, and they were thought to be in connexion with an enlarged liver. The inguinal glands were a little larger than normal, and were very firm. The epitrochlear glands were enlarged and firm; the glands in the neck and axilla were moderately enlarged, freely movable, and nowhere matted together. The blood count was:

[1] *Johns Hopkins Hosp. Bull.*, Baltimore, 1891, ii, p. 18.

2,234,000 reds per cubic centimetre, and a ratio of white to red of 1 to 25; hæmoglobin 28 per cent. On November 14 the ratio of white to red was 1 to 16.

The temperature fell from 103° F. on November 11, and on November 14 was 99·5° F. She complained a great deal of shortness of breath, vomited, and seemed very ill. The urine was scanty, specific gravity 1020, contained a small amount of albumin and a few hyaline casts. The pulse became very rapid. On November 15 and 16 she had nausea and vomiting, became unconscious on November 16, and died early on the morning of November 17.

Autopsy (Dr. Councilman).—The external lymph glands were enlarged and hard. The peritoneal cavity contained 200 c.c. of slightly bloody fluid. The lower border of the spleen was 11 cm. from the ribs. The mesenteric and peritoneal lymph glands were moderately enlarged and hard. Both liver and spleen were surrounded by firm fibrous adhesions. The liver was brownish-yellow in colour, very tough and hard. It was divided into a number of nodular masses from the size of an apple to that of a filbert, some of them almost separated from the liver and only connected with it by a thin pedicle. The greater portion of the liver was made up of an enlarged left lobe. The right lobe was divided up by bands of connective tissue into the nodular masses already mentioned. On section of the liver there were large bands of connective tissue which traversed it in different directions, and from which smaller bands were given off. The largest of these bands ran between the right and left lobes. There were in addition fibrous gummata which projected from the capsule into the liver substance, and in these were hard necrotic areas. The portal vein was dilated to double its normal size. The spleen measured 23 cm. by 16 cm. The surface was covered by slight adhesions, but was otherwise normal. The surface of the section was firm, of a dark purple-red colour. Neither the trabeculæ nor the Malpighian bodies were visible. The organ weighed 1,510 grm. The right lung was small and firmly bound down by old adhesions. In the lower part of the pleural cavity there was a cavity containing 70 c.c. of opaque, gritty, semi-fluid material.

The blood-picture was that of leukæmia. It was before the days of accurate differential counts. A very similar case has been reported by Hoche from von Jaksch's clinic[1] in a girl, aged 20, admitted with

[1] *Berl. klin. Wochenschr.*, 1902, No. 16.

the clinical picture of splenic anæmia. With a progressive fall in the red corpuscles there was an increase in the leucocytes, which reached 58,400 per cubic centimetre — 1 to 46 red. The autopsy showed syphilis of the liver.

A very similar picture may be present in acquired syphilis. On December 11, 1897, a man, aged 34, was admitted to the Johns Hopkins Hospital with an enormously enlarged irregular spleen, a red blood count of 1,400,000, leucocytes 7,500 per cubic millimetre. The patient had had syphilis, and three years ago had been in another hospital with jaundice and dropsy, both of which had gradually disappeared. For eighteen months he has noticed the gradual increase of a mass in the left side of the abdomen, and he has become anæmic. The spleen extended beyond the navel and below the level of the anterior superior spine of the ilium. It was freely movable, irregular in shape, the edges rounded, but notches could not be felt. The liver formed an irregular mass in the right hypochondrium, with rounded edges and fissured surface. The picture was very like that of the primary splenic anæmia, but the history and the condition of the liver left, I think, no doubt of the nature of the disease.

For the past four or five years there has been under observation at the Radcliffe Infirmary a boy who, at the time of his death, was aged 11. In 1906 and 1907 we had him in the ward for the examiners for the M.B. as a case of splenomegaly. We did not recognize the nature of the trouble until some three or four years ago, when he was admitted with nodes on the shins and syphilitic arthritis on the left knee. At this time the liver was slightly enlarged and a little irregular, but the blood count was practically normal. The father had died of obstruction of the bowels. The mother had lost several children, but there was nothing to suggest syphilis in the family. The spleen was very large, reaching to the right beyond the navel and below the anterior superior spine. It was smooth, not painful, and the notch could be felt. When first under observation the liver was enlarged and irregular, the left lobe easily palpable. Subsequently the liver decreased in size and the rounded irregular edge could at once be determined. His last admission was under Dr. Collier on Christmas Day, 1912. The following is an abstract of a long history:—

He looked fairly well. Red blood corpuscles, 5,770,000; leucocytes, 4,640; hæmoglobin, 65 per cent. The spleen was about the same size as on previous admission, filling the greater part of the left half of the abdomen. The liver could not be felt in the middle line. In the nipple line an ovoid, somewhat irregular, smooth tumour could be felt. The fingers could be placed beneath it and the under surface was distinctly irregular. In January the ascites came and increased rapidly, so that he had to be tapped. On February 15 he had bleeding from the gums; on February 23 a severe attack of vomiting of blood. The anæmia then became pronounced, the red blood corpuscles falling below 2,000,000, the ascites recurred, and he had to be tapped several times. On March 11 he had several large bloody stools. On March 12 he vomited twice in large amounts, the spleen became much reduced in size. There was a slight rise in temperature, and during the day he had to be tapped frequently. On February 24 he again had vomiting of blood, and he died on the night of February 27. The Wassermann reaction was negative.

The post-mortem, by Dr. A. G. Gibson, showed (1) the usual features of anæmia; (2) œsophageal varices, from one of which the bleeding had come; (3) a greatly enlarged spleen; and (4) a syphilitic liver, which presented very remarkable features. The left lobe was reduced to a thin flat band; the right lobe was reduced in size, much scarred, fissured, and cirrhotic, with many coarse bands dividing islands of greyish-yellow liver substance. The most interesting feature was the oval mass which was felt during life, as it was attached to the anterior portion of the right lobe, the capsule somewhat thickened; in section the surface was smooth and of a normal, red-brown colour, without a trace of cirrhosis, but there were several small gummata, from about 3 to 4 mm. in diameter. This was really the only normal portion of the organ.

The point which I wish to emphasize in this paper is that syphilis of the liver may present a picture clearly resembling Banti's disease, the splenomegaly, anæmia and hæmatemesis completely overshadowing the hepatic features. The spleen has been removed as in the case of splenic anæmia reported by Dr. S. Coupland.[1] Splenectomy was performed by Mr. Pearce Gould. Two year later the patient died with melæna, hæmatemesis and ascites. The post-mortem showed typically scarred syphilitic liver, with varicose veins in œsophagus and rectum.

[1] *Brit. Med. Journ.*, 1886, i, p. 1445.

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SPECIALISM IN THE GENERAL HOSPITAL.

By SIR WILLIAM OSLER, Bart.,

Regius Professor of Medicine, Oxford; Honorary Professor of Medicine, The Johns Hopkins University.

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SPECIALISM IN THE GENERAL HOSPITAL.*

By SIR WILLIAM OSLER, Bart.,
Regius Professor of Medicine, Oxford; Honorary Professor of Medicine, The Johns Hopkins University.

It is not easy to put in words my appreciation of the honor of delivering one of the formal addresses at the opening of this institute or to express my gratification at the inauguration of this new development in the Johns Hopkins Medical School. The pleasure is heightened by the thought that the generosity of an old and valued friend has made to-day possible. This hospital has already experienced the wise liberality of Mr. Henry Phipps, one of whose tuberculosis foundations, under its management, ranks as a model of its kind.

That, after nearly a quarter of a century, all those professionally concerned in the early working of the hospital are here to take part in this ceremony, is, for us at least, a happy circumstance. One man I should like to have seen with us, Francis T. King, the first president of the hospital, whose devotion to its interest and whose faith in its future were the stay and support of his declining years. Three of those closely connected with the early organization have passed away. Dr. John S. Billings was, from the first, the adviser of the board of trustees, the real designer of the hospital, and the friend to whom we all turned for advice. I know with what satisfaction he looked back on this part of a life great in achievements for the public and the profession.

No one of all that fine band of men with whom we were associated, Judge Dobbin, Judge Gwinn, Mr. Francis White, Mr. Lewis Hopkins, Mr. W. T. Dixon, Mr. G. W. Corner, Dr. Cary Thomas, Dr. Alan Smith, Judge Brown, Mr. James Cary, Mr. Joseph Elliott, Mr. C. Morton Stewart, would have appreciated to-day more keenly than Daniel C. Gilman, whose work in connection with the opening of the hospital must never be forgotten. He was a man with rare vision and one also who could drive the

* Address delivered at the opening exercises of the Henry Phipps Psychiatric Clinic, The Johns Hopkins Hospital, Baltimore, Md., April 16-18, 1913.

straight furrow, as the people of this state—of the country at large—well know. And how Isabel Hampton would have rejoiced to see this day—with its great opportunity to develop the special work so dear to her heart. How full of gratitude must be our first director, Dr. Hurd, to see the fruition of many years of strenuous, hopeful toil!

In 1889 this institution seemed to many the last word in hospital construction, and those of us who were fortunate enough to take charge of the departments felt that here was something to be lived up to, something in which our dreams could be realized. Only when in working order did we feel its incompleteness. We had no medical school, a big gap quickly filled by the generosity of Miss Garrett and her friends. Year by year saw new departments added, new lecture rooms, operating rooms, laboratories, additions to the out-patient departments, to the Nurses' Home, and, by Mr. Marburg to the private wards; and hand in hand, an internal growth in efficiency, and an ever-widening sphere of influence, educational and philanthropic. Our ambition was to do for medicine what Mr. Gilman and his faculties of the university were doing in art and science, and at a pace hard to follow. The race was not an easy one, but fortunately there were close bonds between the two training stables, and we had the advantage of the prestige of their 13 years of brilliant success.

Only a few impressions of life endure. We use the same cylinders over and over again, the dots and markings become confused, and when we call for a record, a jumbled medley is poured out, a confused message from the past. But certain records are time-fast, and bite in such a way that no subsequent impressions can blur the clearness, and the story comes out fresh and sharp. So it is when I call up those early years so full of happiness, so full of hope. And to have seen in so many ways the fulfillment of our heart's desire is more than we could have expected, more indeed than we deserved.

I am sorry for you young men of this generation. You will do great things, you will have great victories, and, standing on our shoulders you will see far, but you can never have our sensations. To have lived through a revolution, to have seen a new birth of science, a new dispensation of health, reorganized medical schools, remodeled hospitals, a new outlook for humanity, is not given to every generation.

By temperament a dreamer, wherever I have worked, visions of the future have beset me, sometimes to my comfort, more often to my despair. In desolate days I have wandered with Don Quixote, tilting at windmills; in happier ones I have had the rare good fortune to dream dreams through the gate of horn, and to see their realization, to have both the vision from Pisgah and the crossing the Jordan. I have seen the school in which I began in Toronto, in an old building, dirty beyond belief, transformed into one of the most flourishing on the continent, a staff of seven teachers increased sevenfold; my alma mater, McGill, prosperous even then in men of mettle, but housed in wretched quarters, now in palatial buildings, and in affiliation with two of the best equipped of modern hospitals. How paltry were my aspirations of those days! How insignificant do they seem. My feelings when Sir Donald Smith, now Lord Strathcona, gave us the first endowment of $50,000, could not be stirred to the same intensity to-day by less than a million! Nearly 30 years have passed since I joined the University of Pennsylvania, the premier school of the country. There were new buildings, and a new hospital grouped about a single arts building. But what a transformation since! Whole squares of West Philadelphia annexed and covered with laboratories, dormitories and lecture halls and largely due to the magic energy of a prince of dreamers, William Pepper.

It has been my lot to see others do what I should have liked to do myself, and to feel that it has been better done! Looking back over a somewhat vagrant career, my fission from an academic body has always been a stimulus, and has invariably quickened the pace of progress. And this thought was a consolation when I left this comfortable billet, a few years ago. Among the scanty seeds scattered in my peaceful valedictory only those in which I ventured into the dangerous region of prophecy appear to have fallen on good ground.

I spoke of the needs of special departments—hoping that within 25 years we should have a psychiatric institute, a children's hospital, a genito-urinary clinic and a special building for diseases of the eye, ear and throat. Two of these are already accomplished facts—the Harriet Lane Johnston Children's Department has been opened; to-day we open the Phipps Psychiatric Institute, and for the new genito-urinary clinic, that money has been furnished through the liberality of Mr. James Buchanan Brady. Others will follow rapidly, and it is safe to say that within a dozen years there will be as many special departments, semi-independent units in a great organization. The occasion seems fitted for the expression of a few thoughts on specialism in the general hospital.

The work of the units is identical; each a place where rich and poor receive the best skilled help that the profession can command; each a place where students are taught; each a center of study and research. Let us consider briefly these three functions. Similar in diversity, each unit in organization, in aims, and in methods, is a replica of the other. Each represents a technical school linked to the university by the medical faculty of which, by Mr. Hopkins' will, this hospital was to form a part. They differ from the more purely scientific departments of the medical school in one important particular. The hospital units mint, for current use in the community, the gold wrought by the miners of science. This is their first function.

A mother to-day brings her child to Dr. Harry Thomas, at the neurological department, a poor dwarfed, idiotic creature, but all the same very dear to her heart. It is a far cry from the little laboratory where Schiff made his immortal experiments, and literally thousands of workers in the mines of science have slaved years to find the pure gold, handed out freely from this hospital to that poor woman, with which salvation was wrought for her poor child. It seems so easy now. "Ah, a cretin. How interesting! How old do you say? Eight? Why, she looks three. All right, do not worry, the child will get well quick; get these powders. Yes, three times a day!"

An anxious mother, whose son goes to Manila next week, brings him to Dr. Barker in the private ward for an anti-typhoid inoculation. Again a far cry from Zurich, where Klebs—so often a pioneer—first saw the typhoid bacillus. Again, a host of miners and a vast store of gold—golden knowledge, with which, would they but use it, people of the country could redeem from certain death thousands of their sons and daughters.

The two incidents I have mentioned illustrate what is going on in every unit of a hospital to-day. Take another—that street brawl last night. "Yes, he was shot through the abdomen." "A dozen wounds in the bowels, you say? Hum! What a job! Must have taken you a long time—doing well, of course." "Oh, yes, we got him early—they all do well now!" Who would have believed such a story in my student days? Again, the pure gold dug out by the elder Gross, Lister, Halsted and thousands of miners, minted in the laboratories and handed out, Mr. President, to the public last night by your surgeons.

We sit over the fire in the evening and pile on the coal without a thought of the dark and dangerous lives of the poor miners who risk so much for so little. It distresses my soul to think that we have done so little for the miners of science, and it does not lessen my distress to know that very often they do not give a thought to us. That coal put on the grate last evening—do you think the Hungarian in West Virginia thought how comfortable you would be over the fire? No! Nor did Schiff realize that his work would be utilized to brighten the hopes of thousands of mothers or that he was following a lode richer for humanity than the Golden Fleece. Only a cold-hearted, apathetic, phlegmatic, batrachian, white-livered generation, with blood congealed in the cold storage of commercialism, could not recognize the enormous debt which we owe to these self-sacrificing miners of science; and yet there are to-day sons of Belial, brothers of Schimei, daughters of Jezebel, direct descendants of the Scribes, Pharisees and hypocrites in the time of Christ, who malign these prophets and wise men, winners in a fight for humanity unparalleled in the annals of the race.

The perfect physical form in man or woman is much more sought than found. The perfect mental form is even more rare. The best to hope for in the average man, from nature and nurture, is to have a right judgment in all things. In how few of us is this consummation reached! One philosopher made the comforting remark that "Every man has a sane spot somewhere." Burton, in hs survey of humanity in the famous *Anatomy of Melancholy,* concludes that the whole world is mad, and needs a journey to Anticyra (where the best hellebore, a specific against madness, was grown).

There should be, Mr. President, no lack of candidates for help from the unit we open to-day. Many a man goes to his physician now for an overhauling of his machinery. I found a big West Virginian in the private ward one morning. The history was colorless. I went over him thoroughly. "There is nothing the matter with you," I said. "I did not say there was," came the reply, "that is what I wanted to know."

We are all a bit sensitive on the subject of our mental health, but a yearly stocktaking of psychic and moral states, under the skilled supervision of Professor Meyer, would be most helpful to most of us.

Mr. J. A. A tendency to irritability of temper.

Mrs. R . Too much given to introspection.

Miss B. Over-anxious about her soul.

Master G. Worried by a neurasthenic mother.

These would be some of the headings in the diagnosis slips. But the Institute will have enough to do—meeting a demand for the early treatment of borderland and acute cases.

The progress in the rational treatment of insanity is a bright chapter in the history of the past century. The story recently told by Dr. Hurd, of the changes in this country within forty years, is full of encouragement. The larger staff, the skilled assistants, the scientific study of the cases has become a rule and this community has had the benefit of the up-to-date methods of the Sheppard-Pratt Hospital, and has seen with pride the rapid development of the work of the state institutions. New methods of treatment will be tested, every advance in technique controlled, and to new theories will be applied the touchstone of science. A wide diffusion of its benefits should take place through the nurses who will pass through the institute. The discreet, even-balanced, thoroughly-trained mental nurse will be a great boon in general practice, and she will have a sociological value amid the widespread activities that have been aroused in connection with mental hygiene.

That the medical student is an essential factor in the life of a great general hospital, has been of slow recognition in this country. Admitted to the dispensaries, welcomed in the amphitheater, he has been, until recently, rigidly excluded from the wards, except as a casual attendant on ward classes. I am glad to say that from the day he leaves the medical school laboratories, he is in this hospital a co-worker with doctors and nurses, in every one of its activities, and as his right, not as a privilege grudgingly granted by the trustees.

And so it should be in all general hospitals. Every unit must be so organized as to make him fit in as part of its machinery. It is his business to know disease, and for the sake of the public, every possible opportunity should be given to him. I would even throw open the private wards, that the clinical clerks and surgical dressers might see the vagaries of sick life in all classes of society. In the palmy days of Rome, the physician was followed to the houses of the wealthy by his pupils—a practice we could emulate in our private wards—limiting, of course, the numbers, and selecting the cases.

But with the medical student there is a real difficulty, expressed 25 centuries ago by the Father of Medicine, in the famous aphorism "Life is short; the art is long." The stay of the medical student in the hospital is so brief, the amount to be learned so vast, that we can only hope to give him two things—method (technique) and such elementary knowledge as how to examine patients, the life history of a few great diseases and the great principles of surgical practice. He cannot be expected in the short period of the curriculum to go the circle of the units, spending time enough in each to master the chief details of a dozen specialties.

In most schools, a system of elective studies has been arranged to meet this really pressing and serious condition, which has grown in acuteness with the multiplication of the specialties. How can an institute like this touch the medical curriculum? At many points, directly and indirectly. The very existence in a general hospital indicates the recognition of psychiatry as part of its legitimate work. One of the tragedies of the subject has been a dissociation from centers of active professional and university life. A department of medicine, with the closest affiliation with the life of the community, has been segregated and stamped with a taboo of a peculiarly offensive character. Here it will take its proper place—a unit in the work of the medical school of a university.

This, in itself, will be a lesson to the student. A new atmosphere will be diffused, a new group of energies and activities will come into the hospital, which cannot but be helpful. The director, his staff, and the nurses will play a new rôle, which will greatly enhance the reputation of the old company. Living as he does in such close fellowship with the staff of the hospital, the medical student will be influenced in this way by the very presence of the institute.

It is to be hoped too, time may be found for general instruction of the senior class in the elements of neuro-psychology, and with the elective system, an active group of students be found to whom this study will appeal strongly. But after all as practical men, we have to face the Hippocratic aphorism—the art is getting longer and longer, the brain of the medical student, not getting bigger and bigger, has its limits; and though keener and more industrious than ever in history, the time is too short for a man already burdened to the breaking point, to study any specialty from the standpoint of the specialist.

To a large outside body, this institute should cater with extraordinary benefit. There must be a thousand or more assistants in the asylums of the country, whose pineal glands are not yet crystalized, and who should find here inspiration and help. Amid isolated and depressing surroundings, these men do yeomen work in the profession. From the director and his staff, they will receive that warm and encouraging sympathy, the very leaven of life, a quality which has been the inspiration of the benefactions of the founder of this institute. And I hope room and plenty of it will be found for the general practitioner, through whom more than any other group, the benefits of this institute may be distributed. He needs enlightenment, instruction and encouragement—enlightenment as to the vast importance of early deviations from normal mental states, instruction in new methods of diagnosis, and treatment and encouragement to feel that in the great fight for sanity in the community he is the man behind the guns.

A larger outlook is connected with the third function of a hospital unit. The old Greek, with his quick sense of helpfulness, always asked about a work: "Does it make life a better thing?" and Prof. Gilbert Murray remarks that one who wished to give the greatest praise to the Athenians said, "They strove to make gentle the life of the world." The American, the modern Greek—mentally if not orally—always asks the same practical questions; sometimes, in the case of pure science, when it is both foolish and fruitless. But he may ask legitimately how such an institute as this may be helpful in studying lapses and freaks of the human mind—I cannot give the answer. "It is not in the book I learned out of" as the children say. I could tell you in internal medicine, and could refer you to the long list of studies in dysentery, malaria, typhoid fever, pneumonia, heart diseases and blood diseases that have come from the medical unit. But a psychopathic unit is a novelty in a general hospital, designed for the study as well as for the cure of mental aberrations.

We talk a great deal about the human mind, and, when cornered, quote Hamlet to cover an unpleasant ignorance of its true nature. The modern student, like the ancient, takes his stand either with Plato and compares the mind and brain to a player with his musical instrument, or with Lucretius to a musical box wound up for so many years to play so many tunes. Authorities lean to one or other of these views, and I have a shrewd suspicion that some of our distinguished visitors, great representatives in this specialty, do not see eye to eye in this matter. Three things we do know, departures from normal states are extraordinarily common—they are the most distressing of all human ills—they should be studied systematically by experts, with a view to their prevention and cure.

When Dean Swift left the little wealth he had to found a house for fools and mad, he could not forego the pleasure of adding the satiric touch: "No nation needed it so much." This idea was not, I am sure, in the large heart of Mr. Phipps; but a wide-spread feeling has arisen in this country that the hygiene of the mind is just as important as the hygiene of the body—that we must return to the Greek ideal of the fair mind in the fair body. How beautifully Plato visualizes the day (in a passage I am never tired of quoting)—"When our youth will dwell in a land of health amid fair sights and sounds and receive good in everything; and beauty, the effluence of fair works, shall flow into the eye and ear like a health-giving breeze from a purer region, and insensibly draw the soul from earliest years into likeness and sympathy with the beauty of reason." (Republic, Bk. II.)

What a revelation of an awakening in the community that it was possible to organize such a Congress of Mental Hygiene as was held here a few months ago under the auspices of the Medical-Chirurgical Faculty! The program itself was an inspiration. In this country, to recognize a wide-spread need is to meet it; and such gatherings held under auspices of the National Committee will go far to lessen the sad prevalence of early nervous breakdown.

What a philosopher said of the Melissians may be said of many people—they are not fools, but they do just the things that fools do, in the matter of training the young. Unfortunately, we cannot pick our parents, and still, as of old, our hearts give our hands, regardless of our heads. Dr. Mott will tell a tragic tale of heredity in relation to insanity. I am afraid several generations must pass before we see any practical results of the present active eugenic crusade, but there is an immense and hopeful work to be done in educating parents in training-stable methods. An Ethiopian cannot change his skin, but a queen bee results from a change of diet. This institute, I am sure, will play its part in this national campaign of prevention of mental ill health through education—a campaign as important to the public, and just as worthy of support as the great struggles against tuberculosis and infant mortality.

It will be helpful too, to study in a sane, sober and sympathetic way, epidemics of mental, moral and even economic folly as they sweep over the country. The present opportunity should not be missed. With causes just as definite as small-pox or yellow-fever, they never occur under exactly the same conditions, but all have their basis in, and are mere specks upon, that fine old humanity that is ever fighting its way towards the light.

The present out-break has not been equaled since the capture of the Roman world by Oriental cults. The same old-fashioned credulity exists that enabled Mithras and Isis, Apolonius and Alexander to flourish then as the new cults do to-day—and for the same good reason. There is still potency in the protoplasm out of which arose in primitive man, magic, religion and medicine. Circe and Æsculapius were probably twins! Historically our fringe of civilization is of yesterday, if we compare the six or seven thousand years of its record with the millions which must have passed since man assumed his present form on the earth. In this vast perspective Aristotle and Darwin are fellow-students; Hippocrates and Virchow are contemporaries.

Primitive views still prevail everywhere of man's relation to the world and to the uncharted region about him. So recent is the control of the forces of nature that even in the most civilized countries man has not yet adjusted himself to the new conditions, and stands, only half awake, rubbing his eyes, outside of Eden. Still in the thaumaturgic state of mental development, ninety-nine per cent of our fellow creatures, when in trouble, sorrow or sickness, trust to charms, incantations and to the saints. Many a shrine has more followers than Pasteur; many a saint more believers than Lister. Less than 20 years have passed since the last witch was burned in the British Isles!

Mentally the race is still in leading strings, and it has only been in the last brief epoch of its history that Esop and Lewis Carroll have spun yarns for its delight, and Lucian and Voltaire have chastised its follies. In the childhood of the world we cannot expect people yet to put away childish things. These, Mr. President, are some of the hopes which fill our hearts as we think of the future of this new department.

One word of appeal to the units. Members of a corporate body, successful life will depend upon the permeation by harmonics which correlate and control the functions. Isolation means organic inadequacy—each must work in sympathy and in union with the other and all for the benefit of the community—all toward what Bacon calls the lawful goal of the sciences, that human life be endowed with new discoveries and power.

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An Introductory Address

ON

EXAMINATIONS, EXAMINERS, AND EXAMINEES

Delivered at the Opening of the Winter Session at St. George's Hospital Medical School on October 1, 1913

BY

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An Introductory Address

ON

EXAMINATIONS, EXAMINERS, AND EXAMINEES.

GENTLEMEN,—In every department of human knowledge men are asking guidance in the solution of a world-old problem—how to train the mind and heart and hands of the young. The past and the present are in the melting pot—the moulds are ready, and all await with eagerness the result of the casting, and none with greater eagerness than our own profession. For we are in a quandary. Naturally conservative, we are bewildered by the rapidity of a forced progress and change. There is a new outlook in every department—not alone in the fundamentals of science and in methods of practice, but in the relations of the profession to the public and to the State. The actual care of the sick, once our sole duty, is now supplemented by such a host of other activities, social, scientific, and administrative, that an ever-increasing number of our members have nothing to do with patients as such. But the chief difficulty is the extraordinary development in every subject of the curriculum—a new anatomy, a new physiology, a new pathology, new methods of practice, to say nothing of phenomenal changes in physics, chemistry, and biology. Everywhere increased complexity and mind-burdening terminology. What is the teacher to do? And more important, What can the poor student do, confronted with so much new knowledge and a Rabelaisian onomatomania? How simple was a cell in the days of Schwann and of Schultze—nucleus, nucleolus, protoplasm, and cell membrane; to-day in one of the very briefest of recent descriptions I counted 40 new names, not one apparently superfluous. Turn to the index of a new treatise in embryology, to a work on immunity, or to a text-book on neurology, and you will appreciate the extraordinary complexity of the diet of the modern student. Even the titles of the journals startle, and to read intelligently an article in the *Zeitschrift für Chemotherapie* or in the new archives dealing with immunity and metabolism requires a special education.

The truth is, we have outrun an educational system framed in simpler days and for simpler conditions. The pressure comes hard enough upon the teacher, but far harder upon the taught, who suffer in a hundred different ways. To help you to realise this pressure and to suggest measures of relief are the objects of this address.

Examinations and their Relations to Education.

What a student knows and what he can do—these are judged by examinations, oral, written, and practical. Tests of progress, tests on behalf of the public of fitness to follow certain callings, they have always loomed large in educational systems. At the best means to an end, at the worst the end itself, they may be the best part of an education or the worst—they may be its very essence or its ruin. Helpful if an integral part of the training, they may, and do, prove the intellectual ruin of many good men. Long practice as an examiner—year by year since 1875—in many subjects, in many methods, and in many places, an intimate relation with a large body of students, and a keen interest in medical education give me the assurance, if not of wisdom, at least of experience. Moreover, at the old universities survives a mediæval tradition of the omniscience of the professor, and with my brother Regius of Cambridge I enjoy the rare privilege of examining in every subject in the curriculum, from organic chemistry to obstetrics, a privilege with this advantage—it enables me to see the work of many examiners.

Regarding examinations, I have one question to ask—Are they in touch with our system of education? and one suggesto make—That from the day he enters the school, in laboratory, class-room, and wards, the work of the student should count, and count largely, in the final estimate of his fitness.

The Influence of Examinations on Medical Education.

Apart from a general feeling of dissatisfaction with the present system, two things strongly suggest a negative answer to the first question. As a discipline of mind and memory examinations play a leading part in all educational schemes. How they may finally control and sterilise the mind of a nation may be read in the story of China. For this has come about, not from lack of brains, not from any failure to appreciate the value of learning, not from any defect in the system itself, which is more rigid and exacting than anything in Western life, but from the blighting influence of an education directed to a single end, the passing of examinations. To test an education by its practical results at the table is to sin against the spirit of the Greeks, who first taught the fundamental lesson that the pursuit of knowledge to be productive must be disinterested. Nothing is more fatal to a true intellectual training than a constant preoccupation with its practical results. To be of any value an education should prepare for life's work. To train the senses for observation and the mind for reasoning, and to acquire a knowledge of the human machine and its disorders, a man spends five or more years at a medical school. Given a knowledge of the sciences on which it is based there is no more fascinating study, since medicine is the only one of the great professions engaging equally head and heart and hand. In its subject matter there is everything in its favour, and it is the easiest possible thing to carry out John Locke's primary canon in education—arouse an interest. With our present methods there is scarcely a subject which cannot be taught easily, and so many of them are practical, manipulative, and not at all difficult to acquire. To an inquisitive mind the study of medicine may become an absorbing passion full of fascinating problems, so many of which present a deep human interest. In the long category of man's conquests none are more brilliant than those with which a teacher of medicine can inspire his class. It is hard indeed to name a dry subject in the curriculum. And yet in an audience of medical students such a statement nowadays raises a smile. Why? Because we make the examination the end of education, not an accessory in its acquisition. The student is given early the impression that he is in the school to pass certain examinations, and I am afraid the society in which he moves grinds this impression into his soul. Ask *at* what he is working, and the student will answer *for* his first M.B. or his final. The atmosphere is Chinese, not Greek, and too often the one aim is to get through. We have become quite shameless about it, and practically admit a failure in our teaching when we advertise special tutorial classes for the different examinations, and consign a large proportion of our pupils to the tender care of "grinders"—and to no purpose! The spirit is taken out of instruction, and teacher and taught alike go down into the valley of Ezekiel—where they stay among the dry bones.

The Number of Rejections.

And a second circumstance proclaims loudly how out of touch are our tests with our teaching. The qualifying examinations of this country are well organised and admirably conducted, and, speaking by the book, I may say that nowhere is the knowledge that a man can use so freely tested in the laboratory and at the bedside. And it has been so for several generations, yet year by year the General Medical Council issues a report that gives any teacher food for serious thought, as it demonstrates, beyond peradventure, how completely out of touch he or the student, or both, has got with the examiner. A medical school is a human factory, turning out doctors as the finished product at the end of five years of careful preparation and fitting of the mental machinery. Failure is incidental to every human effort, and even the Rolls-Royce Company turns out cars from their shops that fail in the tests, but not many. But from our shops, after five long years or even more, we send our medical motors to be tested for the road by the official experts, and nearly one-half are declared to be defective and sent back to the shops. Use and Wont, those "grey sisters," have so dulled the edge of this bitter experience that we have become accustomed to conditions nearly insupportable. Year by year for a generation the returns in the two great final subjects, the most attractive and the easiest to teach, show from 35 to 45 per cent. of rejections.

To the question much thoughtful attention has been given, and in the General Medical Council so far back as 1896 Mr. Pridgin Teale introduced a motion with the following preamble: "That the present system of accumulated examinations and the enormous increase in the number of rejections resulting from it are not only unjust to the student but damaging to medical education." Mr. Teale pleaded wisely and forcibly for a reduction of the examinations and for the substitution in certain subjects of certificates from the teachers and class examinations.

The Council reports show that the percentage of rejections at the final examinations has progressively risen from 12·4 in 1861 to 22·2 in 1876, to 34·8 in 1886, and to 41·9 in 1895. Mr. Teale, who quotes these figures, remarked that with the multiplication of examinations the more fatal do they become. The figures for the five years 1908 to 1912 show a continuation of the upward movement. Take the great final subjects, medicine and surgery, at the three Boards before which we may say the average student presents himself. I will put the collected figures as concisely as possible. The English Board: medicine—passed 1842, rejected 1135, percentage 38·12; surgery—passed 1821, rejected 1506, percentage 45·23. Scotland: medicine—passed 489 rejected 653, percentage 57·18; surgery—passed 492, rejected 731, percentage 59·77. Ireland: medicine—passed 322, rejected 231, percentage 41·77; surgery—passed 326, rejected 239, percentage 42·30. In the five years a total of 4572 students were examined at the Conjoint Boards of the three kingdoms in medicine, of whom 2019 were rejected, a percentage of 44·16. Of 5105 examined in surgery 2475 were rejected, a percentage of 48·43 Take for comparison the three universities—Edinburgh, Oxford, and Cambridge—for the five years ending 1912. At the Scotch capital there were 985 examined in medicine, of whom 267 were rejected, 27·10 per cent.; in surgery 974, of whom 317 were rejected, 31·52 per cent. In Oxford, where the three final subjects are taken together, it is impossible to say upon which subject a man came down, but in the final examination of 135 candidates 47 were rejected, a percentage of 34·81. At Cambridge during the five years, in medicine of a total number 519, 365 passed and 154 were rejected, a percentage of 29·67; and in surgery of a total 603, 233 were rejected, a percentage of 38·64.

There is not so much difference, you notice, between what may be called the pass men of the Conjoint Boards and the men entering the universities, and I do not believe there is any special difference in stringency between the Oxford and Cambridge examinations and those of the London Conjoint Board. There are two other examinations which the élite of the student body affect. How do they stand? All regret that in London only the select and the elect attempt to get the degree of their own University. And it is difficult! Twice in the past five years more students have failed than have passed the final subjects for the M.B. The total figures for the period are: of 1061 candidates examined 481 were rejected, a percentage of 41·01. And, lastly, to one other qualification, greatly prized, sought only by the very best men, the Olympic athletes of their classes, I will refer—the F.R.C.S. Eng. Consider, please, how carefully this group is trained—only the very best venture to compete, and they have a diet of which the intellectual calories are gauged with surpassing accuracy. There is no doubt they are our very best, the picked steeple-chasers of our stables. How do they fare? I am almost ashamed to read the figures. Your ears have tingled already, but only those hardened by familiarity will not be shocked at the demonstration of such a chasm between education and examination. Of 1186 men who have tried for the primary Fellowship examination of the Royal College of Surgeons during the past five years 821 were rejected, 69·45 per cent. Of 680 men at the final Fellowship examination 294 were rejected, 43·23 per cent. The high-water mark of examination futility was reached in May, 1912, when of 118 candidates for the primary Fellowship only 31 were approved. These are picked men, our very best students, the most carefully prepared, who rarely attempt the trial without months of extra study and attendance upon grinding classes. Of the ploughed I have known personally, many seem to have been over-trained, others had spent their time in unprofitable original research; but all, passed and plucked alike, I maintain, are of the highest type of our students, whose calamities proclaim to the world the breakdown of our present educational system.

The failure is general all along the line and in all grades—at the licensing boards, at the older Universities of Oxford and Cambridge, at Dublin and Edinburgh, at South Kensington, and at Lincoln's Inn-fields; with singular uniformity all tell the same tale. There have been uneasiness and talk, but too much self-satisfied indifference, and even after the famous rout for the primary Fellowship in May last year I am told that satisfaction was expressed with the scope and method of the examination! Satisfactory to the examiners, perhaps, though I doubt it; but most unsatisfactory to the teachers, most painful to the students, and by no means a pleasure to the public as represented by the parents.

How May Relief be Obtained?

I venture to offer a few suggestions. First, by simplifying the curriculum to give the students more time. Allow the teachers a free hand in the matter of systematic lectures. Let them be reduced to a minimum or abolished altogether. One advantage they have—subjects may be dealt with which cannot possibly be illustrated in the wards. But such may be better presented in the "seminar" form, the senior students arranging the subjects among themselves under a skilled assistant. London students still have too many lectures in medicine and surgery to attend; Scotch students many more. I do not speak without experience when I say that the subject of medicine, for example, may be taught without the set lecture. The lecture has its value, a precious one from some lips—a Watson's or a Trousseau's; but its day has gone, to give place to other methods better adapted to modern conditions. Think of the saving of time if the lecture list was snipped in half, or if the lecture was limited to a few subjects, such as physiology and pathology, and if it were an offence for a senior student to be seen in a lecture-room!

Then let us boldly acknowledge the futility of attempting to teach all to all students. Burn the anatomical fetish to which we have sacrificed long enough, and to our great detriment. Just glance at "Cunningham's Anatomy"—1465 pages, many in small type, not one of which is without a water-jump for the first Grand National of the medical student. It is barbaric cruelty with so much ahead to burden the mind with minutiæ which have only a Chinese value—a titanic test of memory. To schedule a minimum of the essentials should not be difficult, once the great principle is acknowledged that in all departments of the curriculum only a few subjects can be mastered thoroughly. I am afraid the secret of the tragic tale I have related lies in a quotation which Socrates made to Alcibiades:

> Full many a thing he knew,
> But knew them all badly.

I acknowledge the difficulty of defining in different subjects a minimum of the essential, but it is not insuperable, and such schedules are issued in some universities.

Secondly, relief may be obtained by giving credit for work done throughout the course, changing the present system of "signing up" for one of reports by demonstrators and assistants on the character of the work done by each student. Let all who teach examine. Let education and examination go hand in hand. Let the day's work tell from the moment a student enters the school. Everyone from the junior demonstrator who supervises the student's first dissection to the professor—all should weigh while teaching. Day by day as I see John Smith in the wards, and read his notes, and watch his clinical work and discuss the features of the patients, or as he narrates his case to the class about the bed and he and I have a Socratic dialogue, instruction and examination go hand in hand, and in such a way that at the end the formal tests should be but an amplification, an extension, and an inclusion of the scores of examinations which have been part of the routine of his life. Perhaps at present Utopian, this plan will be feasible in a new and reorganised generation ; indeed, it is feasible now in self-contained universities. Once accept the principle that instruction and examination should go hand in hand and the difficulty is solved. The returns are automatically passed on to the head of the department. Yes, but someone will say, "Take the judgment of a group of young teachers? It is absurd!" Not a bit. They see more of the students, come into closer contact, and are better able to judge of the quality of their work than the professor, and much more than any outside examiner. According to the character of his work a student should acquire much or little merit, and should be able to take to the examination table enough to pass, or at any rate to make the final test in any subject *pro forma*. Where the classes are small, as in many of the provincial universities, this plan could be easily worked. I have had practical experience of it and came to the conclusion early that the judgment of the man who was fit to teach could be taken in estimating the progress of the student's education. And the system is being adopted. A few months ago I went into the beautiful clinical and pathological laboratory of the new Toronto General Hospital, and in one room I found an examination in pathology going on. The candidate had a set of cards in his hands, on each of which were written the details of the post-mortem examination he had made with a careful discussion of the case. Pass or pluck really depended on the cards a man held. He brought his marks with him—instruction and examination had gone hand in hand. I was delighted to hear from Professor MacKenzie that the system, introduced at McGill by my pupil and successor, the late much lamented Wyatt Johnston, had proved very successful in both Canadian schools.

Thirdly, simplify the examinations. Cut off some of the written papers. In the final subjects the long report on cases, the bedside *viva*, supplemented if need be by a special "oral," will give examiners the necessary knowledge of a candidate's mental outlook. If they will consider, not how much he knows, but how he knows what he knows, the long "written" is superfluous. As one watches a man handle a patient it is easy to tell whether or not he has had a proper training, and for this purpose 15 minutes at the bedside are worth three hours at the desk. We must substitute for the quantitative estimate the qualitative, and judge the student as much by manner as by matter.

Fourthly, when possible, evidence of original work should be substituted for examination. Think of the stimulus to British surgery if, in place of the Egyptian tyranny to which our best students now slavishly bow, the President and Council of the Royal College of Surgeons selected for the Fellowship each year the 15 or 20 of the men under 30 who had distinguished themselves most highly in surgical research. It would change the mental attitude of the younger generation, instil the spirit of Hunter into its members, and prevent the paralysing mental sterility that overtakes many good men who now spend precious plastic years in the dry drudgery of examination details.

Fifthly, compel no student to pass an examination twice in the same subject. At present brain and pocket alike suffer, and the burden could be lightened by a free reciprocity between the examining boards.

Examiners and their Duties.

Men are usually very superior to the system in which they work, and so it is with examiners. After what has been said you may be disappointed not to hear a tirade against them; but I have had a singularly happy experience with my fellow inquisitors, whom I have found, as a rule, among "the mildest-mannered men that ever scuttled ships or cut throats." The two extreme types, the metallic and the molluscoid, illustrate inborn defects of character. The aggressive, harsh nature comes out strongly at the table, and the hard face, with its "what-the-devil-do-you-know" expression, sends a chill to the heart of the candidate, and it reaches his bone marrow when the first question relates, perhaps to a serious mistake in his paper. Imagine the mental state of a poor chap greeted with, "What did you mean by saying that the ciliary muscle is supplied by the pneumogastric nerve?" And the worst of it is that the metallic examiner may have no sense whatever of his failings, but is rather apt to pride himself on a keen appreciation of his duties. I remember a hard-faced inquisitor who took, so it seemed, the greatest pleasure in torturing his victims—dwelling with fiendish glee on all the small mistakes he could find, criticising the spelling, and ending on one occasion with the cheerful remark, "Mr. Jones, who taught you to write?" That evening, talking about examinations, I said in a joking way: "Judge Jeffreys, you are a heartless brute; I wonder some student has not assaulted you." He took it very much to heart, and I had a long letter about the great responsibility of the position and the rigid sense of duty he felt towards the University and the public. And the facial expression of the fellow examiner is not without importance, whether sympathetic, neutral, or antagonistic. One co-examiner always had a sardonic expression, a sort of Arian grin, plainly saying, "Well, you are a hopeless idiot!" The examination room may have the atmosphere of a cold storage chamber, and a student knows at once the type of man with whom he has to deal.

At the other extremity is the invertebrate examiner, so soft and slushy that he has not the heart to reject a man. It is a variety not often met with in this country, but it exists. Sympathy with the student and a strong feeling for his position may completely overmaster the sense of duty to the university and to the public. A former colleague was made unhappy for days if he had to reject a candidate. For some years I sat on an examination board with an elderly professor, a man of great force of character and ability, who never gave a candidate less than 80 per cent. of the possible marks. In the case of the most hopeless duffers with 20, 30, or 40 per cent. in other subjects he would call out "pass." He was a great grief to me, as well as a mystery. At the last meeting which he attended as an examiner he tossed his book to me with a malicious smile. There were 116 candidates, not one of whom he had rejected, and not one of whom had less than 80 per cent.!

Between the metallic and the molluscoid is the large group of sensible examiners who try to put the candidate at his ease and to find out what he knows in a simple, sympathetic manner. But in any case the examiner is apt to take an unfair advantage of his position, and quite unconsciously. A specialist to whom the facts of his subject have become familiar and ingrained is apt to forget the years that have given the facility and the knowledge; and he may wonder when a man hesitates over an Argyll-Robertson pupil or mistakes a pericardial rub for an aortic insufficiency murmur. The most grievous mistake of the examiner is to regard the candidate as his mental equal and to expect from him knowledge of the same quality as that which he possesses, ignoring his long years of study and the short years into which the student has had to cram the knowledge of a dozen subjects.

Examining is often a heart-breaking task, with little to relieve the monotony of the long-drawn papers. It is distressing to meet with abysmal ignorance of elementary facts, and to realise with sorrow how many more minds are constructed as sieves than as sponges. But there are compensations, and who is there among us who does not appreciate Comte's statement that there were few more delightful experiences than the sweet and softened feeling when a young man's examination was thoroughly satisfactory? But it is much nicer to watch the gradual growth of a student's knowledge and to get it out retail day by day than to drag it out wholesale at set times. One thing is certain—the best we have should be devoted to our duties as examiners. Men should give their whole time to the business when at it. Much-engaged men should not be chosen, and to examine in the evening, after a hard day's work, is to handicap the candidates. We shall no doubt come to a time when professional examiners will be appointed by the General Medical Council to act as associates and assessors to the professors. That it is not a task lightly or inadvisedly undertaken the returns I have given indicate only too clearly. Not that we can lay at the doors of the examiners the responsibility for the lamentable state of affairs to which I have referred. No doubt there are unduly severe examinations, and there are examiners with hearts as hard as pieces of the nether millstone, but these are exceptions.

The Examinee and his Position.

When quoting figures I purposely dealt chiefly with the results of the final examinations, and I am sure the feeling uppermost in your minds was one of sympathy with the hundreds of young men who, after five years of hard work, fail in ordinary tests, and this brings us to a brief consideration of the examinee and his position. In two respects he is an unfortunate victim. Of one I have already spoken—the enormous development in the subjects of the curriculum; and here, I am sure, lies his serious difficulty. It is the case of a quart measure and a pint pot. Intellectual dyspepsia from cramming is at the bottom of his trouble. It is like a diet of hot bread, which a man can stand at first, but, as Lowell says in the "Fable for Critics"—

> By gradual steps he
> Is brought to death's door by a mental dyspepsy.

Another cause of the widespread rejections is defective preliminary education; but let me emphasise the fact that the percentages of rejections are nowhere higher than among the very best students—e.g., Cambridge men, among whom in some subjects more than 50 per cent. are rejected. I do not deny that much could be done to relieve the present stasis if all medical students began thoroughly trained in physics, chemistry, and biology. In this respect matters are improving year by year. And we should be more honest with the feeble ones, not fitted either by breeding or by pasture to pursue their studies, who should be asked early to withdraw. It is infinitely kinder to stop a man in his career than to allow him to struggle on painfully and submit to the humiliation of half a dozen or more rejections.

The conclusion of the matter is, the student needs more time for quiet study, fewer classes, fewer lectures, and, above all, the incubus of examinations should be lifted from his soul. To replace the Chinese by the Greek spirit would enable him to seek knowledge for itself, without a thought of the end, tested and taught day by day, the pupil and teacher working together on the same lines, only one a little ahead of the other. This is the ideal towards which we should move. The pity of it all is that we should have made an intolerable burden of the study of one of the most attractive of the professions, but the reform is in our own hands and should not be far off. A paragraph in an address of the late Dr. Stokes contains the pith of my remarks: "Let us emancipate the student, and give him time and opportunity for the cultivation of his mind, so that in his pupilage he shall not be a puppet in the hands of others, but rather a self-relying and reflecting being."

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THE MEDICAL CLINIC:

A RETROSPECT AND A FORECAST.

An Address

DELIVERED BEFORE THE ABERNETHIAN SOCIETY, ST. BARTHOLOMEW'S HOSPITAL, LONDON, DECEMBER 4TH, 1913.

BY

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ON

THE MEDICAL CLINIC:

A RETROSPECT AND A FORECAST.

UNREST and change are the order of the day, and it may be taken as a good sign that the medical profession is bestirring itself about many problems, one of the most important of which relates to the future of our medical schools. Those who have followed the discussions of the past few years will have noticed that two diametrically opposite opinions have been expressed. On the one hand, there is a group thoroughly satisfied with existing conditions—and with themselves—the teaching was never better, the students never more contented, and any change could not but be for the worse. On the other hand, there are those who say that the existing conditions in our large hospitals are inadequate to meet the modern needs of student and of staff, that the teaching is defective, that the rejections at the examinations are shockingly high, that there is inadequate provision for research, and that an entire change is needed in the organization of the clinical departments of our medical schools.

Upon one point all are agreed—that in these islands during the past century an admirable system of teaching medicine and surgery has been evolved. I wish there were time to trace its historical growth; but the practical outcome is that the medical student, in his last years, lives and moves and has his being in the hospital. But with this there has been no internal development of the hospital at all commensurate with the growth of the science of medicine. The century-old custom prevails of a group of physicians and surgeons whose individual "services" are organized neither for teaching nor for research. On the Continent there has grown up a different system. In the medical schools there has gradually been organized separate clinics, each with a head, a graded staff, laboratories, and an organization resembling in every respect that of any other scientific department of the university. The burning question to-day is whether these systems cannot be combined, whether the Continental cannot be safely grafted on the English system. Practically in the large clinics of Paris the two have been combined for more than a century. The medical student is as much at home in the

Paris hospital as he is in the English, but there is not everywhere the complete organization of the German clinics. My address this evening is a small contribution to this problem, as perhaps I am the only English speaking teacher who has combined successfully both systems, and I am going to give you my personal experience. I would not bother any audience with it did I not feel that, at the present moment, it may have a certain value. Montaigne somewhere remarks that to talk about oneself cannot possibly be done without detriment to the person talked about, but you will overlook, I am sure, the necessary personal element in the story.

When I began clinical work in 1870, the Montreal General Hospital was an old coccus- and rat-ridden building, but with two valuable assets for the student—much acute disease and a group of keen teachers. Pneumonia, phthisis, sepsis and dysentery were rife. The "services" were not separated, and a man for three months looked after medical and surgical patients, jumbled together in the same wards. The physic of the men who were really surgeons was better than the surgery of the men who were really physicians, which is the best that can be said of a very bad arrangement. The talk of the teachers was of the Royal Infirmary of Edinburgh, or of Glasgow, of the Meath Hospital, of the Rotunda, and of Bart's, of Guy's, of St. Thomas's; and in a town four-fifths French the lights of Paris medicine burned brightly. Scottish and English methods prevailed, and we had to serve our time as dressers and clerks, and, indeed, in serious cases we very often at night took our share in the nursing. There were four first-rate teachers of medicine on the staff—Howard, Wright, MacCallum and Drake—three of whom had learned at first hand the great language of Graves and of Stokes. The bedside instruction was excellent and the clerking a serious business. I spent the greater part of the summer of 1871 at the hospital, and we had admirable out-patient clinics from Dr. Howard, and a small group worked in the wards under Dr. MacCallum. An excellent plan, copied from an old custom of the *Lancet*, was for the clinical clerk to report the cases of special interest under *Hospital Practice* in the local medical monthly. My first appearance in print is in the *Canadian Medical and Surgical Journal*, reporting cases from Dr. MacCallum's wards. Our teachers were men in whose busy lives in large general practice the hospital work was a pleasant and a profitable incident. A man like Palmer Howard got all that was possible out of the position, working hard at the hospital, studying the literature, writing excellent papers, and teaching with extraordinary care and accuracy; naturally such a man exercised a wide influence, lay and medical. I left the old General Hospital with a good deal of practical experience to my credit and with warm friends among the members of the staff.

In the summer of 1872 after a short *Rundreise*, Dublin Glasgow, and Edinburgh, I settled at the Physiology

Laboratory, University College, with Professor Burdon-Sanderson, where I spent about fifteen months working at histology and physiology. At the hospital across the way I saw in full swing the admirable English system, with the ward work done by the student himself the essential feature. I was not a regular student of the hospital, but through the kind introduction of Dr. Burdon-Sanderson and of Dr. Charlton Bastian, an old family friend, I had many opportunities of seeing Jenner and Wilson Fox, and my notebooks contain many precepts of these model clinicians. From Ringer, Bastian, and Tilbury Fox, I learned, too, how attractive out-patient teaching could be made. Ringer I always felt missed his generation, and suffered from living in advance of it.

The autumn semester of the next year was spent in Berlin, where I had my first introduction to the medical clinic on a large scale. Professor Burdon-Sanderson had given me a letter to Frerichs, who very kindly assigned places in the arena of his clinic to Dr. (afterwards Sir) Stephen Mackenzie, and to Dr. (afterwards Sir) Charles Hutchinson, and myself. To Hoffmann, Riess and Ewald, his assistants, we were under obligation for many attentions. The other clinic of the Charité was in charge of Traube. The experience of the semester was invaluable. Systematically, day by day, the more important cases of the wards were shown, the symptoms, pathology, and treatment discussed at length. To each case a student was called, who was supposed to take charge of the examination and to answer questions. Sometimes this was serious for the student, though very often quite formal. He was supposed to keep himself informed of the progress of his patient day by day. I remember one morning Professor Frerichs called down a student who had had a case the day before, and he asked, "How is your patient this morning, Mr. Schmidt?" To which the reply, "Very well indeed, very well; he is much better than yesterday." To which the professor replied in his slow, quiet way, "Very well indeed; he died this morning; you will see what was the matter shortly."

The wealth of material in each department, the systematic arrangement of the clinic, the graded assistants, all men of experience working at the problems of disease, was a striking contrast to the small hospital service of the London clinician, with his single house-physician and absence of all laboratory accommodation. Traube made a great impression upon me as an ideal physiological clinician, and to the three volumes of his *Gesammelte Beiträge* I still turn for clinical information.

The first five months of 1874 I spent in Vienna attending the clinics of Hebra, Bamberger and Widerhoffer. In Bamberger I found another ideal clinician—accurate, painstaking, devoting the whole morning to his teaching and "rounds."

When I returned to Montreal in September, 1874, the Professor of the Institutes of Medicine had had to retire on account of heart disease, and instead of getting, as I had hoped, a position as his demonstrator, the faculty appointed me lecturer with the ghastly task of delivering four systematic lectures a week for the winter session, from which period dates my ingrained hostility to this type of teaching. Four years in the *post-mortem* room of the general hospital, with clinical work during the small-pox epidemic, seemed to warrant the governors of the general hospital in appointing me, in 1878, full physician, over the heads—it seems scandalous to me now—of the assistant physicians. The day of the election I left (with my friend George Ross) for London to take my Membership of the College of Physicians and to work at clinical medicine. For three months we had a delightful experience. Murchison, whom I had seen before in 1873, was most kind, and I do not think we missed one of his hospital visits. He was a model bedside teacher—so clear in his expositions, so thorough and painstaking with the student. My old friend Luther Holden introduced us to Gee, in whom were combined the spirit of Hippocrates and the method of Sydenham. Fred. Roberts, at University College Hospital, showed us how physical diagnosis could be taught. We rarely missed a visit with Bastian and Ringer, and at Queen Square I began a long friendship with that brilliant ornament of British medicine, Gowers. With my old comrade Stephen Mackenzie we went to Sutton's Sunday morning class at the London—his "Sunday School" as it was called—and we learned to have deep respect for his clinical and pathological skill. I mention these trivial détails to indicate that before beginning work as clinic teacher I had at least seen some of the best men of the day.

In the summer session of 1879 I had my first clinical class. We worked together through Gee's *Auscultation and Percussion*, and in the ward visit, physical diagnosis exercises, and in a clinical microscopy class the greater part of the morning was spent. I came across the other day the clinical notebook I had prepared for the students with a motto from Froude. "The knowledge which a man can use is the only real knowledge, the only knowledge which has life and growth in it, and converts itself into practical power. The rest hangs like dust about the brain, or dries like raindrops off the stones." The next five years passed in teaching physiology and pathology in the winter session and clinical medicine in the summer. In 1884 I spent four months in Germany, chiefly at Leipzig, working at pathology with Weigert, and clinical medicine with Wagner, a model teacher who devoted the whole morning to hospital work, and whose clinic was splendidly arranged for post-graduate study. After a preliminary visit to the ward he would enter the amphitheatre with clock-like regularity, and day by day demonstrate the more important cases, always finishing the morning's work with a visit to the *post-mortem* room.

This year I accepted the chair of clinical medicine in the University of Pennsylvania, Philadelphia, the premier medical school of the United States, founded in 1789 by

Morgan, Shippen, and Wistar, a group of men who had come strongly under the influence of John Hunter. The teaching of medicine was by lectures and the theatre clinic, which, with the large classes and short period of study, had become an important educational feature. In the hands of a man like William Pepper it resembled rather the larger French clinic, but all through it was an affair of the professor, who demonstrated three or four cases, and dwelt specially upon the diagnosis and treatment. Ward classes for physical diagnosis were in vogue, but clinical clerks were unknown and theoretical lectures occupied a large share of the student's time. The University Hospital and Blockley, the large city hospital, contained an abundance of clinical material which could be utilized for physical diagnosis and for general clinical instruction. I started a small clinical laboratory, which was in charge of Dr. George Dock, now Professor of Medicine in St. Louis. At the Infirmary for Nervous Diseases I became associated with that remarkable man, Dr. S. Weir Mitchell whose career illustrates how a great clinician may develop apart from academic influences or work. The pleasantest memories of five years' sojourn in the "Quaker city" are associated with my friendship with this modern Francesco Redi.

The opening of the Johns Hopkins Hospital in 1889 marked a new departure in medical education in the United States. It was not the hospital itself, as there were many larger and just as good; it was not the men appointed, as there were others quite as well qualified; it was the organization. For the first time in an English-speaking country a hospital was organized in units, each one in charge of a head or chief. The day after my appointment I had a telegram from Dr. Gilman, president of the university, who had been asked to open the hospital, to meet him at the Fifth Avenue Hotel, New York. He said to Dr. Welch and me: "I have asked you to come here as the manager is an old friend of mine, and we will spend a couple of days; there is no difference really between a hospital and a hotel." We saw everything arranged in departments, with responsible heads, and over all a director. "This," he said, "is really the hospital, and we shall model ours upon it. The clinical unit of a hospital is the exact counterpart of one of the subdivisions of any great hotel or department store."

Fortunately the university had not enough money at first to open the medical school, so that we had several years to wait, during which there was only post-graduate teaching, and we were able to complete our organization.

I am going to show you, illustrated by lantern slides, the method of work gradually adopted in the medical unit. But first let me say that we had the good sense to make a high standard for entrance to the school, either the B.A. or the B.Sc. Through the influence of Professor Newell Martin, to whom American biological science owes a deep debt, and Drs. Remsen and Welch, an admirable three years' preliminary course to medicine was offered by the university.

By the time the first class of medical students had reached the final stage the hospital was in very good working order. The medical unit consisted of about seventy beds (the number gradually increased to above one hundred), a large out-patient department, and a clinical laboratory close to the chief wards. In charge was the head, *ex officio* professor of medicine in the university, a resident staff of first, second, and third assistants (nominated by the professor), a fourth assistant in charge of the laboratory; and in addition four house physicians, appointed annually. The first assistant, a man of experience, remained for some years, and in the absence of the chief was in complete control of the department. He had rooms in the hospital and was paid £200 a year, half by the hospital, half by the university. All of the assistants were engaged in teaching and were paid. The appointments were for no fixed period, and during the sixteen years of my control there were only five first assistants, Dr. Lafleur, now Professor of Medicine at McGill, Dr. Thayer, Professor of Clinical Medicine at the Johns Hopkins Hospital, Dr. Futcher, Associate Professor of Medicine at the Johns Hopkins Hospital, Dr. McCrae, Professor of Medicine at Jefferson College, Philadelphia, and Dr. Cole, at present Director of the hospital connected with the Rockefeller Institute. In each instance these men had lived as junior and senior assistants in the hospital for seven, eight, or more years. I had the good fortune to have in charge of the clinical laboratory for some years Dr. Emerson, now Professor of Medicine in the University of Indiana.

I have always felt that the success which followed this experiment—for such it was in hospital work in the United States, at any rate—was due to the type of men we had as senior assistants in the various departments. We chose the best that were to be had; the nomination was in the hands of the chief of the department; they were given responsibility, encouraged to teach, and to write, and their professional development was promoted in every way. An excellent plan, greatly favoured by the director of the hospital, Dr. Hurd, was to allow the senior assistants every couple of years a vacation of from four to six months to go abroad for study. The out-patient section of the medical unit was in charge of a separate staff, usually men who had been senior assistants and had gone into practice in the city. There were three; each took two days a week, and had his own staff of three or four assistants, and all were directly engaged in teaching. You may gather from this some idea of the size of a medical unit and of the number of men at work in it, at least twenty-three or twenty-four when I left the hospital. This may be said to be an impossible task for one man to control. Not at all; it is all a question of organization, of subdivision of labour, and of co-operation among workers, and the introduction into a department of modern business methods.

To come now to the actual work. The first duty in the unit is the care of the patient. For the sake of hospital managers I would like to make a statement. If one wishes patients well taken care of, their diseases thoroughly studied, and their treatment in every detail up to date, have medical students in the wards and out-patient departments. They represent the suprarenal extract of the body medical, maintaining the tonus and furnishing the working stimulus. A man's attitude towards his fellow-creatures is largely temperamental. If naturally devoid of the milk of human kindness, to assume a kindly interest in the sick is impossible. This was the meaning of that striking remark of Hippocrates that to a proper love of the profession must be joined a love for humanity—or words to that effect. In any ward visit one can see immediately the spirit in a hospital—whether patients are regarded as just so much material, or as our brethren deserving under all circumstances of every possible consideration and kindness. I have always felt that in this respect we can all take a lesson from our French colleagues, whose gentle courtesy towards their patients has always made a deep impression upon me. In the wards of the Bicêtre, or of the Salpêtrière, where congregate the very dregs of humanity, the greetings of the old men and women show how they feel that in their physician one friend at any rate is left.

The second great function of the clinic is concerned with teaching—assistants, students, nurses. One of the special advantages of an organization of this kind is the progressive training of a group of young men who take part in the work and are taught progressively, often unconsciously, how to teach.

The first assistant is the understudy of the chief, the second of the first, the third of the second, and any one at a moment's notice is able to take the duties of the other. If Professor Halstead was absent at any time or during his summer vacation, the first assistant did the operative work and had charge of the clinic. If I was away, my first assistant took my place, and did my day's work in the hospital. In this way a group of men are educated who are fit to take teaching positions, and a source of the most legitimate pride in a teacher is to have his old associates scattered over the country in responsible positions. The organization of the university clinic exists primarily for the training of the student, who has a right to demand systematic, thorough, and punctual instruction, enough to give a working knowledge of his profession. With students in a hospital as part of its machinery, and if you do not try to teach them too much or lecture them too much, in two years, given a thorough preliminary training, they should get a very fair knowledge of medicine and surgery.

Junior Clinical Class.

We divided the classes into junior and senior, representing the third and fourth years. As our numbers were limited we rarely had more than sixty to seventy in each. They were arranged in three groups in each year—medical, surgical, obstetrical and gynaecological—each of which spent about three months and a half in medicine and surgery and the rest of the time in obstetrics and gynaecology. Let us take first the junior class. A strong believer in the out-patient department for teaching purposes we utilized this almost exclusively for the junior students. The arrangement was as follows:

(*a*) *Physical Diagnosis.*

The three men in charge of the out-patients were demonstrators or associates in medicine, and responsible for the routine instruction in physical diagnosis. To each one a small group of students was assigned who day by day

Fig. 1.—Out-patient clinic.

helped in the work and were taught practically physical diagnosis. As the school grew this teaching fell into the hands of experienced men such as Dr. Thayer, Dr. Futcher, and Dr. McCrae, and it was with special satisfaction that I saw the full development of this work. The out-patient department was arranged with suitable teaching rooms and a small laboratory. When the Phipps Tuberculosis Dispensary was opened as an annex, each member of the junior class passed through it in the routine of training. The out-patient room offers much the best opportunities for the beginner. He sees the sick man or the sick child as he is, and he can be taught much more satisfactorily how to take the histories provided that he has plenty of time, numerous instructors, plenty of patients, and ample accommodation. In medicine the work of a junior student was to get a knowledge of disease and of its methods of recognition in the out-patient department. To supplement this, three times a week, at the close of the out-patient hours, was held—

(b) A Systematic Out-patient Clinic.

I used to call this an observation class, as its primary function was to train men in the use of their senses. My instruction to the assistants was "send in anything the men can see or handle." The picture (Fig. 1) shows the out-patient clinic at work in a room large enough to hold thirty men comfortably seated. Students were taken in routine, and by this next picture (Table I) it is seen how

TABLE I.—*Cases for the Month of January, 1901.*

Date.	Clerk.	Case.
Jan. 3	Riggins	Periostitis, luetic.
,, 3	Oschner	Chlorosis.
,, 10	Wright	Haemachromatosis.
,, 10	Scholl	Enlarged liver, syphilitic.
,, 12	Simpson	Cancer of stomach.
,, 12	Steele	Lues, secondary.
,, 12	Talant (Miss)	Tachycardia.
,, 15	Silverberg	Aneurysm, carotid.
,, 15	Wight	Angiomata, nasal haemorrhage.
,, 15	Williams (Miss)	Dementia praecox.
,, 15	Williams	Lues, secondary.
,, 17	Arsdall	Phthisis.
,, 17	Browne	Aneurysm, thoracic.
,, 19	Auer	Haemoglobinuria.
,, 19	Briggs	Thickened pleura.
,, 22	Bruns	Epithelioma of lip.
,, 22	Bryan	Acute pleural effusion.
,, 24	Bush	Tuberculosis, pulmonary, pleural, and peritoneal.
,, 24	Churchman	Malignant disease of oesophagus.
,, 24	Clarke	Gout.
,, 29	Cook	Pleurisy, tuberculous.
,, 29	Coons	Tabes, mitral disease.
,, 29	Dolley	Polypnoea, neurasthenia.
,, 29	Duffy	Pulmonary tuberculosis.

the scheme worked. The clerk's name was put down, the name of the patient, and then the ward if he was admitted.

The clerk was expected "to keep track" of his case, and to report on it in a way that you will hear in a few minutes. Upon one strong conviction I have always tried to act—to make as far as possible the student participate in the teaching. The next picture (Table II) illustrates

TABLE II.—*1900–1901.*

Date.	Name.	Subject.	Read.
Oct. 6	Bryan	Pediculi and peliomata	x. 14
,, 9	Dohme	Method of healing of aneurysm	x. 16
,, 9	Bush	Fowler and Fowler's solution	v. 8
,, 9	Coons	Virchow's original description of leukaemia	x. 30
,, 11	Duffy	Huntingdon's paper on chronic chorea	x. 20
,, 16	Ferry	Lung stones	x. 15
,, 16	Frankenthal	Gastric ulcer at early age	x. 25
,, 18	Haynes (Miss)	Diagnosis of varieties of tape-worm	x. 25
,, 20	Hirshberg	Hippocrates's description of phthisical chest	xi. 12
,, 25	Lehr	Bronchiectasis, pathology of	xi. 1
,, 30	Reede	Round-up for October	xi. 8
Nov. 13	Briggs	Argyria, smallest amount of nitrate of silver to cause,	xi. 22
,, 13	Williams (Miss)	First description of mitral stenosis	xi. 22
,, 15	Wright	History of Peruvian bark	ii. 21
,, 17	Bruns	Nerve changes in herpes zoster	xi. 22
,, 17	Clarke	Visible peristalsis in pregnant uterus and in distended bladder	xii. 4
,, 22	Cook	Analysis of lithia waters	xii. 13
,, 24	Dolley	*Re* discovery of thyroid feeding	xii. 11
,, 24	Duffy	St. Vitus	xii. 24
,, 27	Ferry	Round-up for November	xii. 5
Dec. 4	Frankenthal	Subcutaneous fibroid nodules	xii. 6
,, 6	Erving	Glycosuria in tuberculosis	xii. 11
,, 6	Glenny	Who first described the *bruit de diable*	xii. 13
,, 6	Hardy	Weir Mitchell's paper on post-hemiplegic movements	xii. 20
,, 11	Lootz (Miss)	*Re* prognosis of diabetes in the young	i. 3
,, 13	Haviland	Acquired lues in congenital syphilis	i. 8
,, 17	Karsted	Necrosis in chrome workers	iii. 7
,, 20	Meisenhelder, J. E.	Round-up for December	i. 5

how this was carried out. At the top of the list you see the words "pediculi" and "peliomata." A case had come in with this association. It is an interesting point, and Mr. Bryan, the student who happened to be called up, was asked to report on the subject the next week. If you go down the list you will see what a motley group of subjects came under discussion. Take, for example, No. 3 on the list, Fowler. I would ask: "Who is Dr. Fowler who introduced Fowler's solution? Where was the article published?" Of course, Mr. Bush had not the faintest notion; but he was at once reassured when I told him that I also did not know. Nor could he give an affirmative to the next question: "Where will you look for it?" In such cases they were always referred to the *Index Catalogue* of the Surgeon-General's Library; sometimes to Neale's *Medical Digest*, and if the books were not in our own library they could be procured from the Surgeon-General's. Two things were required from the student who presented his report—brevity and lucidity—and, as far as possible, men were encouraged to speak, not to read from a MS. You see from the list how varied were the subjects presented during one semester. I got a great deal of instruction myself, we saw a great deal of valuable medical literature, it did not take very much time, and it was a great help in the education of the individual student.

On the table you will see at the end of each month the word "round-up," which we took from a practice of the Western cattle ranches. The last man called at the end of each month had to report the next week on the cases that had been before us during the month. In this way we kept in touch with them, and at the end of the session a complete report was presented by the eight or nine men who had had the monthly round-ups. Table III shows the

TABLE III.

(Cases, 230; deaths, 15; mortality, 6.5 per cent.)

	Cases.	Deaths.
1. Specific infectious diseases	61	6
2. Diseases of digestive system ...	35	7
3. Diseases of respiratory system ...	21	0
4. Diseases of circulatory system ...	32	1
5. Constitutional diseases	17	0
6. Diseases of blood and ductless glands	20	0
7. Diseases of kidney	5	1
8. Diseases of nervous system	22	0
9. Diseases due to animal and vegetable parasites	4	0
10. Diseases due to intoxications ...	6	0
11. Pregnancy	1	0
12. Anatomical and pathological curiosities	6	0

analysis of the session's work. You see that 230 cases were presented in 1899-1900, and I pass round a typewritten copy of the report which each student could procure. It illustrates the wealth of material available for teaching in the out-patient department of any large general hospital. You will be impressed with that first item on the list—61 cases of specific infections. It is a great advantage to see these in the unwashed, unprepared condition in which they present themselves at the hospital; and an analysis such as you see in the next figures could only be arranged by a great deal of co-operative work among the

TABLE IV.—*Specific Infectious Diseases.*

	Cases.	Deaths.
A. *Malarial Infection* (12 cases; 1 death).		
(*a*) Aestivo-autumnal	3	1
(*b*) Single and double tertian	9	0
October	5	
November	3	
December	2	
February	1	
(11 cases; history of chills and fever during summer.)		
April (tertian infection)	1	
(No history of chills and fever during previous summer.)		
Fatal case (aestivo-autumnal infection): Malarial nephritis.		
B. *Typhoid Fever and its Sequelae* (5 cases).		
(*a*) Abortive typhoid (October and November)	2	...
(*b*) Obliteration of femoral vein (ten years' duration	1	
(*c*) Hemiplegia with athetosis (two years' duration, developed three weeks after attack)	1	
(*d*) Peripheral neuritis (seen October, 1899, developed ataxia, at present greatly improved)	1	
C. *Sequelae of Diphtheria* (4 cases).		
(*a*) Peripheral neuritis (all in children developing during or from two to four weeks after attack	4	0
Pathological lesion—		
(1) Paralysis of palate in	4	
(2) Ptosis in	3	
(3) Paralysis of iris in	1	
(4) Paralysis of legs developing two weeks after paralysis of palate ...	1	
(All made complete but slow recoveries.)		
D. *Pneumonia* (1 case with extensive pleurisy) ...	2	0
E. *Varicella*	1	0
F. *Parotitis*	1	0
(The last two patients were both negro children.)		
G. *Febricula*	1	
H. *Amoebic dysentery*	1	
I. *Gonorrhoeal Arthritis* (five years' duration, girl 15)	1	
J. *Syphilis* (other than of the liver)	15	0
(*a*) Secondary (rash appearing five weeks to eight months after primary sore) ...	9	
(*b*) Tertiary	4	
(1) Perforation of palate	1	
(2) Periostitis	1	
(3) Arthritis...	1	
(All in women 25 to 40 years.)		
(4) Gumma of scalp	1	
(*c*) Congenital	2	0
(1) Girl, 18		
(2) Negro child, 3 months.		
K. *Tuberculosis*	18	5
(*a*) Pulmonary	15	4
(12 men, 3 women, about equally divided between negroes and whites. 10 under 3 years, 5 over 30 years, greatest number between 20 and 30 years.)		
(*b*) Peritonitis	1	1
(*c*) Ulcer of lip	1	0
(*d*) Lupus (5 years' duration)	1	0

students. Table IV, a page of the report, shows the analysis of the cases of specific infectious diseases. Of course such a rich group of interesting cases could only be obtained through the keen co operation of assistants

Fig. 2.—Clinical laboratory.

Fig. 3.—Clinical laboratory.

always on the look-out after suitable cases to show at this third-year clinic. For the teacher himself this type of class is ideal, only it must be thoroughly practical, theoretical discussions must be tabooed, and the student must do as much work as possible. It is an ideal way in which to begin the study, as the young men are encouraged to look up the literature, and to visit their own cases whether in the homes or in the wards, and it gives good men an opportunity to show what they could do in the way of presenting the reports.

(c) *The Clinical Laboratory.*

The young medical student needs above all things method and technique, and to be trained early in the use of instruments of precision. In the physiological and pathological classes he becomes adept in the use of the microscope, etc., and when he comes to the hospital side he should have opportunities to apply this knowledge in the study of disease. He may get this haphazard, doing work in the out-patient rooms and in the wards, but it is very much better to have well-organized instruction extending throughout the entire session. In the scheme which we followed each student had his place in the laboratory with a microscope, always a good one, rented to him by the school for £1 a year. Here three afternoons a week throughout the entire session the junior class had routine instruction in clinical laboratory methods. The next two pictures (Figs. 2 and 3) represent the class at work. How much really good work may be done in classes of this sort may be gathered from Emerson's *Manual for the Clinical Laboratory*, which is largely based on material collected by the students. I was fortunate to have in charge of the laboratory such men as Lazier (who sacrificed his life in the yellow fever investigations), Camac, Emerson, and Cole.

In a laboratory of this type the student feels at home, with his own apparatus and reagents; here he can do his private work, always in reach of skilled assistance, and in a scientific atmosphere, as researches were always in progress.

The junior clinical student had plenty to do, with physical diagnosis classes, the routine work of the out-patient department, the tri-weekly out-patient clinics, and three afternoons weekly in the clinical laboratory. He had one other class—

(d) *The General Clinic.*

The general clinic, which both the juniors and the seniors attended, and of the organization of which I will speak in a few minutes. You notice that the work of the junior student was almost exclusively in the out-patient department. There are those, I know, who feel that instruction may be better given to him in the wards, and that, as a senior, he appreciates more the out-patient department, but if the out-patient work is suitably arranged, and if teaching is made a predominant feature, there are many advantages in confining the work of the juniors to this section of the hospital. Of course, there is no objection whatever to the teaching of physical diagnosis in the wards, but one has to consider the patients.

Senior Clinical Class.

In the three chief subjects the men were assigned for work in the wards as clinical clerks or surgical dressers in groups of 20 to 25.

(a) Ward Work.

Each morning until 12 o'clock was free for it ; the ward visit was made at 9 o'clock sharp. The number of beds assigned to each clerk varied—five, six, or eight, or even more. Under the direction of the house-physician, the clerk took the history and worked up the case, doing

Fig. 4.—Ward visit.

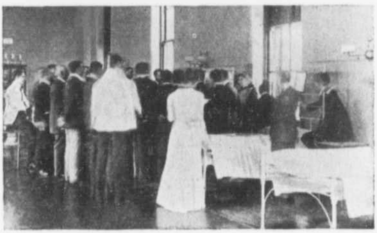

Fig. 5.—Ward visit.

himself the various analyses. For this purpose each clinical clerk had to have his own microscope, rented from the school, and his own place with the reagents, etc., in the clinical laboratory. The ward visit was on the plan with which you are so familiar. I show you a couple of pictures (Figs. 4 and 5) which illustrate its disadvantage—namely, the crowding round the bed—and in the next figures (Figs. 6 and 7) you may see the professor dictating a note or listening to a student making a report. Of a new case the clerk was encouraged to give orally a summary, not to read a full elaborate history. In this way he was again made to help with the teaching, and, in fact, he was encouraged to do as much of the talking as possible. The Socratic dialogue is the ideal bedside

Fig. 6.—Ward visit.

Fig. 7.—Ward visit

method, in which long harangues are out of place, and, after all, the priceless value of the system is not in the tongue of the teacher, but in the daily routine of personal contact with the patient, who is really the teacher. The assistants shared the ward work with me, and on alternate days, when I had the out-patient clinic, they made the visit with the clinical clerks.

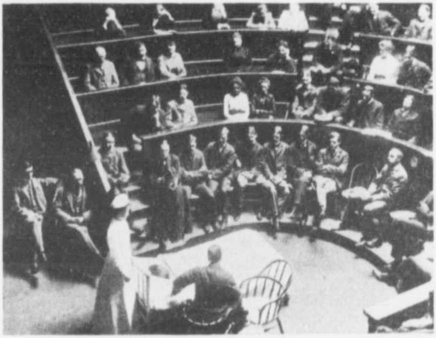

Fig. 8.—Theatre teaching.

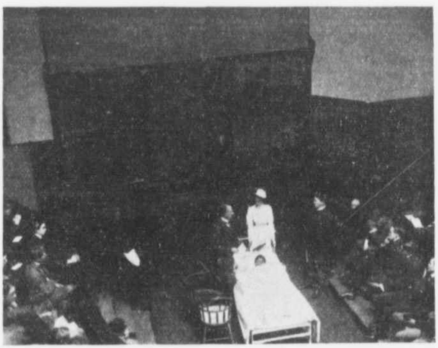

Fig. 9.—Theatre teaching.

(*b*) *The General Clinic.*

There are several methods of conducting what may be called the theatre clinic of a hospital. In the German method a series of cases is usually presented, on which the professor gives a more or less elaborate lecture. In

France, from the days of Corvisart, the ward visit has been the feature, after which the teacher lectures, usually without the cases before him, on special affections. Sometimes these lectures are extraordinarily complicated. I heard Dieulafoy lecture three successive Saturdays on the same case.

I utilized the theatre clinic largely to present to both the junior and senior students the general work of the wards. These next two pictures (Figs. 8 and 9) illustrate the theatre and the method of teaching. As far as possible we followed the seasons and their acute diseases; typhoid fever and malaria in the early autumn, then pneumonia as the winter progressed. Special emphasis was always laid on the more common affections. The clinical clerk described the main features of the case, if possible without his notes, talking, as I always insisted, to the back benches. This, again, was for a definite purpose—to teach the young fellows to control their vasomotors and to stand and think and talk simultaneously. In response to a question a keen student would give an answer that contributed not a little to the lecture itself. You notice on the second figure of the clinic (Fig. 9) the large blackboards. The lists of cases that you see represent an important feature of the clinic. As I mentioned, its special object was to present, week by week, to the third and fourth year students—all of whom were required to attend—the work of the wards. On the important diseases committees of the students were appointed to report. The tabulated lists on the blackboard represent the cases of typhoid fever and pneumonia entered week by week. Only the typhoid cases with complications were put up, but the entire experience of the clinic with pneumonia was presented. One of the first questions asked was for the chairman of the typhoid and pneumonia committees to report. In the longer list on the blackboard you see for the session 1900–1901 some 60 cases of pneumonia, very many of which were shown at the clinic, and all of which we reported upon. At the end of the session typewritten copies of these lists were circulated among the students. By the end of his fourth year a man could have a knowledge of at least 70 or 80 cases of pneumonia and of the complications of several hundred cases of typhoid fever.

Very special stress was laid upon this side of the work, and here again you see the important feature of making the student an active participant in the teaching. As far as possible groups of cases illustrating special features of disease were presented; very often an assistant participated in and was asked to present a case which he worked up specially. Sometimes we had a symposium conducted by the students. I remember on one occasion, when we had in the wards a number of cases of diabetes, the students held the clinic, and six of them presented the various features of the disease. Of course, they could not let the occasion pass without a joke, and on my table and in their buttonholes were sweet-peas! One last feature remains to be noticed. The concluding remark always was: What deaths? what *post-mortems!* If a *post-mortem* examination had been held, the clerk whose patient had died was responsible for the demonstration of the lesions. In making it as far as possible a student's affair the clinic may lack the dramatic unity of the French or the thoroughness of the German, but I claim for the method an educational feature of a high order; well arranged by the assistants and students, there is one thing it will not miss—the power to draw large and appreciative audiences.

(c) *Seminar Classes.*

In a very busy clinic there is neither the time nor is there the necessity for systematic lectures, but even in a rich hospital service it is impossible to show the student even types of all diseases, so that it is necessary to supplement in some way the teaching of the wards, the dispensary, and the theatre. We managed this in two ways. One of the assistants held each week what is called a "recitation" class, in which the students were examined upon set subjects given out previously. Sometimes text-book chapters were put down for study, sometimes journal articles, and, as far as possible, the important literature of the subject discussed was placed on the table. In this way one feels sure that the student gets at least some knowledge of the more obscure and less common maladies.

Then, a couple of years before I left, the assistants and the clinical clerks started a weekly *seminar*, in which, seated about a long table, the important recent contributions in the literature usually to the diseases under observation were reported upon and discussed.

(d) *Research.*

The third function of the clinic is organization for research, a side of the work which presents many difficulties. If a laboratory man, the professor may neglect patients and students, and if an old time bread-and-butter clinician he may neglect the laboratory side. He sets the pace, but one thing is certain, that in a university clinic the interest of the student should be paramount.

Every patient presents problems for research, and the clinical clerk should be able to carry out the necessary investigations. For this purpose there must be skilled assistants, directly attached to the clinic, who are able to advise and control his bacteriological, chemical and physiological studies. For example, in pneumonia and in typhoid fever the bacteriological work should be done under skilled supervision, and the clerk should be able to make his own blood cultures or to plate out a stool. In gout and diabetes he should carry out his own chemical studies with the help of a trained clinical chemist in a laboratory attached to the clinic; and in a case of heart-block he should have at hand all the graphic and electrical apparatus necessary for this study. The student should himself carry out researches, particularly if he comes into the ward with a good chemical training. With reference to the arrangement of the laboratories one of two plans may be followed. In very large hospitals they may be concentrated in one building and even combined with pathology, but in the university medical clinic there are great advantages in having small laboratories of bacteriology, chemistry and pathological physiology associated directly with the wards.

In every university department the chief research must be done by the young assistants and special students under the direction of the chief, who fertilizes them with ideas. Here again it is a matter largely of organization, only I feel strongly that however important research may be every man associated with the clinic should take his share in teaching, and should be made to feel that the student is the pivot round which the machine works. Research becomes very absorbing, and in some men fosters a seclusive selfishness that is most deplorable. I can testify in an interesting way to the large amount of good work that may be done by the students and young assistants. When I left the Johns Hopkins Hospital, the graduates of the first eight years of the medical school presented me with twelve handsomely bound volumes containing just five hundred contributions they had made.

As briefly as possible this is a summary of my life as a clinical teacher. At a farewell dinner given to me by the profession of the United States and Canada, I expressed the pious wish that my epitaph should be, "He introduced routine bedside teaching into the United States"; and I think I may claim for my colleagues that in all the departments of the Johns Hopkins Hospital the English and Continental systems of teaching were combined with great advantage.

A Forecast.

Now, in a few concluding words, let me give you a forecast. I designedly took this subject for my address because the future is with you young men, who are certain to see within the next few years radical changes in the medical schools of this country. There are two important problems. Is it possible to organize in the English hospitals university clinics such as exist on the Continent, and such as those which we had at the Johns Hopkins Hospital? There are difficulties, of course, but they are not insuperable, and, once started, clinics of this type will be instituted in every school in the kingdom. Only let them be complete; the chief in full control, responsible for the teaching, responsible for the work of his assistants, and let them be well equipped with all modern accessories for research The other problem is more difficult. Shall the director of such a clinic devote his whole time to the work, or shall he be allowed to take consulting work? For the former many advantages may be claimed, though the plan has nowhere yet had a practical trial. The amount of work in a modern clinic is enormous—quite enough to take up the time and energies of any one man in conducting the teaching, treating the patients, and superintending the researches. Then it is attractive to think of a group of super-clinicians, not bothered with the cares of consulting practice, and whose whole interests are in scientific work. It is claimed that as much good will follow the adoption of the plan of whole-time clinicians as has followed the whole-time physiologists and anatomists. Against it may be urged the danger of handing over students who are to be general practitioners to a group of teachers completely out of touch with the conditions under which these young men will have to live. The clinician should always be in the fighting line, and in close touch with the rank and file, with the men behind the guns, who are doing the real work of the profession. The question, too, is whether the best men could be secured; whether academic and scientific distinctions would satisfy these men. Then for the hospital itself, wou'd it be best to keep our best in clinical seclusion? Would there not be the danger of the evolution throughout the country of a set of clinical prigs, the boundary of whose horizon would be the laboratory, and whose only human interest would be research? I say frankly that I am not in favour of the whole-time clinical teacher. This is not surprising, as my life has been largely spent in association with my professional brethren, participating in the many interests we have had in common. At the same time let me freely confess that I mistrust my own judgement, as this is a problem for young men and for the future. I know how hard it is "to serve God and mammon," to try to do one's duty as a teacher and to live up to the responsibility of a large department, and at the same time to meet the outside demands of your brethren and of the public. And if added to this you have an active interest in medical societies, and in the multifarious local and general problems, the breaking point may be reached. I had had thirty-one years of uninterrupted hard work. William Pepper, my predecessor in Philadelphia, died of angina at 55; John Musser, my successor, of the same disease at 53! After listening to my story you may wonder how it was possible to leave a place so gratifying to the ambitions of any clinical teacher: I had had a good innings and was glad to get away without a serious breakdown.

BURTON'S ANATOMY OF MELANCHOLY

A PAPER BY

SIR WILLIAM OSLER

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BURTON'S ANATOMY OF MELANCHOLY

By Sir William Osler

MELANCHOLY may be defined as a state of mind in which a man is so out of touch with his environment that life has lost its sweetness. Galen speaks of it as "a malady that injures the mind, associated with profound depression and aversion from the things one loves best." Burton himself nowhere defines it, but quotes definitions from Fernelius, Fuschius, and other authors. And great minds are not free from it: "nullum magnum ingenium sine mixtura dementiæ," says Aristotle; to defend the truth of which thesis Reveille-Parise has written an interesting monograph. Unfortunately from birth melancholy marks some for her own: those unhappy souls who at every stage smell the mould above the rose, and sing, with Lady Mary Wortley Montagu, "With toilsome steps I pass thro life's dull road." From the transitory form, the "blues" or low spirits, "no man living," as our author says, "is free, no stoic known so wise, none so happy, none so patient, so generous, so godly, so divine that can vindicate himself; so well composed but more or less sometime or other he feels the smart of it." Life is a mixed "glukupicric passion." Into this infernal gulf we must all wade; happy those who do not get beyond the shallows; but when the habit becomes "a settled humor, a chronic or continuate disease," the unfortunate victim cries aloud with the Psalmist, "All thy waves and storms have gone over me."

Of the "eighty-eight varieties" said to exist, Burton will treat only the severer, inveterate, fixed forms, not the passing melancholy which is more or less a character of mortality. Naturally a malady of such universal prevalence has a literature of corresponding importance. A glance through the titles of the Index Catalogue of the Surgeon's General Library gives one some idea of its extent in medicine: books, monographs, journal articles by the score have been written on the subject. There is scarcely an ancient author of note who has not dealt with some aspect of it. But among them all one only has the touchstone of time declared to be of enduring, of supreme, merit; the centuries have made Burton's book a permanent possession of literature. Though called by the author a *cento,* a patchwork, this is by no means a correct designation. "The Anatomy of Melancholy" is a great medical treatise, orderly in arrangement, serious in purpose, and weighty beyond belief with authorities. Scores of works written by seventeenth-century worthies more learned than Burton, have long since sunk in the ooze. Neither system, nor matter, nor form, has sufficed to float them to our day. Nor would "The Anatomy" have reached a second edition if its vitality had depended upon the professional picture; but in it a subject of universal interest is enriched with deep human sympathy; and with its roots in this soil Burton's book still lives.

The main facts of Robert Burton's life are in the book. He was born at Lindley in Leicestershire of a family of which he was justly proud and to the members of which he not infrequently refers in his book. At the end of the "Digression of Air Rectified," mentioning pleasant high places in England, he speaks of Oldbury "in the confines of Warwickshire, where I have often looked about me with great delight, at the foot of which hill I was born." Possibly it was from his mother that he got his love for the study of medicine. He states that she had "excellent skill in chirurgery, sore eyes, aches, etc., and such experimental medicines, as all the country where she dwelt can witness, to have done many famous and good cures upon diverse poor folks that were otherwise destitute of help." He seems delighted to have found that one of her cures for ague, an amulet of a spider in a nutshell lapped in silk, was mentioned by Dioscorides and approved by Matthiolus. After attending school at Nuneaton and Sutton Coldfield in Warwickshire, he followed his brother William, in 1593, to Brasenose College, Oxford, as a commoner. In 1599 he was elected a Student of Christ Church, which he calls the most flourishing college of Europe, and where he lived, as he says, "a silent, sedentary, solitary, private life," trying to learn wisdom, "penned up most part in my study." He never travelled, but he took a great delight in the study of cosmography; and for his recreation he would wander round about the world in map or card. He had neither wife nor children, good or bad, to provide for; he was neither rich nor poor; he had little and wanted nothing. All his treasure was in Minerva's tower. He was all his life *aquae potor.* He was a mere spectator of others' fortunes and adventures, and so he rubbed on through his forty-seven years of college life, "*privus privatus;* as I have still lived, so I now continue, *statu quo prius,* left to a solitary life, and mine own domestic discontents; saving that sometimes, *ne quid mentiar,* as Diogenes went into the city, and Democritus to the haven, to see fashions, I did for my recreation now and then walk abroad, look into the world, and could not choose but make some little observation, *non tam sagax observator, ac simplex recitator,* not as they did to scoff or laugh at all, but with a mixed passion."

After his appointment at Christ Church, Burton took orders and did the ordinary work of a college tutor. He was also Vicar of St. Thomas in the West and Rector of Segrave in Leicestershire. "He was an exact mathematician," says Wood, "a curious calculator of nativities, a general-read scholar, a thorough-paced philologist, and one that understood the surveying of lands well. As he was by many accounted a severe student, a devourer of authors, a melancholy and humorous person; so by others, who knew him well, a person of great honesty, plain dealing, and charity. I have heard some of the ancients of Christ Church often say, that his company was very merry, facete, and juvenile; and no man in his time did surpass him for his ready and dexterous interlarding his common discourses among them with verses from the poets, or sentences from classic authors; which being then all the fashion in the University, made his company the more acceptable."

Burton's stay at Christ Church came under the deanship of Dr. Fell, whom he remembers in his will. That he took an active share in the college life is evidenced by the fact that he wrote many occasional verses and a Latin comedy called "Philosophaster," which was acted on Shrove Monday, February 16, 1617-18. We may infer from his will that he was an intimate friend of Dean Fell and his family; and he remembers a number of his friends, so that, though an old bachelor, he was well looked after and doubtless much beloved in the community. His will indicates also that he was on the best of terms with his family, to whom he left the greater part of his considerable estate. When the melancholy fits increased, "nothing could make him laugh but going to the bridge-foot and hearing the ribaldry of the bargemen, which rarely failed to throw him into a violent fit of laughter." He died on the twenty-fifth of January, 1639-40, very near the time which he had some years before foretold from the calculation of his nativity; and Wood remarks that "being exact, several of the students did not forbear to whisper among themselves, that rather than there should be mistake in the calculation, he sent up his soul to heaven through a noose about his neck." He was buried in the north aisle of Christ Church Cathedral; and there is a handsome monument with his bust, painted to the life, and the calculation of his nativity.

For the writing of the book we have Burton's full reasons. To escape melancholy he wrote upon it, to ease his mind, for he had *gravidum cor, fœdum caput,* a kind of imposthume in his head, of which he was desirous to be unladen, and he could imagine no fitter evacuation. He calls melancholy his mistress, his Egeria; and he would comfort "one sorrow with another, idleness with idleness, *ut ex Vipera Theriacum,* make an antidote out of that which was the prime cause of my disease." Many notable authors, he says, have done the same—Tully and Cardan, for example; and he can speak from experience, and could help others out of a fellow feeling. Though oppressed with a vast chaos and confusion of books, so that his eyes ache with reading and his fingers with turning, and though many excellent physicians have written elaborate treatises on this subject, he will venture to weave the same web and twist the same rope again. He has laboriously collected this *cento* out of divers writers and that *sine injuria.* He can say with Macrobius, *"Omne meum, nihil meum,* 'tis all mine and none mine." At any rate, like an honest man he cites and quotes his authors; but if, as Synesius says, "it is a greater offense to steal dead men's labors than their clothes," what shall become of most authors? He must plead guilty and hold up his hand at the bar with the rest. Still, the method and composition is his own and he hopes it shows a scholar. He realizes that this is a medical subject and that great exception may be taken that he, a divine, has meddled with physic. The apology must be given in his own words:

There be many other subjects, I do easily grant, both in humanity and divinity, fit to be treated of, of which had I written *ad ostentationem* only, to show myself, I should have rather chosen, and in which I have been more conversant, I could have more willingly luxuriated, and better satisfied myself and others; but that at this time I was fatally driven upon this rock of melancholy, and carried away by this by-stream, which, as a rillet, is deducted from the main channel of my studies, in which I have pleased and busied myself at idle hours, as a subject most necessary and commodious. Not that I prefer it before divinity, which I do acknowledge to be the queen of professions, and to which all the rest are as handmaids, but that in divinity I saw no such great need. For had I written positively, there be so many books in that kind, so many commentators, treatises, pamphlets, expositions, sermons, that whole teams of oxen cannot draw them; and had I been as forward and ambitious as some others, I might have haply printed a sermon at Paul's Cross, a sermon in St. Mary's Oxon, a sermon in Christ Church, or a sermon before the right honorable, right reverend, a sermon before the right worshipful, a sermon in Latin, in English, a sermon with a name, a sermon without, a sermon, a sermon, etc. But I have been ever as desirous to suppress my labors in this kind, as others have been to press and publish theirs.

And the physicians, he says, must not feel aggrieved. Have not many of their sect taken orders—Marcilius Ficinus and T. Linacre, for example? And as this melancholy is "a common infirmity of body and soul," "a compound mixed malady," in which a divine can do little alone and a physician much less, he hopes it is not unbecoming in one who is by profession a divine, and by inclination a physician, and who was fortunate enough to have Jupiter in his sixth house, to write on the subject. But if the good reader be not satisfied and complains that the discourse is too medicinal or savors too much of humanity, he promises to make amends in some treatise of divinity. All the same, he hopes it may suffice when his reasons and motives are considered—"the generality of the disease, the necessity of the cure, and the commodity or common good that will arise to all men by the knowledge of it."

In explaining the adoption of the pseudonym, "Democritus Junior," Burton says that he laughed and scoffed with Lucian and again he wept with Heraclitus; and he tells of the visit of Hippocrates to Abdera, where he found Democritus sitting under a shady bower, with a book on his knees, the subject of which was melancholy, and about him lay the carcasses of many beasts newly cut up in order to find the seat of the *atra bilis,* or melancholy, and how it was engendered. As this book is lost, our author undertakes to revive it again, prosecute and finish it in this treatise. Burton's name does not occur in the title-page of any of the seventeenth-century editions; but at the end of the postscript, which is only in the first edition, is the name, Robert Burton, "from my Studie in Christ Church, Oxon, Dec. 5th, 1620." His anonymity has been respected in all subsequent editions until the one issued in 1895. The work was dedicated to George, Lord Berkeley, who had presented him with the living of Segrave. It is not surprising that the book at once had a great success: "The first, second, and third editions were suddenly gone, eagerly read," as Burton says in one place, when discussing the peevishness of men's judgments and the diversity of tastes in readers—*"Pro captu lectoris habent sua fata libelli."* A lucky fate has followed "The Anatomy," which has held its readers for well-nigh three centuries.

The frontispiece is one of the most Burtonian features of the work. In the absence of information as to its origin, we may well suppose that the author himself prepared the design which was carried out by the well-known engraver of the time, Charles Le Blond. The upper centre figure represents Democritus of Abdera as Hippocrates found him sitting in a garden in the suburbs with a book on his lap. Borage is growing in the garden, and on the wall there are pictures of animals—the cats and dogs of which he has made anatomy. The sign of Saturn is in the sky. To the left is a landscape of jealousy, and there are two fighting cocks (evidently bantams), a swan, a heron, and a kingfisher; and the verses state that there are two roaring bulls to be seen, but they are not visible in any of my folios. For the frontispiece of Tegg's edition, the engraver has taken liberties, as he has left out the fighting cocks and put in the tail, at any rate, of one of the bulls. A bird and a bat and a section of the moon appear in the sky. The third section at the top represents solitariness—animals alone in the desert with bats and owls hovering over them. In the next section is Inamorato inditing a ditty:

His lute and books about him lie,
As symptoms of his vanity.
If this do not enough disclose,
To paint him, take thyself by th' nose.

Opposite is the Hypochondriac:

About him pots and glasses lie,
Newly brought from's apothecary.
This Saturn's aspects signify,
You see them portray'd in the sky.

The next section represents the superstitious man, and opposite him is the madman naked in chains—a ghastly sight. Then below at the lower corners are borage and hellebore, which were "the sovereign plants to purge the veins of melancholy" and, if well assayed, the best medicine that God ere made for this malady. And lastly, a portrait of the author, which the verses tell us shows the habit which he wore and his image as he appeared to the world, though his mind would have to be guessed by his writings. It was neither pride nor vainglory made him put his picture here, but "the printer would needs have it so."

With appropriate verses, Democritus Junior sends his book into the open day, hoping its pleasant vein may save those who con its lore in city—or country—from witches of care. Surely Catos will not love it, and leudful matrons will cry "pish!" and frown and yet read on. For dainty damsels, whom he confesses to love dear as life, he would spread his best stories. The melancholy wight or pensive lover will in its pages find himself in clover and gain both sense and laughter. The learned leech may find here no trifling prize, but to the crafty lawyer he cries "caitiff, avaunt!" Of his faults he asks the ripe scholar to be oblivious, but not refuse praise to his merit, in lines which have the ring of Matt Prior. Flippant spouter and empty prater will search his pages for polished words and verse; and the doggerel poet, his brother, is welcome to the jests and stories. He will fly from and not reply to sour critics and Scotch reviewers. To the friendly though severe censor who complains of his free and even smutty vein, he pleads with Catullus that his life is pure beyond the breath of scandal, and in any case he is ever willing to be improved by censure.

To use his own expression, Burton was a minion of the Muses. I have already mentioned that his play, "Philosophaster," was acted at Christ Church, and that there are a number of his occasional verses in the college collections of the period. In the third edition of "The Anatomy," 1628, appeared the well-known poem on melancholy, the author's address to his book, with its description of the frontispiece. The poem presents all the shifting phases of his sweet and bitter passion in alternate verses of praise and condemnation. Let me quote the first and the last of the twelve stanzas. The first runs:

When I go musing all alone,
Thinking of divers things fore-known,
When I build castles in the air,
Void of sorrow and void of fear,
Pleasing myself with phantasms sweet,
Methinks the time runs very fleet.
All my joys to this are folly,
Naught so sweet as Melancholy.

And then the other picture:

I'll change my state with any wretch,
Thou canst from gaol or dunghill fetch;
My pain's past cure, another hell,
I may not in this torment dwell!
Now desperate I hate my life,
Lend me a halter or a knife.
All my griefs to this are jolly,
Naught so damn'd as Melancholy.

Warton remarked upon the similarity of idea in the contrast between these two dispositions in Milton's famous poems, "L'Allegro" and "Il Penseroso"—the "Hence loathèd Melancholy" in the one, and the "Hail! thou Goddess sage and holy, Hail! divinest Melancholy," in the other; and the antithesis maintained throughout the two poems may possibly have been suggested to Milton by the lines of Burton.

Few writers show such familiarity as Burton with poetry ancient and modern; and his books at Christ Church and the Bodleian testify to his fondness for literature of this class. There are those who hold that Francis Bacon not only wrote Shakespeare's plays and Spenser's "Faerie Queene," but also Burton's "Anatomy of Melancholy." With the biliteral cipher, the whole story of Queen Elizabeth, Essex, and Bacon may be found in the pages of Democritus Junior! Is it not just as reasonable to suppose, as the late Mr. Parker of Oxford suggested, that Burton himself wrote the plays of Shakespeare? Does he not quote him several times, and are there not fine original editions of "Venus and Adonis" and "The Rape of Lucrece" among his books in the Bodleian?

II

"The Anatomy of Melancholy" consists of a long introduction, the subject-matter on melancholy, and three long digressions. The introduction occupies about one-fourth of the book. Burton states that he has had to do the whole business himself, that the book was composed out of a confused company of notes, that he had not time to lick it into shape as a bear does her whelps, and it was writ with as small deliberation as he ordinarily spoke, without any affectation of big words. He is a loose student, he says, a rude writer, and as free as loose. He calls a spade a spade, and his wit lacks the stimulus of wine, as he was a water-drinker. He warns those who are melancholy not to read the symptoms or prognosis, lest they should appropriate the things there spoken to their person and get more harm than good.

Then he is transported in imagination with Cyprian and Jerome to some place where he can view the whole world. He finds that "kingdoms and provinces are melancholy, cities and families, all creatures, vegetables, sensible and rational; that all sorts, sexes, ages, conditions, are out of tune." He promises to bring arguments to show that most men are mad and have more need of a pilgrimage to the Anticyrae than to Loretto, more need of hellebore than of tobacco. And this he proceeds to prove abundantly from the Scriptures and from the writers of all time. Incidentally he gives the interesting story, probably apocryphal, of the visit of Hippocrates to Democritus. If the sage of Abdera could return and see the religious follies, the bloody wars, the injustice, the oppression, he would think us as mad as his fellow-townsmen. Page after page he piles up with illustrations of human folly, and asks every now and then how would Democritus have been confounded. Would he think you or any man else well in their wits? Can all the hellebore in the Anticyrae cure these men—no, sure—an acre of hellebore alone could do it!

Burton was a warm advocate for home industries, a tariff reformer, and would not allow England to be made a dumping ground for foreign manufactures. The paragraph is worth quoting: "We send our best commodities beyond the seas, which they make good use of to their necessities, set themselves a work about, and severally improve, sending the same to us back at dear rates, or else make toys and baubles of the tails of them, which they sell to us again, at as great a reckoning as the whole." He is full of sensible suggestions about the improvements of roads, and the drainage of bad lands, and the neglect of the navigable rivers. Following the example of Plato and of More, he sketches his own Utopia, a new Atlantis, a poetical commonwealth. As his predecessor, Democritus, was a politician and recorder of Abdera, why should not he presume to do as much? Then follows a delightful sketch, based in part upon More's "Utopia" and full of common-sense, practical suggestions. He is a strong advocate for old age pensions. Why should a smith, a carpenter, a husbandman, who has spent his time in continual labor and without whom we cannot live—why should he be left in his old age to beg or starve and lead a miserable life? The introduction ends with a serio-comical address to the reader, saying if he is denied this liberty of speech he will take it; he owes him nothing, he looks for no favor at his hand, he is independent, and may say anything he wishes in the guise of Democritus. Then of a sudden he comes to himself: "No, I recant, I will not, I care, I fear, I confess my fault, acknowledge a great offense"; and he promises a more sober discourse in the future. In a later edition a small section of a few lines follows the introduction, in which Burton again admonishes the reader at leisure, not to asperse, calumniate, or slander Democritus Junior; and this is followed by ten lines of blank verse, in which he concludes that a thousand Heraclituses and a thousand Democrituses are needed, and that all the world must be sent to Anticyra to graze on hellebore.

The treatise itself is divided into three main partitions, and each of these into sections, members, and subsections. A synopsis precedes each partition, bristling with the brackets which learned writers in his time loved to use. There are many books written entirely in this synoptical way, and Burton had many models in his own library. This is a feature of the book which at once attracts attention and is, I believe, unique among books reprinted at the present day. It is impossible to give more than the briefest sketch of the way in which Burton deals with the subject; but the first partition is taken up almost entirely with the causes, symptoms, and prognostics of melancholy. The second partition deals with the cure, and the third with love melancholy and religious melancholy. Three important digressions occur on anatomy, on air rectified, and on the nature of the spirits.

The anatomy and physiology are those of the early part of the seventeenth century before the great discovery by Harvey; and it is remarkable that in the fourth or fifth edition he did not refer to the circulation of the blood. The four humors of the body—blood, phlegm, bile, and serum—play an important part, particularly the black bile which was supposed to cause melancholy. The natural, vital, and animal spirits of the old writers are everywhere evident. The subject is treated in a most systematic manner, and nothing could be more irrational than the criticism of Hallam that the volumes are apparently "a great sweeping of miscellaneous literature from the Bodleian library." As it is very difficult to make a proper division of melancholy, Burton first deals with the subject in a general manner and then proceeds to speak of the particular species—head melancholy, hypochondriacal melancholy, and melancholy from the whole body. The third partition, as was said, is devoted entirely to the subjects of love and religious melancholy. The causes are discussed at great length and under fifteen subsections, ranging from bad diet to over-much study. This part of the work is really a psychological treatise with illustrations from history and literature. A most attractive section is on the love of learning as a cause, with a digression on the misery of scholars. For two main reasons students are more subject than others to this malady—the sedentary, solitary life in which health is neglected, and continuous meditation in the head, which leaves the stomach and liver destitute.

About one-fourth of the work—the second partition—is taken up with the cure of melancholy. This is a strictly medical treatise in which the author has collected all the known information about the treatment of mental disorders; the entire pharmacopœia is brought in, and Burton writes prescriptions like a physician. There is scarcely a medical author of note who is not quoted. It is in this section that there occurs the delightful digression on air rectified, the first English tractate on climatology. Burton here shows that he was a great student of geography and revelled in traveller's tales. He starts off in a most characteristic way: "As a long-winged hawk, when he is first whistled off the fist, mounts aloft, and for his pleasure fetcheth many a circuit in the air, still soaring higher and higher till he be come to his full pitch, and in the end, when the game is sprung, comes down amain, and stoops upon a sudden: so will I, having now come at last into these ample fields of air, wherein I may freely expatiate and exercise myself for my recreation, a while rove, wander round about the world, mount aloft to those ethereal orbs and celestial spheres, and so descend to my former elements again. In which progress I will first see whether that relation of the friar of Oxford be true, concerning those northern parts under the Pole (if I meet *obiter* with the wandering Jew, Elias Artifex, or Lucian's Icaromenippus, they shall be my guides), whether there be such four Euripuses, and a great rock of loadstones, which may cause the needle in the compass still to bend that way, and what should be the true cause of the variation of the compass. Is it a magnetical rock, or the pole-star, as Cardan will?"

One would scarcely have expected from a student of Christ Church, much less from an old bachelor and a divine, the most elaborate treatise on love that has ever been written. It is not surprising that Burton apologizes that many will think the subject too light for a divine and too comical, a subject fit only for a wanton poet or some idle person; but he declares that an old, grave, discreet man is fittest to discuss of love matters, that he has had more experience, has a more staid judgment, and can give better cautions and more solid precepts. He says: "I will examine all the kinds of love, his nature, beginning, difference, objects, how it is honest or dishonest, a virtue or vice, a natural passion or a disease, his power and effects, how far it extends: of which, although something has been said in the first partition, in those sections of perturbations (for love and hatred are the first and most common passions, from which all the rest arise, and are attendant, as Piccolomineus holds, or as Nich. Caussinus, the *primum mobile* of all other affections, which carry them all about them), I will now more copiously dilate, through all his parts and several branches, that so it may better appear what love is, and how it varies with the objects, how in defect, or (which is most ordinary and common) immoderate, and in excess, causeth melancholy." And he keeps his promise.

There is no such collection of stories of love and its effect in all literature; no such tribute to the power of beauty; no such picture of the artificial allurements; no such representations of its power of debasement. And what a section on jealousy!—its causes, its symptoms, and its cure. One could almost write the history of every noted woman from his pages:

> All the golden
> Names of olden
> Women yet by men's love cherished.

Burton says that after the harsh and unpleasant discourse of melancholy which had molested the patience of the reader and tired the author, he will ask leave to recreate himself in this kind, and promises to tell such pretty stories that foul befall him that is not well pleased with them. Nor does he propose to mince matters: "He will call a spade a spade, and will sound all the depths of this inordinate love of ours, which nothing can withstand or stave off." All the love stories, pure and impure, of literature are here. Jacob and Rachel, Sichem and Dinah, Judah and Tamar, Samson and Delilah, David and Bathsheba, Amon and Thamar; the stories of Esther, Judith, and Susannah; the loves of the gods—the fopperies of Mars and Venus, of Neptune and Amymone; Jupiter and his amorous escapades. Modest

Matilda, Pretty Playful Pegg, Sweet Singing Susan, Mincing Merry Moll, Dainty Dancing Doll, Neat Nancy, Jolly Joan, Nimble Nell, Kissing Kate, Bouncing Bess with black eyes, Fair Phyllis with fine white hands,—all flit across Burton's pages as he depicts the vagaries of the great passion, not a single aspect of which is omitted.

Religious melancholy is a form which Burton made peculiarly his own. Many writers had dealt with other aspects of the subject, but he very rightly says of religious melancholy: "I have no pattern to follow, . . . no man to imitate. No physician hath yet distinctly written of it, as of the other." Then he deals with the varied effects of religion in a remarkable way. He says: "Give me but a little leave, and I will set before your eyes in brief a stupendous, vast, infinite ocean of incredible madness and folly: a sea full of shelves and rocks, sands, gulfs, Euripuses and contrary tides, full of fearful monsters, uncouth shapes, roaring waves, tempests, and Siren calms, halcyonian seas, unspeakable misery, such comedies and tragedies, such absurd and ridiculous, feral and lamentable fits, that I know not whether they are more to be pitied or derided, or may be believed, but that we daily see the same still practised in our days, fresh examples, *nova novitia,* fresh objects of misery and madness, in this kind, that are still represented unto us, abroad, at home, in the midst of us, in our bosoms." Heretics, old and new, schismatics, schoolmen, prophets, enthusiasts, martyrs, are all discussed with their several vagaries. This section concludes with the address to those who are in a state of religious despair, written at the instigation of his brother.

III

Though it smells of the lamp, "The Anatomy" has a peculiar fragrance of its own, blended with that aroma so dear to the student of old times which suggests the alcoves in Duke Humphrey or the benches at Merton Library.

Burton himself acknowledges that he is largely the purveyor of other men's wits; but, as he says, he has wronged no author and given every man his own. He is certainly the greatest borrower in literature. Others perhaps have borrowed nearly as freely, but have concealed it. He has not the art of Ben Jonson, in whose "Discoveries" whole sentences from authors are woven together with such great skill that it is only lately that both thoughts and form have been assigned to their lawful owners. A careless reader might suppose that certain sections represented what Lowell called

> A mire ankle deep of deliberate confusion
> Made up of old jumbles of classic allusion,—

but one has not to go far before seeing a method in this apparent confusion; and the quotations are marshalled in telling order. Page after page of "The Anatomy" is made up of what Milton would call "horse loads of citation," the opinions of authors in their own words, Burton acting as a conjunction. Take, for example, a page which I opened at random—page 300 of Tegg's edition. There are twenty-one references covering the whole range of ancient and modern learning. The Bible, the fathers of the church, particularly St. Augustine; the fathers of medicine, Hippocrates, Galen, the Alexandrians, the Arabians, and every fifteenth-century medical writer of note; Plato, Aristotle, Seneca, the poets of all ages, the travellers in all climes, the mystical writers, the encyclopedists—all are laid under contribution in this vast emporium. Well indeed could he say—"non meus hic sermo—'tis not my speech." What has become of his commonplace books? He says that the quotations are often made at random, but he must have kept some references. In no copies of the early editions can I find marginal notes, and there are very few ~~of~~ his books /in at Christ Church and in the Bodleian.

His own style is often delightful, and one cannot but regret that we have not more of Burton and less of Bodley. An apology which he makes gives a good idea of his vigor: "And for those other faults of barbarism, Doric dialect, extemporanean style, tautologies, apish imitation, a rhapsody of rags gathered together from several dung-hills, excrements of authors, toys and fopperies confusedly tumbled out, without art, invention, judgment, wit, learning, harsh, raw, rude, fantastical, absurd, insolent, indiscreet, ill-composed, indigested, vain, scurrile, idle, dull, and dry; I confess all ('tis partly affected), thou canst not think worse of me than I do of myself. 'Tis not worth the reading, I yield it, I desire thee not to lose time in perusing so vain a subject, I should be peradventure loath myself to read him or thee so writing." In another place he says that he is studying entirely to inform his reader's understanding, not to please his ear: "So that as a river runs, sometimes precipitate and swift, then dull and slow; now direct, then *per ambages;* now deep, then shallow; now muddy, then clear; now broad, then narrow; doth my style flow: now serious, then light; now comical, then satirical; now more elaborate, then remiss, as the present subject required, or as at that time I was affected. And if thou vouchsafe to read this treatise, it shall seem no otherwise to thee, than the way to an ordinary traveller, sometimes fair, sometimes foul, here champaign, there enclosed; barren in one place, better soil in another: by woods, groves, hills, dales, plains, etc."

The result is that Burton often tells a story in a charming fashion. I do not know that there is anything much better in literature than the following tale of the poor scholar who would become a prebendary, a cathedral official with a good stipend:

In *Moronia Pia,* or *Moronia Felix,* I know not whither, nor how long since, nor in what Cathedral Church, a fat prebend fell void. The carcass scarce cold, many suitors were up in an instant. The first had rich friends, a good purse, and he was resolved to outbid any man before he would lose it, every man supposed he should carry it. The second was my Lord Bishop's chaplain (in whose gift it was) and he thought it his due to have it. The third was nobly born, and he meant to get it by his great parents, patrons, and allies. The fourth stood upon his worth, he had newly found out strange mysteries in chemistry, and other rare inventions, which he would detect to the public good. The fifth was a painful preacher, and he was commended by the whole parish where he dwelt, he had all their hands to his certificate. The sixth was the prebendary's son lately deceased, his father died in debt (for it, as they say), left a wife and many poor children. The seventh stood upon fair promises, which to him and his noble friends had been formerly made for the next place in his lordship's gift. The eighth pretended great losses, and what he had suffered for the Church, what pains he had taken at home and abroad, and besides, he brought noblemen's letters. The ninth had married a kinswoman, and he sent his wife to sue for him. The tenth was a foreign doctor, a late convert, and wanted means. The eleventh would exchange for another, he did not like the former's site, could not agree with his neighbors and fellows upon any terms, he would be gone. The twelfth and last was (a suitor in conceit) a right honest, civil, sober, man, an excellent scholar, and such a one as lived private in the university, but he had neither means nor money to compass it; besides, he hated all such courses, he could not speak for himself, neither had he any friends to solicit his cause, and therefore made no suit, could not expect, neither did he hope for, or look after it. The good Bishop, amongst a jury of competitors thus perplexed, and not yet resolved what to do, or on whom to bestow it, at the last, of his own accord, mere motion, and bountiful nature, gave it freely to the university student, altogether unknown to him by fame; and, to be brief, the academical scholar had the prebend sent him for a present. The news was no sooner published abroad but all good students rejoiced, and were much cheered up with it, though some would not believe it; others, as men amazed, said it was a miracle; but one amongst the rest thanked God for it, and said, *Nunc juvat tandem studiosum esse, et Deo integro corde servire*—At last there is some advantage in being studious, and in serving God with integrity! You have heard my tale, but alas! it is but a tale, a mere fiction, 'twas never so, never like to be, and so let it rest.

No book of any language presents such a stage of moving pictures—kings and queens in their greatness and in their glory, in their madness and in their despair; generals and conquerors with their ambitions and their activities; the princes of the church in their pride and in their shame; philosophers of all ages, now rejoicing in the power of intellect, and again grovelling before the idols of the tribe; the heroes of the race who have fought the battle of the oppressed in all lands; criminals, small and great, from the petty thief to Nero with his unspeakable atrocities; the great navigators and explorers with whom Burton travelled so much in map and card, and whose stories were his delight; the martyrs and the virgins of all religions, the deluded and fanatics of all theologies; the possessed of devils and the possessed of God; the beauties, frail and faithful, the Lucretias and the Helens, all are there. The lovers, old and young; the fools who were accounted wise, and the wise who were really fools; the madmen of all history, to anatomize whom is the special object of the book; the world itself, against which he brings a railing accusation—the motley procession of humanity sweeps before us on his stage, a fantastic but fascinated medley at which he does not know whether to weep or to laugh.

Which age of the world has been most subject to this feral passion, so graphically portrayed by Burton, is a question to be asked but not easily answered. I believe that the improved conditions of modern life have added enormously to the world's cheerfulness. Few now sigh for love, fewer still for money; and it is no longer fashionable to air our sorrows in public. In spite of this, the worries and stress of business, the pangs of misprized love, the anguish of religious despair, make an increasing number of unhappy ones choose death rather than a bitter life. With the exception of a monograph by the great Dean of St. Paul's, I know of no more interesting discussion on suicide than that with which the first part of the book closes. Only one who had himself made the descent into the hell could have written the tender passage with which the section closes: "Thus of their goods and bodies we can dispose; but what shall become of their souls, God alone can tell; his mercy may come *inter pontem et fontem, inter gladium et jugulum,* betwixt the bridge and the brook, the knife and the throat.

Quod cuiquam contigit, cuivis potest. Who knows how he may be tempted? It is his case, it may be thine. *Quæ sua sors hodie est, cras fore vestra potest.* We ought not to be so rash and rigorous in our censures, as some are; charity will judge and hope the best: God be merciful unto us all."

The greatest gift that nature or grace can bestow upon a man is the *aequus animus,* the even-balanced soul; but unfortunately nature rather than grace, disposition rather than education, determines its existence. I cannot agree with William King, the last of the Oxford Jacobeans, in his assertion that it is not to be acquired. On the contrary, I maintain that much may be done to cultivate a cheerful heart, but we must begin young if we are to have the Grecian rather than the Hebrew outlook on life.

A recognition of the possible depths of this affection should make us bear with a light heart those transient and unavoidable disappointments in life which we are rather apt to nurse than to shake off with a smile. With the prayer of Themistocles for forgetfulness on our lips, let us bury the worries of yesterday in the work of to-day. Some little tincture of Saturn may be allowed in our hearts, but never in our faces. Sorrow and sadness must come to each one—it is our lot:

> We look before and after
> And pine for what is not:
> Our sincerest laughter
> With some pain is fraught;
> Our sweetest songs are those that tell of saddest thought.

We can best oppose any tendency to melancholy by an active life of unselfish devotion to others; and with the advice with which Burton ends the book, I will close:

> Sperate miseri;
> Cavete felices.
>
> If unhappy, have hope;
> If happy, be cautious.

THE VISCERAL LESIONS OF PURPURA AND ALLIED CONDITIONS.

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THE VISCERAL LESIONS OF PURPURA AND ALLIED CONDITIONS.

Introduction.

In his well-known work on *Cutaneous Diseases* (1808) Willan first reported the occurrence of visceral symptoms in a case of purpura of great severity, with vomiting, excruciating abdominal pain, diarrhoea and bloody stools. In addition to purpura, there were "anasarcous swellings on the thighs and hands," evidently angio-neurotic oedema, and on the back of the hands two gangrenous sloughs. It is particularly interesting that Willan should have thus noted the polymorphous character of the skin eruption. Olivier (d'Angers),[1] in 1827, gave a good account of the abdominal complications of purpura; and Henoch,[2] 1874, and Couty,[3] 1876, described the cases more fully, and now the combination of purpura with abdominal pains is called after the late distinguished Berlin paediatrist. Since then there have been scores of communications; I have myself reported long series of cases;[4] and Pratt has given a good summary of our present knowledge in vol. iv of my *System of Medicine*. The general literature of purpura to 1909 is given in the first and second series of the *Index Catalogue of the Surgeon-General's Library*. An excellent analysis of the recorded cases with abdominal symptoms to 1889 is given by v. Dusch and Hoche in the *Henoch Festschrift*, Berlin, 1890.

Character of the Skin Lesions.

From the anatomical standpoint four lesions are met with in the cases under consideration. All are exudative, in which the blood elements—either the red blood corpuscles alone, the serum alone, or both combined—pass out of the vessels.

1. *Purpura.*

This, the most common lesion, is either simple or associated with swelling, purpura urticans, and with oedema of the hands and feet or about the joints, particularly the knees and elbows. The larger areas may be capped with bullae—purpura bullosa. There are cases in which the vesicular character of the purpura is very striking. A man aged 34 was admitted in his fourth severe attack of purpura. The backs of the hands were covered with simple purpura; just below the right elbow was a fresh eruption of blebs looking like herpes, some on hyperaemic, some on purpuric bases. Two inches above the left condyle was a patch of pearly vesicles, solid, not on reddened base; above the joint of the other elbow was a raised bulla 2 cm. by 7 mm. with haemorrhagic contents. Over the right second rib were two patches of pemphigoid purpura, one 2 by 3 cm., the other 1½ cm. in length. Practically all varieties of purpura are seen, reaching to the severest grade of morbus maculosus werlhoffii.

2. *Effusion.*

Effusions of serum alone, forming the ordinary wheals of urticaria or the patches of angio-neurotic oedema, are the next in frequency of occurrence. The clinical features may be those of ordinary urticaria or of angio-neurotic oedema.

3. *Erythema.*

Erythema, either diffuse and with or without swelling, or localized, as in the common form of erythema exudativum multiforme; sometimes patches have the appearance of erythema nodosum. In Case XIII[5] of my series a patient had attacks of violent colic for months without skin lesions, and then was admitted with a typical attack of erythema multiforme on hands, forearms, face; on the legs some of the patches were exactly like erythema nodosum.

4. *Necrotic Areas.*

When a localized infiltration of blood and serum is very intense in a patch of considerable size, bullae form and the superficial layers of the skin necrose, leaving an open ulcer. This is more frequently seen in the severer types of purpura, with large serous exudation, but it may occur in intense erythema, as in that most typical of all varieties, chilblains.

There are two outstanding clinical features—first, the recurrence of attacks at long or short intervals over periods ranging from a few months to many years, and secondly, the morphological inconstancy of the skin lesions. In Willan's case purpura, angio-neurotic oedema, and necrotic sloughs were present in one attack. Within a few weeks the patient may run the gamut of a skin atlas—purpura, oedema, exudative erythema, pemphigoid lesions, etc.; or in the same individual followed for many years the skin lesions may differ in the different attacks. Very many of my reported cases followed for years have shown these polymorphic characters.

Even the unusually stable, hereditary form of angio-neurotic oedema may present erythematous lesions of the worst type. For years I had correspondence with a Mrs. W., aged 54, of California, a victim of aggravated angio-neurotic oedema of twenty years' standing; a case illustrating how terrible the disease may be. Her mother had the same affection. The attack began when she was 27, after the birth of her second child. Oedema would come on at any time, anywhere, accompanied with severe vomiting, often of blood. Tea, coffee, or strawberries would bring on an attack within three hours. The face and throat were much affected. The attacks usually began with red spots like wheals on the cheeks. The outlines of the neck would be obliterated. She came into hospital, October 4th, 1904, in an attack, with infiltration of the inner side of the left arm and elbow, with black and blue spots, and the right arm enormously oedematous, with a vivid erythema extending up and down the arm. There was no fever, no enlargement of the spleen, no albumin in the urine. A specially interesting thing was to find that this patient belonged to the New Jersey family of hereditary angio-neurotic oedema, which I described in 1888.[6] She was the great-great-granddaughter of the man, aged 92 (who had been taken as a boy to see the famous Benjamin Rush), who so kindly worked out for me the family history. It is worth noting that another member of this family had had her appendix removed for the colic associated with oedema, and two had died of oedema of the glottis.

Visceral Lesions.

The visceral lesions are of two types. First, mechanical, due to the presence of exudate in the walls of the stomach or intestine, effusion of blood on a mucous surface, or into the substance of an organ; secondly, inflammatory, as nephritis, less often endocarditis, pleurisy, pericarditis, pneumonia, or peritonitis.

The cases have a dual etiology, infectious and metabolic. Purpura, with or without erythema and exudative lesions, may follow gonorrhoea, otitis media, parturition, phimosis, and local lesions of the skin. The rheumatic poison is believed to be responsible for a large group; and in the case of a child with severe purpura in the third and again in the fifth year, chorea in the sixth without endocarditis, severe urticaria in the same year with ill-health, chills, fever, and well-marked endocarditis, such a view is probably correct. The arthritis, too, is held to indicate the same cause, but it may have a very different explanation. The bacteriological examination of these cases has not been very satisfactory—no unanimity has been reached as to the organisms. On the other hand, there is a large group in which the lesions are an expression of perverted metabolism. Chronic angio-neurotic oedema, urticaria, and some forms of purpura are possibly anaphylactic phenomena in persons sensitized for certain protein substances. It is interesting to note that experimental sensitization may be transmitted. Hay fever, the idiosyncrasy to iodine, quinine, to strawberries and shellfish, are all manifestations of this supersensitiveness. The phenomena of serum sickness reproduce in a graphic way the features of the skin diseases which the French group under erythema. The local oedemas, the urticaria, the purpura, the arthritis, the vomiting, and the persistence for years of the sensitiveness, are paralleled by the lifelong liability to recurrence in some cases of angio-neurotic oedema and of purpura.

The diverse localization, the variable character of the exudate, now serum alone, now blood, or blood and serum together, are points that await explanation. The actual exudate is conditioned by the epithelial cells of the capillary wall, damaged by a circulating poison, as so well shown in experiments with snake venom. But it may only be some such subtle change in the blood serum as takes place in the peripheral circulation in paroxysmal haemoglobinaemia. In one patient exposure to a temperature near the freezing point at once brought out a crop of urticaria on the face; and Wild[7] reports a severe purpura following exposure to a great heat. Before long the anaphylactic key will unlock the mystery of these cases. The malignant purpura of the specific fevers and of the rare primary form may be anaphylactic phenomena. The following observation bears out the idea that the primary action of the noxious agent is on the epithelial wall. In a case of purpura fulminans seen with Dr. Brock at Rome[8] the skin was plum-coloured on the third day. Having abdominal distress at the outset, the man had put a large mustard leaf below the navel, which had reddened but not blistered an area of skin 6 by 8 inches. Everywhere else but into the skin of this region haemorrhage had occurred. The same blood had circulated, but the stimulating influence of the mustard had effected a change in the capillary walls of the area, enabling them to resist an injury to which all others had succumbed.

Cerebral Manifestations.

There are two groups of cases—the one with transient attacks of paresis, such as occur in Raynaud's disease and in arterio-sclerosis; the other in which the paralysis is due to coarse haemorrhage.

In Case xv[9] a man, aged 29, had had from the age of 12 recurring attacks of urticaria, angio-neurotic oedema, colic, purpura, haematuria, and albuminuria. When 13 he had a sudden attack of hemiplegia, which lasted for twenty-four hours, and during the year he had five or six attacks, in which for a few hours or for an entire day he lost the power of the arm or leg, usually on the left side. Some of these occurred in association with outbreaks of oedema.

It is possible that the following case is of the same nature:

Recurring Purpura for Six Years; Hemiplegia in an Attack; Angio-neurotic Oedema of Arms, Hands, and Feet.

Mrs. M. E. C., aged 69, seen with Dr. Cameron, October 5th, 1903.

The patient was a very healthy woman, of good family history. She had had five children. She was very strong and well until six years ago, since when she had

had recurring attacks of purpura on the legs and feet, rarely on the hands or face. Once she had a few spots on the conjunctivae. Never during this entire period for more than a week or ten days has the skin of the legs not shown haemorrhages. They came out in successive crops, and were usually associated with marked swelling of the feet. At first there was no swelling of the joints, but lately the knees and ankles have been painful and swollen in the attacks. She had seen scores of doctors, and in consequence of the attacks had become progressively debilitated.

For the past two years she had had on the arms and face remarkable swellings. In a few hours the hands would swell to such an extent that to take off the dress the sleeve had to be ripped. Big knot-like swellings as large as an egg would appear on the forehead, and the elbows and the knees would frequently swell. These swellings were never red, and there was never purpura with them. They would often coincide with a severe outbreak of purpura on the legs.

Two years ago, during the onset of an unusually severe outbreak of purpura, she had an attack with slight loss of consciousness, and for two days could not speak, and there was paresis of the right side, which gradually disappeared, and she got quite well. She had had at intervals bad bronchial attacks, but never colic.

She was a very thin, delicate-looking woman, pale and sallow. The pulse was regular, the heart's action fairly strong and regular. There was no swelling of the gums. The legs, from the knees down, were swollen, both ankles were enlarged, and the right little finger. From the hips to the toes the skin was of a very dark colour, from old faded haemorrhages, and there was an outbreak of fresh purpura in many places, very thickly set over the ankles, almost uniform. There was no heart murmur; no enlargement of the spleen or of the liver.

Coarse haemorrhage into the brain is not very common in purpura, but there are a good many cases in the literature; [10] I have notes of only three.

Purpura Haemorrhagica, Hemiplegia.

On February 27th, 1902, I saw, with Dr. Wegefarth and Dr. Thayer, Mr. F., aged 21. The condition was as follows: Resting on his left side, apparently sleeping, he could not be roused to consciousness. Blood was trickling from the left nostril; both had been plugged. He was breathing 24 to the minute; the pulse was 56, rather jerky. The superficial veins of the hands were very full. The pupils were dilated and inactive. The face was coverd with numerous petechiae, of large size. There were many bluish subcutaneous haemorrhages, and one or two subconjunctival. The skin of the body generally presented numerous petechiae, and in places quite large blotches of haemorrhage. On the thighs there were large subcutaneous infiltrations. On the back haemorrhages had occurred into the acne spots, many of which were capped with haemorrhagic scabs. There was bleeding from the gums, and there were haemorrhages beneath the submucosa of the lips. In a basin near by there was half a pint of dark, bloody fluid, and a large fresh clot was attached to the plug in the nostril. On turning him over, the left arm seemed specially limp, and he did not move it; it dropped "dead," and was much more relaxed than on the other side. No difference in the facial muscles. The left leg seemed more relaxed than the other, and the nurse said that he had not moved the limb on that side since morning.

The patient had been a healthy young fellow. There was no history of bleeding in the family. When a child of 2, after a fit of passion, he had had an attack of haemorrhage from the stomach. He had had occasional "nose-bleed," but nothing of any moment. Three weeks ago he had bleeding from the nose, which had been rather troublesome. On Sunday, February 23rd, he had recurrence, and Dr. Wegefarth had to plug the nostrils. On Monday and Tuesday it was noticed that he had a few petechial spots about his face and legs. On Tuesday and Wednesday he was up and about, but he had a little bleeding from the gums. On Wednesday the haemorrhages into the skin became more abundant; he had bleeding from the nose and from gums, and in the evening he began to have vomiting of blood, and has vomited four or five times since. He became very much worse to-day, and has been comatose. The blood coagulation time was not specially delayed.

Recurring Epistaxis, Purpura, Hemiplegia, Haemorrhage into the Brain.

In a case of Dr. Bressler's a man, aged 63, had occasionally had rheumatism, and for some months before his fatal illness recurring epistaxis. He then began to have bleeding from the mouth and gums, with purple spots over the body. When seen on June 28th he was pale, the body covered with numerous purpuric spots, the left foot swollen. The examination of the organs was negative. On July 4th, at 9 p.m., he had convulsions, limited to the left side. He became deeply comatose and unconscious; the paralysis persisted, and he died on July 5th.

At the autopsy the viscera looked healthy. On the right side of the brain there was a large subdural haemorrhage, covering the whole of the dura and the outer part of the frontal lobe. Immediately behind the fissure of Rolando was a clot as big a walnut extending into the brain substance.

Attacks of Purpura in the 7th Year, with Nausea and Colic; when 16 admitted with Purpura, Vomiting, Colic, Aphasia, and Right Hemiplegia; Operation; Death.

C. B., aged 16, admitted March 24th, 1904, with paralysis on the right side, aphasia, and blotches of haemorrhage in the skin. No history of haemorrhages in the family.

She was healthy until her 7th year, when she had scarlet fever, not a severe attack, after which purple spots began to appear periodically, sometimes once a month, sometimes less frequently, scattered over the body, face, and arms. The spots ranged in size from a small coin to the palm of the hand. She was treated for this trouble in the out-patient department on March 20th, 1897, and in June, 1897. In both of these attacks there was a history also of nausea and vomiting and abdominal pain. She had also bleeding from the nose. On March 24th, 1904, she was admitted, giving a history of having had the same recurrences of the skin trouble, and occasionally with attacks of nausea, vomiting, and pain. In one of these attacks in February of this year she had pain and swelling in the left ankle-joint, but no redness. She has only menstruated once, when she was about 12 years old.

She looks a strong, well-developed girl. The present illness began on March 22nd. She had been in her usual health, and had gone out to an evening party with some friends. Returning, she became suddenly unable to speak clearly. She herself was aware of this, and said that there was some difficulty in swallowing. She slept restlessly, and on the 23rd still had an inability to get the right word; no trouble in walking. On Thursday morning, the 24th, she was not so well, but she walked a considerable distance to the hospital. It was found that she could not speak. She moved her right hand and forearm a little, but she could not raise the arm to her head. There was no sign of paralysis of the face or of the leg. During the examination in the out-patient department she had a severe convulsion, beginning on the right side of the face and involving the arm and the hand. She had a second convulsion shortly afterwards, after which she became unconscious. There were numerous haemorrhages scattered over the skin, particularly on the chest, along the arms, and several large areas on the legs. The gums were not swollen; no bleeding from the mucous membranes. The blood count after admission gave red blood corpuscles 4,500,000, leucocytes 14,800, haemoglobin 20 per cent.; blood coagulation time 14½ minutes. Blood pressure 125 mm. The physical examination of the thorax and abdomen was negative. The spleen was not enlarged.

On the following morning I saw the patient at the ward visit. There was no sign of paralysis of the face. She could not speak, and she took very little interest in her surroundings. The right leg was not paralysed. I was proceeding to examine her chest when she began to twitch the forefinger of the right hand; then the fingers extended, the arm began to twitch, the head turned to the right, the eyes became staring, and in a few moments she had a general convulsion. She lay in a state of coma all day, and had five convulsions. Fresh haemorrhages appeared over the skin of the body and limbs. The condition seemed to justify operation in the hope that it was a cortical clot. Dr. Cushing exposed the left motor area, and found the dura very tense and the brain and subpial space of a uniform deep cherry colour, but no free clot. For the next three days she seemed better. There were no fresh convulsions, and she seemed to understand what was said, and on the 26th she made attempts at talking. She gradually became more comatose, and died on the 29th. There was no autopsy. The urine contained a trace of albumin, but no tube casts.

Ocular Lesions.

In anaemia and leukaemia, in cachectic states, and in arterio-sclerosis retinal haemorrhage is common, conjunctival less frequent. In the haemorrhagic types of the specific fevers extensive bleeding may take place, and in black small-pox I have seen the corneae sunk in a wall of subconjunctival haemorrhage. When in ophthalmic doubt I turn to de Schweinitz, but even in his encyclopaedic handbook I can find no reference to some of the complications here described, and the cases indicate how serious may be the lesions in the forms of skin disease under consideration.

In purpura haemorrhagica bleeding may take place into the eyeball. In the fatal case seen with Dr. Wegefarth and Dr. Thayer the right eye was completely filled with blood clot.

Recurring Purpura for Years; Haemorrhage from the Conjunctiva.

A woman, aged 63 (seen with Dr. F. F. Smith), whose mother and twin sister had both died of purpura, began to have haemorrhages when about 54, passing blood occasionally from the bowels and from the kidneys. Two years later she had severe attacks of epistaxis. In 1902 she had haemorrhage from the right conjunctiva for twelve days, which was only controlled by compresses. When I saw her she had had severe pains in the legs and had had outbreaks of purpura in the course of the superficial nerves.

Purpura Haemorrhagica, Haemorrhages into Right Eye with Detachment of Retina.

In a severe and fatal case of purpura, Frank A., aged 22, admitted January 1st, 1895, Dr. Randolph reported on January 5th widespread haemorrhages in the right eye with detachment of the retina on the inner and lower half; many retinal haemorrhages also in the left eye.

There is another group of extraordinary interest in which the eyes are seriously inflamed in connexion with the skin lesions of the erythema group. The cases are rare.

Recurring Colic; Angio-neurotic Oedema and Erythema on and off for Five Years; Freedom for a Couple of Years; Recurrence with Iritis and Retinal Haemorrhage; Ophthalmitis; Removal of Eye.

On March 30th, 1901, I saw P. M. M., aged 41, a patient of Dr. Billings and Dr. George Fiske of Chicago, who had had a very chequered medical history. During 1890, at intervals, he had severe attacks of colic, and appendicitis was suspected. Previous to this he had had once an eruption on the skin. In 1891 swellings appeared in the fleshy part of the legs, which were sometimes red, sometimes not. They were called erythema, and in one attack the well-known dermatologist, Dr. Hyde, diagnosed erythema nodosum. With the attacks he had iritis of great severity. These attacks recurred during the next few years, so that his life was a burden. He sometimes had severe pharyngitis. In September, 1895, with swellings in the calves and thighs, sometimes red, sometimes not, and stiff ankles, he had iritis and acute orchitis. At Christmas, 1895, he had choroido-retinitis. Then for a year or two he was better. The attacks recurred in April, 1900. He was operated upon for iritis, and in May, 1900, the left eye had to be taken out. He was better until January, 1901, though he had slight attacks of the swellings; then the right eye became involved—slight retinal haemorrhages—and he was again threatened with iritis. In October and November he was much troubled with the swellings, which would come and go, appearing suddenly and lasting eight or ten hours, recurring during three or four days—evidently in part haemorrhagic, as the skin was often left with a deep brown stain. He had several slight attacks of swellings about the elbows and once on the thumb. A month ago he appeared to have a slight erosion on the cornea. Of the patient's two children, one has had swellings in the right leg and in the thigh, very like those that afflicted the father. There have been no changes in the blood or in the urine. He has tried all possible plans of treatment without receiving any benefit.

There can be no doubt that this case belongs to the group under consideration. The swellings sometimes resembled erythema nodosum, sometimes angio-neurotic oedema. How tragic this ocular association may be is shown by the following case.

On Third Day of Febrile Attack, Purpura, Iritis, with Ocular Haemorrhage; Blindness.

Mary E., aged 8, seen May 21st, with Dr. Jones of Mount Washington. She had been a healthy girl, with good family history. She was seen first by the doctor in a slight febrile attack without any local features. On the third day there was an outbreak of purpura all over the body, some spots as large as 8 or 10 mm. in diameter and slightly raised. The hands and wrists and ankles were swollen. She became delirious, and was very ill. On the third day of the attack haemorrhagic spots appeared on the conjunctivae, and there was intense pain in the eyes.

Dr. Randolph determined the presence of iritis with severe haemorrhage. The condition of the eyes grew rapidly worse, and within three days the sight was completely lost. The child remained very ill for seven weeks, with recurring attacks of purpura. After the first week the fever was slight, there were no changes in the urine, and the child gradually recovered, but with extensive degeneration in both eyeballs—the lenses opaque and adherent to the irides.

In this last case, also of great severity, the child has fortunately recovered with some vision.

Purpura; Colic; Infiltrated Areas of Skin with Necrosis; Acute Iritis and Capsulitis.

R. A., aged 7, admitted to the Radcliffe Infirmary under Dr. Mallam on May 21st, 1912.

On Friday, May 17th, he was at school. In the evening he complained of pains in the legs, and was much disturbed all night. He was seen by Dr. Venning of Steeple Aston on Saturday, and throughout that day and on Sunday he became much worse; there were vomiting and diarrhoea; the temperature rose on Saturday, and in the evening he became delirious. On Sunday his mother first noticed purple patches on the skin, and on that day he began to complain of pain in the eyes, but they looked all right on Monday. As he seemed very ill, and the temperature was rising, he was sent in to the infirmary. There were purpuric spots on the arms and legs, and several large ones formed by the coalescence of smaller ones. On the right shoulder was a raised patch with a deep inflammatory base, 4 cm. in length by 2 cm. in width, covered by a haemorrhagic bleb. There were three others of this character, one on the right leg and two on the buttocks. The right shoulder was slightly swollen, both elbows tender, but the skin not red.

The following is an abstract of Mr. Adams's note on the eyes: Corneae dull and steamy, conjunctivae injected, anterior chambers filled with a cloudy exudate which hides the iris except at the periphery. In the left eye inflammation not so intense, but a film of exudate spreads over the iris, and there was a collection of yellowish material in the lower half of the anterior chamber, but without a straight margin, as in hypopyon. In neither eye is there much ciliary injection. On the 23rd both eyes were better, the corneae brighter, but there were central films of opacity on the anterior capsule of the lens, and the cornea of the right eye was still dull.

For the first two days in hospital the temperature ranged between 102.5° and 103°. On the 23rd he was given 20 c.cm. of an antistreptococcic serum. On the 24th the right elbow was more swollen and the left elbow was also stiff. The skin spots were subsiding, but the larger areas were covered with haemorrhagic blebs. On the 25th he had an attack of abdominal pain. The large patch on the skin of the right shoulder was less swollen, but presented a dirty-looking necrotic centre. The blood count was: Red blood corpuscles, 3 millions; haemoglobin, 50 per cent.; leucocytes, 13,100. The spleen was not enlarged. On the 25th and 26th the temperature remained about 101°; on the 27th, 28th, and 29th it fell, and became normal on June 2nd.

On June 1st Mr. Adams's eye note was: *Left eye*, cornea bright, central opacity on anterior capsule of lens is smaller. *Right eye*, iris still very muddy, pupil irregular, much injection of the cornea and conjunctiva. The patient's general condition was much better, and from this time on he improved rapidly.

Gastro-intestinal Symptoms.

To these, the most distressing though not the most dangerous of the visceral complications, the name of Henoch is given when associated with purpura, though they occur with any member of the erythema group of skin lesions. The manifestations may be for years abdominal without skin eruptions.

Colic is the common symptom, and occurred in 25 out of 29 cases analysed in 1904.[11] The attacks may be transient, lasting only a few minutes, but recurring several times during the course of the day. They may be of great severity, causing the patient to writhe in the bed. They occur most frequently at night. The attacks are independent of diet, and occur with the skin rash or in the intervals of the outbreaks until the rash fades. In protracted cases the colic may not appear for a couple of months, and then be very severe. The position of the pain is usually central, and may radiate to all parts; very often the child cannot fix upon the spot accurately. I have never met with an instance in which the pain was limited to the right iliac fossa. The abdomen is usually flat, not painful on pressure, without increase in the muscle tension, though it may often be difficult to palpate the child satisfactorily. There may be marked tenderness along the transverse colon.

Vomiting, with or without pain, is perhaps quite as frequent as colic, with which it is very often associated. If the child has eaten recently, the food is vomited with mucus and watery fluid, and, if the vomiting is very severe, flakes of blood. It may be frequent, without pain, and there are remarkable gastric crises such as I described in Case I of my first series,[12] in which, with the colic and vomiting, the patient had fever and delirium. In some attacks there were no skin lesions.

Vomiting of blood is common enough in severe types of purpura. It may also occur in connexion with colic in milder forms which have no extensive cutaneous haemorrhages or bleeding from other mucous surfaces.

Diarrhoea, which is not nearly so common as vomiting, is of two types; increased frequency of the stools, either lienteric or watery, three to six in the day, with blood and mucus. With severe purpura the blood may be in large amount, colouring the entire stool, and very little changed. In the ordinary cases with the colic the stools contain mucus streaked with blood. In connexion with the diagnosis the colic, frequency of the stools, and the blood may be highly suggestive of intussusception, for which, indeed, operation has been performed.

The study of the conditions under which the gastro-intestinal crises occur is of special importance. It may be useful to group them as follows:

First, *cases without skin lesions*. On several occasions I have drawn attention to this interesting type. In Case I, a man aged 27 had for six years attacks of colic with diarrhoea, always associated with raised blotches of erythema, forming large whelks and wheals, which turned black. For two years he has had the abdominal pains without any skin lesions. In Case XIII the patient was operated upon in November, 1896, for an ovarian tumour, and one week after she had the first attack of abdominal pain, and two subsequently while she was in hospital, in each of which morphine had to be given. For six months the attacks recurred every week or ten days, often of such severity that she had to cry out. It was a dry colic, and never associated with a skin rash. Then on June 3rd she was admitted to hospital with fever in an outbreak of typical exudative erythema—hands and feet, face and neck. The attack was very severe, but she recovered after two relapses. Subsequently she had very little colic, but in 1931, in Russia, she had haemorrhage from the stomach. On February 12th, 1902, while leaving the theatre, she had profuse haematemesis, which was repeated during the night. The next morning I saw her in a state of profound anaemia, with the most striking cadaveric odour I have ever noted. She died that evening. In Case XVIII,[13] a child, aged 7, had swellings of the knees in the first year; from the second to the seventh recurring attacks of adbominal pain with vomiting, but no skin rashes; admitted in an attack of pain, with vomiting, with purpura and urticaria, outbreaks of which occurred during her admission. The following is an illustrative case in which the gastro-intestinal attacks were of great severity, occurring at intervals of from a few weeks to two or three months between the first and tenth years; the skin lesions were only occasionally present.

Attacks of Fever with Colic and Gastro-intestinal Trouble from 1st to 10th Year; Recurring Outbreaks of Urticaria, Purpura, and a Vesicular Rash; Good Health in the Intervals; Gradual Recovery.

Alex. L. C., aged 10, seen May 11th, 1908, with Dr. Moorhead of Bath, was a healthy baby; weighed 8½ lb., but did not thrive till weaned. From the first year he has had recurring attacks of gastro-intestinal trouble, beginning usually with slight fever for one day, then abdominal pain of a colicky character, sometimes with a shivering fit so that the bed would shake; not often vomiting, usually some diarrhoea. The fever persists for two or three days, the pain for four or five. The abdomen sometimes becomes swollen. The stools often contain large quantities of mucus, and in one of the worst attacks which he had at 5 years there was blood. The urine was never abnormal. He has never had any swelling of the joints. These attacks have recurred at intervals of from a few weeks to two or three months ever since his first year. With many of the attacks he has had remarkable skin rashes, most frequently like ordinary hives occurring on the legs and arms, and they come out in successive crops. On several occasions the skin eruption has been purple, and the spots persisted. In one attack the diagnosis was made of chicken-pox, as the arms and legs and the entire trunk were covered with small spots which became vesiculated. In the intervals between the attacks he is very well. His mother thinks that diet has no special influence.

There is nothing in the family history; there are two other healthy children. He is a well-grown boy with a good colour, and weighs 4½ st.; the tongue is clean; teeth are good; skin of the face clear; the chest is well formed, good expansion; abdomen natural looking, no distension, everywhere soft, no tenderness; descending colon readily felt; spleen not palpable; pylorus not palpable; no distension anywhere of the colon; liver is not enlarged; right kidney just palpable; upper limit of liver flatness is on the fifth; apex beat of heart in normal situation; no enlargement of organ; heart sounds are clear; joints not enlarged, nowhere tender; no fibroid nodules; the skin is everywhere clear, nowhere any trace of old spots. The attacks are evidently of great severity, but they are fortunately lessening. He only had two in 1907, and has had no attacks since November. His stay at Bath has improved his general health very much, and he looks now in good condition. I heard of this case two years later; the attacks have diminished in frequency, and he has grown much stronger.

It is quite possible that certain cases of children with obscure cramps may belong to this type. In my third paper[14] I have referred to a family in which the mother, until puberty, had attacks of colic and vomiting. Three children have had hives very badly, and the boy, aged 13, had had for nine years, at intervals of from a month or two, sometimes for a couple of weeks, every day severe colic, occasionally of extreme severity. There was never pain in skin rash.

Secondly, *in association with haemophilia.* In this disease, as is well known, it is not simply a matter of bleeding from accidental blows or cuts, but there are spontaneous haemorrhages, cutaneous, arthritic, and visceral. With the latter the symptoms may suggest the acute abdomen. I saw on his deathbed a few months ago, with Dr. Birch, a boy, a bleeder from infancy, who had twice had haemorrhage into the peritoneum, once producing a condition highly suggestive of acute peritonitis.

In Larned's[15] case a haemophilic subject on August 24th, 1907, had a curious abdominal attack which was diagnosed Henoch's purpura. There was general abdominal pain and distension. There was no marked muscle spasm in the right iliac fossa, and no special point of tenderness.

One is doubtful whether this was really a case of haemophilia, according to the more strict definition introduced by Bulloch, as the history is somewhat indefinite, and both women and men of the family have bled; yet the patient had had frequent epistaxis, there had been difficulty in checking bleeding from slight wounds, and in 1902 he nearly bled to death after an operation for ingrowing toenail.

An Oxford patient, evidently a bleeder, frequently admitted to the Radcliffe Infirmary, has had on several occasions severe attacks of abdominal pain. On September 17th, 1905, he noticed pain in the abdomen; on the 18th, 19th, and 20th the pain was severe, and he remained in bed. The bowels were loose, and the stools were dark-coloured. On the 21st he was sick at the stomach, and the vomitus was blood-stained; on the morning of the 23rd the pain was again very severe, requiring a third of a grain of morphine for its relief. There was a large subcutaneous haemorrhage along the inner side of the left leg; there were no other haemorrhages. The colic recurred at intervals in less severe attacks for a week or more, and gradually disappeared. Twice before he has had attacks similar to the present, the last one three years ago, and both associated with blood in the vomitus and in the stools. He has had altogether four or five attacks of this character.

In this family, the history of which was worked out by the late Dr. Leckey, there was no trace of a bleeder. The mother knew of no case in her family, in which there is a marked tuberculosis history. She has two sons and two daughters; both of the sons, of whom the younger is the patient, have shown from birth a marked tendency to bleed. The father states that they were never expected to live, as they bled profusely from cuts, often from the nose; slight bruises would be followed by enormous haemorrhages beneath the skin; extraction of teeth in both was followed by protracted bleeding. The brother, who had had epistaxis, cutaneous haemorrhages, and bleedings into the joints, accompanied with great pain, became tuberculous and had profuse haemoptysis, and died at the age of 27.

The patient himself I have seen frequently, and it is difficult to escape the conclusion that both he and his brother were genuine bleeders. He has had all varieties of bleeding—cutaneous, spontaneous blotches, has bled profusely from accidental cuts, after extraction of the teeth, and slight blows would be followed by enormous bruises. He has had many attacks of swelling of the knees, with pain and haemorrhage into and about them.

Thirdly, *with ordinary urticaria.* I have seen a number of cases illustrating this association. No. xiv of my reported series, a physician, in whose case I was very much interested, had from his twentieth year, at intervals of a few months, most extraordinary outbreaks of urticaria, with nausea, vomiting, and abdominal pain. He finally died in an attack which began in the usual way, persisted, and passed into one of fatal purpura haemorrhagica.

For Five Years recurring Attacks of Urticaria, with much Oedema, Vomiting, and Abdominal Distress.

I saw on October 25th, 1901, a man who to the age of 45 had been very healthy, without special digestive disturbance. For five years his life had been a burden with recurring attacks of urticaria, associated with vomiting of an aggravated type. For an hour or two before the attack he has a feeling of uneasiness, sometimes shivering, or even a positive chill, then the wheals come out over all parts, as a rule several hours before the vomiting comes on. In bad attacks the skin rash is very extensive; the whole body appears swollen, the hands are puffy and covered with red and oedematous blotches, the lips are swollen and stiff. The vomiting lasts from ten to twenty-four hours; nothing stays on the stomach; there is never actual pain, but a great deal of distress with the vomiting. He has never been jaundiced, and he had no diarrhoea. At first he thought that indiscretion in diet brought on the attacks, but regulating the food had been tried without success. In the five years the longest interval between the attacks was three and a half months; he has had one every month for the past six months. He was very large and stout when the attacks came on, and in the five years he lost 70 lb. in weight! He now looks a man in excellent health; good colour, with clean tongue; and the most careful examination revealed nothing wrong in any of his systems. His blood coagulation time was normal. Prolonged treatment with grey powder and calcium lactate gave him great relief, and he passed several months without an attack.

A very similar case has been reported by Dr. J. J. Pringle. For nearly fourteen years a man had recurring attacks of urticaria of great intensity, with many of which there was profuse haematemesis. I heard from Dr. Pringle recently that this patient has recovered completely, and is now a healthy man of 80 years.

Fourthly, *angio-neurotic oedema*. In the ordinary forms in which there is transient oedema of the eyelid, or of the forehead, or of one hand, there is not often colic, but in the severer varieties the gastro-intestinal crises may be a special feature. I have already referred to it in the family form, in which it is apparently very common. The abdominal attacks may occur alone, or with very slight swelling. The following is a good illustration, occurring also in the familial variety.

Father and Sister the Subjects of Angio-neurotic Oedema. Attacks from the Fourth Year of great severity, usually of Oedema, but sometimes Erythema, associated at times with Vomiting and Pain.

Miss F., aged 58, referred to me April 7th, 1910, by Dr. Martyn of Exmouth, who wished me to study the case, knowing my interest in the subject.

Family History.—Father died at 86 of strangulated hernia. He had been subject to attacks of swelling all through his life. The daughter had seen him in many of these. Sometimes one arm would swell to double the natural size. Some of the attacks were of great severity, and associated with great pain in the abdomen and sickness. They did not diminish as he grew older, and he rarely passed a month without an attack. His mother was not subject to it. The family consists of one brother and two sisters. The brother has never been attacked. The sister, now aged 60, began to have attacks at her 29th year. The swellings are chiefly in the hands and feet, and she only occasionally has vomiting and diarrhoea with them. She has six children, none of whom have been affected.

The patient began to have attacks at the age of 4; all through her childhood she was greatly troubled, and of late years they have recurred with great frequency. At one time she would pass six weeks or two months without an attack, then they came on one in a month, then every ten or twelve days; now she rarely passes a week without swelling somewhere. They come on any part of the body, not so much on the face now as formerly. She has had attacks which were supposed to be erysipelas, so swollen, red, puffy, and oedematous were the eyelids and face. Now the attacks are generally in the hands or arms or somewhere on the trunk. She can tell a little while before they come on, as she feels very heavy and dull and has attacks of yawning. The swelling lasts for from three to six hours, rarely for twenty-four or thirty-six. The spots are generally pale-looking, occasionally red and shining. She never remembers to have seen red or black spots, nor has she had any haemorrhage from the mucous membrane. As a rule with the swelling there is an uneasy sensation in the abdomen, often amounting to actual colic; then she has retching and vomiting, but never diarrhoea. She has had severe abdominal attacks without the skin swelling.

Fifthly, the largest group in which the gastro-intestinal symptoms occur in connexion with simple purpura with or without urticaria. To-day the frequency with which these attacks are mistaken for appendicitis makes the condition important. Take, for example, the following case, which I saw preliminary to the surgeon being called in, as the symptoms were so suggestive of the acute abdomen.

H. V., aged 15, seen with Dr. Wainwright, May 23rd, 1908. He has been always strong and well, with the exception of a tendency from the sixth month of age to what his mother calls the "bumps." On and off, at intervals of from a few weeks to six months, spots came out over the skin, sometimes like ordinary hives, sometimes like flea-bites. He has never had a very severe attack. The mother attributed the condition to indiscretions in diet. Lately he has had, as a rule, two or three attacks a year, most commonly on the arms and legs. They take two or three days to disappear, and sometimes come out in crops. Early in May he was at Brighton, and he complained of some pains in the legs and wrists. Shortly after May 12th the attack came on with slight fever, and he had to go to bed. The next day he was covered—arms, legs, and back of the neck—with bright red spots, the individual ones raised with marked erythema between them. They began to fade and left the skin stained. Every few days there have been recurrences. The last crop came out yesterday. On the 13th he began to have pain in the abdomen, not localized, not associated with vomiting, and not increased by food. During the next few days it became more intense, occurring in paroxysms, and on the 19th he had several very severe attacks, and appendicitis was suspected. The abdomen was never distended. It was tender in the flanks below the costal border, not over the appendix. He had no vomiting, no diarrhoea, but the stools were singularly offensive. On the 20th he passed a small mass like orange pulp streaked with blood. The urine was normal. On the 12th and 13th the temperature was normal, on the 14th, in the evening, 100°; since then it has varied between 99° and 101°. Last night it was 101°, and 100° this morning. At 4 o'clock yesterday morning he had a slight chilly feeling.

Examination.—Rather a delicate-looking boy; tongue lightly furred; a spot like a recent wheal on his left cheek. He does not look very ill, and gives a very good account of himself. *Skin:* Arms and legs covered with fading urticaria and with stains of former patches. On the arms are several fresh spots. The legs to the upper part of the thigh are covered with the same fading stains, and there are a few fresh wheals, no purpura, no spots on the trunk. There is no arthritis. *Abdomen:* Flat, natural looking; respiratory movements a little restricted, but he takes a deep breath without wincing; the appendix region not tender. Nothing abnormal in chest. The boy made a rapid recovery.

The following case was admitted to the surgical ward of the Radcliffe Infirmary:

R. D. B., aged 20, was admitted April 1st, 1912, supposed to have appendicitis or intestinal obstruction. Two weeks before he had had pain in the lower part of the abdomen and had vomited twice. Last week he again had abdominal pain and slight stiffness and swelling of the calf of the right leg. The abdominal pain had increased, and he was admitted to the surgical ward. There was no distension of the abdomen, but he had pain, and the motions contained some mucus streaked with blood. Within twenty-four hours of admission he complained of stiffness in the elbows, and was found to have purpura, so that he was transferred to Dr. Collier's ward. He was a healthy-looking man of good colour; he complained of pain in the epigastrium and stiffness of the elbows. There were purpuric spots upon the right external malleolus, both elbows, and the left shoulder. One of these patches was large and raised with a diameter of about 1 cm. The heart and lungs were normal; the spleen could not be felt; the liver was not enlarged. The urine had a specific gravity of 1010, with a slight cloud of albumin, no blood. Red blood cells were 5,100,000; haemoglobin, 95 per cent.; leucocytes 11,200.

On the first day after admission he vomited after each meal, and there were streaks of blood. The pain was less, though he had a sharp attack during the night. There was an extension of the purpura both in legs and arms. On April 12th there was a small amount of blood in the stools, and he vomited several times. On April 13th and 14th no vomiting; the purpura was fading, but on the dorsum of the left foot there was a definite haemorrhagic bleb. On April 15th he had an attack of abdominal pain and vomited once. From this time on he improved rapidly, the albumin disappeared from the urine, and he was discharged well on May 1st.

I have known at least five cases admitted to the surgical wards, and many instances of operation for appendicitis have been reported in the literature. Sutherland[16] has collected many of these, and the more recent ones have been collected by Withington[17] and by Seymour

Barling.[18] The condition found with operation has been local infiltration of the bowel wall with blood or with serum. In the majority of cases the ileum has been involved. In a case reported by Jacobson [19] the appendix itself was involved in haemorrhagic oedema. In a woman aged 37, with fever and pain in the right side, operation showed an acutely inflamed haemorrhagic appendix. Following the operation the patient had haemoptysis, epistaxis, and an outbreak of purpura.

Lastly, *intussusception* may complicate abdominal purpura or angio-neurotic oedema. One can understand how easily this may follow local infiltration of the bowel wall. Several cases have been operated upon successfully by Tonking,[20] Lett,[21] and Seymour Barling. In Lett's case death followed a second attack of intussusception. Without the characteristic sausage-shaped tumour the diagnosis is difficult, as the frequent small stools of blood and mucus—often, indeed, large amounts of blood—are not uncommon features in abdominal purpura. As the difficulty in examination may be great, in a doubtful case an anaesthetic should be administered. It is well to remember, however, that a palpable tumour may be caused by a massive exudate into the bowel wall itself, Greig's case; [22] by a clot in the lumen of the bowel, as in FitzWilliam's case,[23] or by a massive haemorrhage into the mesentery, as reported by Lett. In a case reported by Parkinson [24] operation was performed for suspected intussusception. Death occurred on the following day. *General peritonitis* was found with haemorrhages in the walls of both large and small intestines. In a case reported by Vierhuff [25] an adult with purpura haemorrhagica and blood in the stools and symptoms of intussusception recovered after passing a piece of the bowel. A remarkable case of peritonitis is reported by Silbermann.[26] A child, aged 10, had purpura, arthritis, fever, colic, haemorrhage from the stomach and the bowels; in a relapse there were symptoms of the acute abdomen and of diffused peritonitis. *Post mortem* a small perforation was found in the fundus of the stomach.

Renal Complications.

These are the most serious of the whole group. I have excluded the haematuria when one of the manifestations of purpura haemorrhagica, that is to say, in cases of widespread bleeding into the skin and from the mucous membranes.

In the ordinary angio-neurotic oedema there may be transient albuminuria, but nephritis is rare. In my third paper I called attention to the seriousness of nephritis as a complication of the erythema group. Of the seven deaths in that series five were with uraemia. I have now additional cases to record. All of the cases had albumin with tube casts or blood. All but one of the cases with nephritis had purpura. No case had angio-neurotic oedema alone. Four had recurring attacks of polymorphic skin lesions. The cases fall into three groups.

1. Those which ran an acute course with dropsy, and death in uraemia within three months. Cases III and VIII of my published series[27] resembled ordinary severe nephritis with dropsy. Death occurred in both within twelve weeks of the onset. One was a child of 6, the other a child of 5, in whom nephritis came on in association with recurring purpura. In two other cases, Nos. XIX and XXVI[28] nephritis was a terminal event in a long series of skin and visceral manifestations, in one case in the seventh and in the other in the eighth month of the illness.

2. In a second group the albumin disappears and the patients get perfectly well. There were ten of such in the series. It may take several months before the albumin disappears. The general health may be excellent, while the urine shows a large amount of albumin and many tube casts.

Thirdly, in a fortunately small number of cases the nephritis becomes chronic. In the three reported here for the first time, albumin and casts have persisted for months. The danger is the gradual development of a progressive nephritis with the usual secondary cardio-vascular changes. I saw frequently with the late Dr. Prentice of Washington a boy who in his 13th year had three typical attacks of Henoch's purpura with acute nephritis. In the following year he had several terribly severe outbreaks, in one of which large haemorrhages into the skin sloughed. The boy was shown by Dr. Prentice at the Association of American Physicians with dropsy, albuminuria, retinitis, increased tension, stiff arteries, and hypertrophied heart.

The following cases, not yet reported, will give a general idea of the severer forms of nephritis.

Epistaxis; Pains in Hip and Swelling of Legs following a Wetting; Purpura; Recurrence of Attacks; Slight Fever; Haematuria; Much Albumin, Tube Casts; Angio-neurotic Oedema; Gradual Recovery; Persistence of Albumin in Large Amount Nine Months after Convalescence.

Harry C. (admitted to the Radcliffe Infirmary, under Dr. Mallam, February 2nd, 1912), aged about 20, with negative family history, and uniformly good health, except that for the last five or six years he has had frequent epistaxis. He got a wetting on Saturday, January 6th, 1912. On the 9th and two or three days subsequently he felt pain in the right hip; then he noticed that his legs began to swell at night, and three or four days later red spots came out on the skin of his legs. He was able to go on with his work, though he felt stiff and sore. He slept well and had a good appetite.

I saw him on Tuesday, February 6th. He then had an extensive purpuric rash on the skin of the legs—a fresh crop, he said—and there were signs of old spots. Both feet and ankles were slightly oedematous. The abdomen seemed normal. The backs of the hands were puffy and oedematous. The urine had a fair amount of albumin and a little blood, with numerous epithelial casts. He got better rapidly and sat up. In a few days he had another attack of purpura. On the 9th he complained for the first time of pain in the abdomen and vomited in the evening. He had slight fever, up to 100.5°. For a week he was better and the purpura faded. Then on the 18th he had sudden swelling of the right hand, which on the following day spread up the right arm to the elbow, and the left hand was also swollen. Every day there was slight abdominal pain. The temperature on February 18th was 101.2°; still albumin in the urine and a trace of blood.

On February 20th he had swelling of the right upper eyelid. He passed a small quantity of bright red blood from the bowel. On the 21st he had haematuria ; on the 22nd he looked very ill. He vomited five or six times during the night, had a great deal of abdominal pain, the right eyelid was much swollen, the oedema was in spots petechial. Numerous granular casts and many blood corpuscles in the urine. On the 23rd a fresh crop of purpura appeared about the elbows and knees, and the vomiting persisted. For the next week he had at intervals paroxysms of severe abdominal pain. The vomiting was better, the swelling of the eyelids disappeared, but he had successive crops of purpura about the wrists and ankles. Early in March he began to improve, the pains disappeared, and up to the 15th he had no reappearance of the purpura. The albumin was still present on his discharge, and he had lost 15½ lb.

October 21st, 1913. He came back for examination today. He looks perfectly well, has gained his normal weight, has a good colour, general examination negative. Apex beat is in normal situation, arteries are not sclerotic, urine still shows a large amount of albumin, and in the centrifugalized specimen many tube casts, chiefly hyaline, a few granular.

Severe Attack of Henoch's Purpura, with Necrosis, and Ulceration of Spots on the Legs; Nephritis; Many Slight Recurrences; Admission in a Sharp Attack, with Abdominal Pain and Haematuria; after Several Relapses, Discharged Cured, but with Much Albumin in the Urine.

Gladys B., aged 14, admitted under Dr. Brooks, June 23rd, 1913, with pains in the legs and purpuric eruption. She was in the Leicester Infirmary in the winter with a severe attack of Henoch's purpura, haematuria, with albuminuria and tube casts. There were extensive haemorrhagic lesions on the legs, many of which broke down, leaving ulcers which took a long time to heal. Since leaving the infirmary she has had several attacks of purpura fever. On admission she had no fever, but a purpuric eruption on the legs, which on the following day extended to the hands and arms; some of the spots were raised and urticarial. Urine: Specific gravity 1014, moderate amount of blood, much albumin, Esbach 0.3. On the 26th she had severe vomiting, no pain, but she brought up a little blood. During July she had recurring attacks of urticaria and purpura. Once she had bleeding from the gums and she has had several attacks of abdominal pain. The haematuria has been persistent. There was blood until the week of her discharge. The specific gravity of the urine was about 1015, the albumin was always very abundant, and there were a moderate number of hyaline and epithelial tube casts. She left the infirmary on October 1st very much better, having gained in weight.

I saw her again on October 14th. She looked well, general condition good. There was still a very large amount of albumin, curdy and thick, occupying the greater part of the test tube above the acid. There were a few hyaline and epithelial tube casts.

She was readmitted in November, another mild attack of purpura. There was no change in the urine.

Dr. Sturrock has allowed me to make a reference to the following remarkable case at present under his care:

On June 11th, I saw with him a lad, aged 9. A week previously he had a sudden swelling at the back of the right hand. That night he had an attack of colic. A few days later there was an eruption of purpura on the feet and legs and slightly on the arms. The temperature was 100–101°. For the first month colic was the troublesome symptom. The first crop of spots faded, and were succeeded by others of the same description. Urine was normal.

During July he had occasional attacks of colic, and spots at intervals. On the 20th he had another profuse outbreak, covering the arms and legs and abdomen, with several large confluent patches over the knees, arms, and shoulders, and some of the spots were raised and firm. He had had some vomiting, and had brought up some blood. Afterwards he had had blood and mucus in the stools. This morning he had a large bloody stool with clots. In the afternoon he began to vomit, and brought up much blood and mucus. In the absence of Dr. Sturrock I was called hurriedly about 3 o'clock, and his condition looked very serious. Purpura had extended. The spots were very thickly set on the abdomen and about the joints. The pulse was 140. He was very nauseated and looked collapsed. Dr. Gibson at once prepared fresh human blood serum, of which he had three injectious of 10 c.cm. within twelve hours. Whether *post hoc* or *propter hoc* it is difficult to say, but he improved rapidly. He had no further vomiting, and for ten days steadily improved. Albumin appeared in the urine, but not in large amounts.

Towards the end of July haematuria appeared. The urine at times was bloody, at others smoky. There was a large amount of albumin and a few tube casts. During August the boy's condition was on the whole better, but the urine remained smoky with much albumin. About the middle of the third week he had an attack of angioneurotic oedema, involving first one side of the forehead, then the whole face, and lasting four or five days, without redness. He continued to have at intervals crops of spots.

About September 1st spots appeared on the backs of the hands, about the ankles and calves, of a different character—raised, infiltrated, haemorrhagic—from 3 to 6 mm. in extent, bright red in colour, and firm to the touch. Scattered among them were seven or eight hemispherical, yellowish-brown spots of a molluscoid character. On the back of the right leg were two pemphigoid blebs, with narrow red areolae, one of which was $1\frac{1}{2}$ cm. in diameter. Both were extraordinarily firm and solid. Scattered over the trunk were a few reddish raised papules, several of which were capped with small blebs. The urine has increased in amounts of 60, 70, 80 oz. in the day, and almost every specimen is smoky; sometimes there is a bright red sample. I examined on September 15th two samples, evening and morning. The amount of albumin in both was large and thick and curdy. Specific gravity in the morning 1004, in the evening 1012. Many blood corpuscles; both samples were centrifugalized, and in a large number of slides there were only a few hyaline casts.

In October and November the skin lesions were better, but he lost in weight, and there has been no change in the urine. Occasionally in the morning it was free from blood, but as a rule it was smoky and contained much albumin, but only occasionally a tube cast. On October 20th, on the left arm, there appeared one of those curious solid blebs about the size of a large pea, quite firm, hemispherical in shape, and the skin about it not reddened but infiltrated, and solid to the touch. During December he was on the whole better, and passed from 60 to 70 oz. of urine. There has been only occasionally spots, sometimes petechiae; sometimes solid, raised, red papules about the elbows and knees. The tongue cleaned. The worst feature is the recurrence, at intervals of from a week to ten days, of attacks of vomiting, with which, as a rule, the amount of urine diminishes; the temperature above 100, sometimes 101; and during these attacks there is an occasional tinge of blood in the urine. As a rule the specific gravity is very low—1004, 1006—the amount of albumin very large, tube casts scanty.

The anatomical lesions of this type of nephritis with purpura have not been much studied. I have not had a *post-portem* examination on any one of my fatal cases. Through the kindness of Dr. W. T. Watson[29] and Dr. W. A. MacCallum I saw the kidneys of a typical case in which death occurred with dropsy at the end of the sixth week from the outbreak of purpura. There was no endocarditis, the spleen was greatly enlarged, the kidneys were enormous, each measuring 12 by 7 cm.; the cortices were pale, the striations distinct, and the glomeruli stood out as translucent nodules like miliary tubercles; there were a few small haemorrhages. In addition to the extensive degeneration of the epithelium, the tubules were filled with desquamated cells, hyaline casts, and red blood corpuscles. The glomeruli showed remarkable changes. Every tuft was much compressed within by a new growth of the capsular sheath, forming a crescentic mass. Dr. MacCallum tells me that this is a type described as adhesive glomerulo-nephritis, in which, with great proliferation of the epithelium, there is also a new growth of connective tissue within the capsules.

Clinically, there are several features of great interest in this type of nephritis. Long after all signs of cutaneous symptoms have disappeared haematuria may persist for months, just enough, perhaps, to tinge the urine.

Secondly, the albumin is unusually abundant, thick and curdy. Thirdly, with large amounts of blood and albumin, tube casts may be absent and scanty. Fourthly, dropsy may be absent, even when the nephritis has persisted for months, as in the three cases at present under observation. And lastly, for months after the patient has recovered his usual health, albumin may persist in the urine in large amount.

The *diagnosis* of the nephritis associated with the skin rashes of the erythema group is as a rule easy, only it must be borne in mind that oedema may not be present, and that the nephritis may persist long after the cutaneous symptoms have disappeared.

The combination of nephritis with a skin rash in which the erythema predominates may lead to the diagnosis of scarlet fever. On June 25th, 1894, I saw in the examining room of the Johns Hopkins Hospital, with Dr. Hewettson, a man aged 23. Three months before he had a skin rash, said to be scarlet fever associated with arthritis, urticaria, and general anasarca. These symptoms gradually disappeared, and he got quite well. Three weeks ago he began again to have pains and swellings in the knees, wrists, and ankles, and purple blotches have occurred in crops on the skin of the legs. The patient was a healthy, well-nourished man, not anaemic, and it was hard to credit that he had had anasarca three months ago. From the groins to the ankles the skin of the legs was covered with urticaria and purpura; there were none on the feet; the urine was not albuminous. He thought—and I was inclined to agree—that the rash at the onset was of much the same character, but more extensive, as that which now exists.

It is also to be remembered that purpura is a by no means uncommon complication of chronic interstitial nephritis. I have notes on a number of cases of this type, and my experience bears out that of Stephen Mackenzie as to the great frequency of this complication. One is, however, sometimes deceived, as in the young chronic interstitial nephritis is consistent with excellent health, and the patient may be admitted with the features of ordinary Henoch's purpura. This happened in the following case.

Jessie S., aged 13, was admitted to the Radcliffe Infirmary, under Dr. Collier, on December 13th, 1911, complaining of pain in the stomach and headache. She has had nocturnal enuresis for five years, and lately she has begun to have vomiting. She looks fairly healthy; the tongue is clean, the teeth are good, there is nothing in the throat, nothing in examination of the chest and abdomen. The urine was 1012, acid, 0.35 per cent. albumin with Esbach, and microscopically a few hyaline and granular casts. She is deaf, and complains of a little pain in the right ear. She has no fever. For the first ten days she was in a curious state, very drowsy, and had vomiting at intervals; then about the 20th the vomiting became more constant (five or six times a day), and the amount of albumin increased. The urine was acid; specific gravity about 1010. She has had a slight attack of abdominal pain. On the 19th and 20th she had severe bleeding from the nose on both sides, and the nostrils had to be plugged. On the 21st there was a raised papular rash on the arms, chiefly the extensor surfaces; in places diffuse erythema, in others small raised red spots. On the abdomen there was an extensive outbreak of purpura; on the anterior surfaces of the thighs a number of larger raised haemorrhagic spots; none on the legs. The urine during the past few days has become turbid and contains numerous streptococci, which have been cultivated. The patient has become very thin, is very restless at night, much disturbed by the vomiting. Albumin ranges from 0.2 to 0.35 per cent.; specific gravity 1010 to 1012. The was no fever; there were no retinal changes, and there was nothing suggestive in the cardio-vascular state. On January 25th there was a fresh outbreak of spots, many of them raised and abundant on the face and forehead. Over the arms the combination of erythema and mottling suggested measles. On the 26th the child had severe abdominal pain and was very drowsy; the urine contained a large amount of albumin, was a little turbid, and had numerous streptococci. She complained of pain in the right side of the face, and gradually the parotid became swollen. The amount of albumin increased; the child grew rapidly worse, became very drowsy, and died on January 28th. *Post-mortem* examination showed (to our surprise) only a fragment of the left kidney, and the right kidney in a state of extreme interstitial nephritis. The left parotid was suppurating.

Manifestly this was a case of latent interstitial nephritis with uraemic symptoms, shown by the vomiting and the drowsiness, in which we were deceived by a combination of abdominal pains and purpura.

Cardiac Complications.

Heart murmurs are common and usually of little significance in debilitated or anaemic children. Endocarditis may be a complication of the infectious purpuras, rheumatic or septic. In what Cheadle used to call the rheumatic cycle the skin lesions and endocarditis may coincide, as in the child already referred to, with outbreaks of purpura and chorea in the third year, and in the fifth a severe attack of urticaria, during which endocarditis was discovered. It occasionally occurs in very severe cases of what is called purpura rheumatica, but it must be rare. The complication was not present in the long series of cases on which Platt based his article. I saw with Dr. Musser a boy with arthritis, purpura, and fever, in whom under observation a loud mitral murmur occurred, which persisted after convalescence. In the septic forms of purpura associated with gonorrhoea, puerperal fever, or a local skin lesion endocarditis is more common and is usually latent.

Respiratory Complications.

In the various forms of purpura respiratory symptoms are not common, but there have been in my series several cases with very remarkable and serious features. In No. II, a boy, aged 10, had for five years an extraordinary sequence of skin lesions, purpura, urticaria, oedema, and erythema. In several attacks he had a bronchial wheezing; then asthma and emphysema came on, and he died in an acute attack of pneumonia with pericarditis. In No. XXVI, a girl, aged 24, with recurring attacks of erythema and purpura, had severe pneumonia during an outbreak. Five months later she died of acute nephritis. No. XI, a child, died of pneumonia a month after an attack of purpura.

The association of asthma and urticaria is an old story. In a case of whooping-cough in an adult asthma persisted for more than eighteen months, and the attacks were associated with intolerable itching between the shoulders and very often an outbreak of urticaria in this region.

Very serious respiratory complications occur in angioneurotic oedema. Dyspnoea may follow great swelling of the neck externally, or, as in a girl from California, seen with Dr. Hale White, the swelling of the tongue and the fauces may be sufficient to obstruct breathing.

The chief danger is oedema of the glottis. Two members of the New Jersey family I have reported died from this cause; both father and daughter as reported by Griffith,[30] and a man aged 21 had tracheotomy performed twice, and in a third attack died before assistance could be reached.[31] The oedema may be in the trachea, as in the extraordinary case reported by Rudolf.[32] A woman aged 63 began to have attacks of erythema and oedema affecting, in the course of three years, lips, nose, ears, legs, and face, usually transient. Twice the mucous membrane of the trachea became swollen, causing great stridor; the second attack proved fatal.

Among other complications may be mentioned the frequency with which the spleen is enlarged; the liver, too, may be swollen. In one case a woman aged 50 was admitted with purpura, abdominal pain, and a temperature of 104°. The pain was high in the region of the gall bladder, and was probably due to gall stones, as jaundice appeared on the following day.

Parotitis is not uncommon in the acute infections with which purpura is associated, such as malignant endocarditis and pneumonia. In such a case as that described under renal symptoms, in which the purpura was a terminal event in a chronic interstitial nephritis, the accompanying parotitis was of the same nature; sepsis was present. But in the following case, under the care of Dr. C. J. Wood, the parotitis occurred in one of these remarkable instances of acute febrile erythema with purpura, in which the patient had half a dozen relapses of great severity.

J. C., aged 22, a medical student with good family history, was strong and well until the present illness.

On November 1st he had a chill, with headache, vomiting, and the temperature rose to 105°. On the second day an eruption appeared all over the body, purplish-red in colour, which lasted for two days. The temperature persisted, with much fever and headache; on the fifth day the right parotid gland became swollen and tender. The symptoms gradually disappeared, and the parotid subsided, and at the end of ten days he was quite well. As mumps were about, it was thought possible to be an anomalous case. He went back to his studies for three days; then with chilliness and headache a second attack came on; the temperature rose to 105°, and on the second day a rash appeared—raised spots, 1 cm. in diameter, some looking like ordinary hives, others of a deep purple colour. With this attack there was nausea and vomiting, but no abdominal pain. At the end of three days he felt quite well. He had in all six or eight of these attacks. In one there was an outbreak of ordinary purpura on the hands and feet. In the third and fourth attacks the knees, ankles, and shoulders were slightly swollen and tender; the superficial lymph glands became enlarged, but not the spleen. In one attack there was a slight conjunctival haemorrhage; the bowels were constipated, but considering the severity of the attacks the general health was not much disturbed. There was no anaemia; there was always a slight leucocytosis. The attacks gradually wore away and the young man recovered.

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BACILLI AND BULLETS

BY

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BACILLI AND BULLETS

AN ADDRESS TO THE OFFICERS AND MEN IN THE CAMPS AT CHURN

I HAVE been asked to say a few words on the question of health in war-time, that you may realize its importance. Formerly an army marched on its belly; *now* it marches on its brain. Only by utilizing existing knowledge, in all grades from Commander-in-Chief to private, is the maximum of success available. To put the largest number of the enemy out of action with a minimum of loss to his own men is the aim of every general. While in one way modern war merges the individual in a great machine, on the other hand the intelligent action of the unit has never been so important a factor in making the machine work smoothly and efficiently. After all, it is the man behind the gun who wins the victory.

What I wish to urge is a true knowledge of your foes, not simply of the bullets, but of the much more important enemy, the bacilli. In the wars of the world they have been as Saul and David—the one slaying thousands, the other tens of thousands. I can never see a group of recruits marching to the dépôt without mentally asking what percentage of these fine fellows will die legitimate and honourable deaths from wounds, what percentage will perish miserably from neglect of ordinary sanitary precautions? It is bitter enough to lose thousands of the best of our young men in a hideous war, but it adds terribly to the tragedy to think that more than one-half of the losses may be due to preventable disease. Typhus fever, malaria, cholera, enteric, and dysentery have won more victories than powder and shot. Some of the diseases I mention need no longer be dreaded. Typhus and malaria, which one hundred years ago routed a great English army in the Walcheren expedition against Antwerp, are no longer formidable foes. But enough remain, as we found by sad experience in South Africa. Of the 22,000 lives lost in that war—can you believe it ?—the bullets accounted for only 8,000, the bacilli for 14,000 ! In the long arduous campaign before us more men will go into the field than ever before in the history of the Empire. Before it is too late, let us take every possible precaution to guard against a repetition of such disasters. I am here to warn you soldiers against enemies more subtle, more dangerous, and more fatal than the Germans, enemies against which no successful battle can be fought without your intelligent co-operation. So far the world has only seen one great war waged with the weapons of science against these foes. Our allies the Japanese went into the Russian campaign prepared as fully against bacilli as against bullets, with the result that the percentage of deaths from disease was the lowest that has ever been attained in a great war. Which lesson shall we learn ? Which example shall we follow, Japan, or South Africa with its sad memories ?

We are not likely to have to fight three of the greatest of former scourges, typhus, malaria, and cholera, though the possibility of the last has to be considered. But there remain dysentery, pneumonia, and enteric, against two of which we should be able to bring to bear successfully resources of modern science.

Dysentery, an inflammation of the large bowel, has been for centuries one of the most terrible of camp diseases, killing thousands, and, in its prolonged damage to health, one of the most fatal of foes to armies. So far as we know, it is conveyed by water, and only by carrying out strictly, under all circumstances, the directions about boiling water can it be prevented. It is a disease which, even under the best of circumstances, cannot always be prevented ; but with care the incidence should be reduced to a minimum, and there should never again be widespread outbreaks in the camps themselves.

Pneumonia is a much more difficult disease to prevent. Many of us, unfortunately, carry the germ with us. In these bright days all goes well in a holiday camp like this ; but when the cold and the rain come, and the long marches, the resisting forces of the body are lowered, the enemy, always on the watch, overpowers the guards, rushes the defences, and attacks the lungs. Be careful not to neglect coughs and colds. A man in good condition should be able to withstand the wettings and exposures that lower the system, but in a winter campaign pneumonia causes a large amount of sickness and is one of the serious enemies of the soldier.

Above all others one disease has proved most fatal in modern warfare—enteric, or typhoid fever. Over and over again it has killed thousands before they ever reached the fighting line. The United States troops had a terrible experience in the Spanish-American War. In six months, between June and November, inclusive, among 107,973 officers and men in 92 volunteer regiments, 20,738, practically one-fifth of the entire number, had typhoid fever, and 1,580 died. Fortunately, in this country typhoid fever is not prevalent in the districts in which camps are placed. The danger is chiefly from persons who have already had the disease and who carry the germs in their intestines, harmless messmates in them, but capable of infecting barracks or camps. You can easily understand how flies lighting on the discharges of such typhoid carriers could convey the germs far and wide. It was in this way probably, and by dust, that the bacilli were so fatal in South Africa. Take to heart these figures: there were 57,684 cases of typhoid fever, of which 19,454 were invalided, and 8,022 died. More died from the bacilli of this disease than from the bullets of the Boers. Do let this terrible record impress upon you the importance of carrying out with religious care the sanitary regulations.

One great advance in connexion with typhoid fever has been made of late years, and of this I am come specially to ask you to take advantage. An attack of an infectious disease so alters the body that it is no longer susceptible to another attack of the same disease; once a person has had scarlet fever, small-pox, or chicken-pox, he is not likely to have a second attack. He is immune, or has what is called immunity. When you expose a solution of sugar to the air, or if you add to it a pinch of yeast, a process goes on which we call fermentation, accompanied by a growth of little germs of the yeast in the fluid, and by an increase in temperature (in fact the solution has a fever), and the composition of the fluid alters, so much so that you can inoculate it afterwards again and again with the same germ, but no further change takes place. Now this is what happens to us when bacilli make a successful entry into our bodies. They overcome the forces that naturally protect the system, and grow just as the yeast does in the sugar solution; but the body puts up a strong fight, all sorts of anti-bodies are formed in the blood, and if recovery takes place, the patient afterwards has immunity, for a time at least, from subsequent attacks. The body has mobilized its forces, and is safe for a few years at least against that disease. It was an Englishman, Jenner, in 1798, who found that it was possible to confer this immunity by giving a person a mild attack of a disease, or of one very like it. Against small-pox all of you have been vaccinated—a harmless, safe, and effective measure. Let me give you a war illustration. General Wood of the United States Army told me that, when he was at Santiago, reports came that in villages not far distant small-pox was raging and the people without help of any kind. He called for volunteers, all men who showed scars of satisfactory vaccination. Groups of these soldiers went into the villages, took care of the small-pox patients, cleaned up the houses, stayed there until the epidemic was over, and not one of them took the disease. Had not those men been vaccinated, at least 99 per cent. of them would have taken small-pox. Now what I wish to ask you is to take advantage of the knowledge that the human body can be protected by vaccination against typhoid fever. Discovered through the researches of Sir Almroth Wright, this measure has been introduced successfully into our own regular army, into the armies of France, the United States, Japan, and Germany. I told you a few minutes ago about the appalling incidence of typhoid fever in the volunteer troops in America during the Spanish-American War. That resulted largely from the wide prevalence of the disease in country districts, so that the camps became infected; and we did not then know the importance of the fly as a carrier, and other points of great moment. But in the regular army in the United States, in which inoculation has been practised now for several years, the number of cases has fallen from 3·53 per thousand men to practically nil. In a strength of 90,646 there were in

1913 only three cases of typhoid fever. In France the enteric rate among the unvaccinated was 168·44 per thousand, and among the vaccinated ·18 per thousand. In India, where the disease has been very prevalent, the success of the measure has been remarkable. In the United States, and in France, and in some other countries this vaccination against the disease is compulsory. It is not a serious procedure; you may feel badly for twenty-four hours, and the site of inoculation will be tender, but I hope I have said enough to convince you that, in the interests of the cause, you should gladly put up with this temporary inconvenience. If the lessons of past experience count, any expeditionary force on the Continent has much more to fear from the bacillus of typhoid fever than from bullets and bayonets. Think again of South Africa with its 57,000 cases of typhoid fever! With a million of men in the field, their efficiency will be increased one-third if we can prevent enteric. It can be prevented, it *must be prevented*; but meanwhile the decision is in your hands, and I know it will be in favour of your King and Country.

THE WAR AND TYPHOID FEVER.

BY

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

Regius Professor of Medicine in the University of Oxford.

(Paper read at a Meeting of the Society of Tropical Medicine and Hygiene, Friday, November 20th, 1914).

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I.

From the days of Homer, Apollo, the far darter, has been a much more formidable foe than his colleague Mars. With the two in conjunction unspeakable woes afflict the sons of men. In his great strait David, you remember, chose three days of pestilence as the equivalent of three months' military disaster. To-day the front of Mars is wrinkled, the world is at war, and the problem for the children of Aesculapius is to keep grandfather Apollo from taking a hand in the fray. In this game another member of the family, Hygeia, holds the trump card and gives victory to the nation that can keep a succession of healthily efficient men in the field. The Empire is confronted with a great task, in the successful performance of which the medical profession may play a leading part. For generations the health of the army and navy has engaged the attention of the very ablest men in our ranks. Let me quote a sentence written in 1785 by GILBERT BLANE, a pioneer in sanitation, and as true to-day: "The great importance of the subject (that is, prevention) will plead my excuse for again calling to mind that such attentions are not only dictated by humanity, but would be the greatest wisdom in an economical and national light, considering how expensive it is to *replace* men and to support invalids, not to mention that it is upon the health and lives of men that every public exertion essentially depends, and upon which even the character of officers in the day of battle may depend."[1]

Of the camp diseases, typhus, malaria, cholera, dysentery, and typhoid fever, it is a reasonable hope that the armies of the West will escape the first three. Dysentery is pretty sure to cause trouble; but with regard to enteric fever we are on trial as a nation and as a profession, in what way it will be the object of this address to shew.

The nineteenth century saw the discovery of the cause of typhoid fever, the recognition of its transmission through polluted water or milk, and the enforcement of sanitary measures, which have caused a steady and gratifying reduction in its prevalence. Those of us brought up upon the writings of SIMON, BUCHANAN, BUDD, and MURCHISON, and convinced of the truth of the water-borne and milk-borne theories, were often confronted with epidemics in schools and barracks and private houses in which it was not possible to trace the infection to either of these sources. Yet experience lent little support to a doctrine of direct contagion. There was some other factor. Even with the purest supply of water and of milk, cases would crop up and local outbreaks occurred. Within the past ten or fifteen years we have not only filled gaps in the etiological picture, but we have added so many details that the canvas is approaching completion. Let me dwell upon four points in our new knowledge.

I. THE IMPORTANCE OF THE INDIVIDUAL CASE AS A FACTOR IN INFECTION.

Though the infectiveness was recognised, only within the past decade have clinicians made it an essential feature to completely sterilize the dejecta, urine and fæces, and to avoid all possible contamination about the patient. As in surgery, we have changed the antiseptic to an aseptic battle, and nowadays the physician feels as keen a duty to keep the surroundings of a patient sterile as to treat his symptoms.

This in itself is a great gain, as the possibility of the abolition of the disease is a problem of the sterilization of the individual cases as they occur. I cannot here enter into the question of the methods of conveyance, but it is sufficient to say we have recognised fingers and flies as two of the chief, and the special liability in houses and wards of food contamination.

II. RECOGNITION OF THE PROTEAN CHARACTER OF THE DISEASE.

Not only are there differences in the germ that causes typhoid, but the clinical picture itself varies from the text-book standard very much more than was dreamt of by LOUIS, BUDD, FLINT, or MURCHISON. A transient febrile attack, a slight diarrhœa, bronchitis, acute nephritis, an attack of pneumonia, cholecystitis, acute pyelocystitis, may be a manifestation of the infection. In endemic areas mild, indefinite illness in children may be due to the typhoid bacillus. The organism, indeed, may lodge and live in an individual without ever causing symptoms, and then acutely excite an illness without a trace of resemblance to the disease we usually associate with its name. One of the first cases in which this was recognised I saw with Dr. CUSHING in Dr. HALSTED'S wards—a woman, aged 26, who had a clean bill of health except for occasional attacks of abdominal pain and vomiting. It was evident at the time of examination that she had acute cholecystitis. Dr. CUSHING removed fifteen large gall stones; pure cultures of the typhoid bacillus were isolated from the mucous contents of the bladder. Here was a woman who had never had, so far as could be ascertained, typhoid fever, and yet she had probably had for years the organism in her gall bladder, which had ultimately caused the formation of the stones, This case at the time unique, is no longer so. In the Spanish-American war, and in the South African war, there were an extraordinary number of mild ambulatory cases, which in the former were frequently reported as malaria. In public health work it is all-important to recognise these mild atypical cases. Dr. CHALMERS, in the Health Report of the City of Glasgow for 1913, calls attention to the simulation of enteric by mild pneumonia and by intestinal catarrh.

Eight cases of enteric appear to have originated from an undetermined case of the latter in a child.

III. THE DISCOVERY OF TYPHOID CARRIERS.

Briefly stated, in from 1 to 3 per cent. of cases of enteric fever the bacilli do not disappear from stools or urine. The patient becomes a chronic carrier and a possible menace to the community. It has been estimated that, in countries in which typhoid fever prevails, the typhoid carriers number from 2 to 3 per 1,000. Infectivity may exist for years, and scores of small epidemics have been traced to carriers. How persistent the infection may be, and how difficult to get rid of, is well illustrated by the case studied for the past five or six years by DAVIES and WALKER HALL, of Bristol. The patient had enteric in July, 1905, and eight instances of infection had been traced to her. The special interest in the case is the careful study of the different plans of treatment and the variability of the presence of the organisms in the urine. They were also isolated from her blood five years after the original attack.[2] The relation of the carrier to public health is of vital importance, particularly the question of the detention of notorious carriers who follow dangerous occupations. The New York Board of Health was judged to be within its rights when an action was brought against them for the illegal detention for three years of the celebrated "Typhoid Mary." Carriers should not follow the occupation of cooks, butchers, grocers, as the fingers deposit bacilli on everything they touch, unless scrupulous attention is paid to cleanliness after defæcation. The good effect of precautionary measures in the case of chronic carriers is illustrated by the report of LENTZ from the Oberstein district.[3] For ten years the disease had been endemic, and then a systematic attempt was made to discover the carriers, of whom six were found in 1894, two in 1897, and one in 1898. They were practically all mothers with large families. It was impossible to enforce vigorous methods of isolation, so that repeated warnings were given, and instructions as to scrupulous cleanliness, particularly after defæcation, never to touch an article of food without a systematic washing of the hands, and having their under-linen carefully sterilized. The fever in the district has practically disappeared.

IV. IMMUNISATION.

Lastly, and the most important point of all, is the discovery of immunisation against the disease, for which we are indebted to the brilliant investigations of Sir ALMROTH WRIGHT. The net result of the enormous amount of work which has been done since the publication of his first paper—September, 1896—is that, for a time at least, man may be immunised safely and surely. It is only by the statistical method that we are able to judge of the results of the practice. While in a way this is unfortunate, as figures have an extraordinary mobility as manipulated by different individuals, still, practical men have to use them and to form judgments by their help. The new iatro-mathematical school of KARL PEARSON and his scholars have made the profession cautious in drawing results from statistics; but in the matter under consideration the figures are, I believe, trustworthy. I will only give a few, the more important.

For many years the death-rate from typhoid fever in the United States has been very high. The disease prevails widely in the country districts. During 1912 it was 16·5 per 100,000 of the population—the lowest for many years. Antityphoid inoculation was voluntary in the U.S. army from 1909 to part of 1911; it was made compulsory in part of 1911 and in 1912 and 1913. Major RUSSELL'S last report, dated May 2nd, 1914,[1] gives the following figures:—

Typhoid Fever, 1907 to 1913, for the whole Army, Officers and Enlisted Men, American and Native Troops.

Year.	Mean Strength.	Cases.		Deaths.		Percentage of Total Cases.	Occurring among those who were Vaccinated.	
		No.	Ratio per 1,000 of Mean Strength.	N.	Ratio per 1,000 of Mean Strength.		Cases.	Deaths.
1907	62,523	237	3·79	19	0·30	8·0	—	—
1908	74,692	339	3·20	24	0·31	10·0	—	—
1909	84,077	282	3·35	22	0·26	7·8	1	0
1910	81,434	198	2·43	14	0·17	7·1	7	0
1911	82,802	70	0·85	8	0·10	11·4	11	1
1912	88,478	27	0·31	4	0·044	14·8	8	0
1913	90,646	3	0·03	0	0·0	0·0	1	0

Major RUSSELL states that no harmful effects have been produced. The newspaper reports of death following antityphoid inoculation in the United States have been shewn to be erroneous. In the case of Private Pantzer, of the National Guard, Brooklyn, death was shewn to be due to malignant endocarditis, and in no way the result of inoculation.[5] The value of these results must be taken in connection with the fact that in many places the barracks are situated in districts in which typhoid fever prevails. In 1911 and 1912 there was a concentration of many thousands of United States troops on the Mexican border in localities quite as favourable to the spread of enteric as in the Spanish-American war.

Apart from vaccination, there has been in all armies a reduction in the number of cases of typhoid fever; thus, between 1882 and 1909 the incidence of the Prussian army dropped from 6·7 per 1,000 to 0·4, while in the same years in the French army a reduction from 16·6 to 3·4. But the special value of the experience of the American army is the remarkable drop in the case incidence which followed antityphoid inoculation without special change in the sanitary environment of the troops. An interesting comparison is reported [6] of two divisions stationed in nearly the same latitude for about the same length of time each on a good site, with artesian water of unimpeachable purity. In the one at Jacksonville, Florida, in 1892, among 10,759 men there were 1,729 certain cases, probably 2,693 (the question of diagnosis of typho-malaria, etc.), with 288 deaths. In San Antonio, Texas, in 1911, among 12,659 men, all inoculated, there was one case of typhoid fever, and no death. In France the results appear to be equally satisfactory, and there is no country in which measures of protection are more needed, as during the past twenty years among the French troops in France there have been 66,000 cases, with 10,000 deaths.[7] Professor VINCENT reported to the International Medical Congress last year that among 30,325 vaccinated men no case occurred, while in the unvaccinated the case-rate was 2·22 per 1,000 in the metropolitan troops and 6·34 in the colonial. Specially good results have been met with in Algiers and Morocco, where the inoculation is compulsory, and the incidence per 1,000 has fallen from 15 to 5. A striking illustration is reported from Avignon by PAGET, in a recently issued Research Defence Society pamphlet. Out of 2,053 men 1,366 were protected and 687 were not. The non-protected had 155 cases with 21 deaths; the protected had not a case. The Italian experience in Tripoli shews that the incidence of the disease among the unvaccinated was 35·3 per 1,000, while among the vaccinated the incidence for those inoculated once was 1·34 per 1,000, for those inoculated twice 1·65, and for those inoculated three times 0·49. The most careful study of the statistics for the British army are those presented in the report of the Antityphoid Committee, 1912:—"The histories, as regards typhoid fever, of 19,314 soldiers, whose average period of service abroad was twenty months, were carefully followed, and every precaution possible was taken to verify the diagnosis bacteriologically. Of this number 10,378 were inoculated and 8,936 not inoculated. The case incidence of typhoid fever among the inoculated was 5·39 per mille, and among the non-inoculated 30·4 per mille.

"There is no reason for supposing that this difference can be attributed to a want of homogeneity between the two groups. The age distribution among inoculated and non-inoculated was approximately the same. They were intermingled and lived under identical conditions."

The profession is greatly indebted to Sir WILLIAM LEISHMAN and his colleagues, HARRISON, SMALLMAN, and TULLOCK, for the good work they have done in connection with this subject.

SYMPTOMS FOLLOWING INOCULATION.

As in this country the practice is voluntary, and as in certain quarters opposition has been offered, I have thought it well to collect data of any untoward effects, and I have to thank many correspondents who have replied to my note in the *British Medical Journal* of October 10th. In the first place it may be stated that with ordinary care and precautions large bodies of troops may be successfully inoculated with extraordinarily little discomfort or disability. Colonel HODGETTS has kindly given me the figures of the recent inoculations of the Canadian contingent, some 31,000 strong, made under his supervision in the camp at Valcartier in the Province of Quebec. Of the total number only one had a local abscess at the site of injection, and there were no serious sequelæ. This may be said to be an exceptionally good record. The inoculations in this country during the past three months have been on a larger scale than ever before attempted, and considering the enormous number—several hundred thousand—the serious sequelæ have been very few. We may group the symptoms as follows :—

1. A varying proportion no symptoms, other than a little headache or malaise, with slight redness and swelling at the point of inoculation.

2. A large proportion run a normal course of what may be called the inoculation fever, which has many resemblances to the so-called serum sickness. The temperature rises within ten or twelve hours, sometimes with a slight feeling of chilliness, and vomiting may occur. There are headache, fugitive pains in the back and joints, sometimes abdominal tenderness, and for twenty-four or thirty-six hours the patient may feel very badly. In mild forms the temperature rises to 101° or 102° ; in the more severe to 103° and 104°, or even higher. Sometimes there is diarrhœa ; in other cases, perhaps in the majority, there is constipation. Giddiness and fainting are reported, and one physician within the first ten days had curious nervous symptoms, feelings of apprehension, and a transient state of neurasthenia. He felt inability to control his muscles, and dreaded lest he should be unable to avoid some impulsive act. There was a slight mental disturbance, and he had what he called "dreadful feelings," and had difficulty in forcing himself to do the simplest acts. In the North Midland Division, among nearly 16,000 inoculated, a man, two days after inoculation, had marked mental symptoms suggestive of confusional insanity, which, fortunately passed away. I saw with Dr. COLLIER an officer whose case was very fully reported to us by Dr. JOYCE of the 4th Royal Berkshire Regiment. He was inoculated on September 14th and, after the usual slight local and general symptoms, on the 17th the temperature was normal. On the 18th he had giddiness, and on returning to his billet when the door was opened he mistook the parlourmaid for the colonel, and raising his hand to the salute overbalanced and fell unconscious. He had a few days' leave, and some weeks later had several giddy attacks.

Heavy exertion and exposure within twenty-four hours after inoculation may be followed by sharp general symptoms. In connection with the abdominal pains that may occur, it is interesting to note that Professor BOYD of Winnipeg, now associated with the 3rd North Midland Field Ambulance, reports two cases (admitted on the same day) with appendicitis—one on the third day after inoculation, the other within twenty-four hours. Both had acute perforation. There have been several reports of sharp localised pain in the region of the caecum, with slight diarrhœa. The highest temperature recorded in the notes sent to me (Professor BOYD) was 106·4°, four days after inoculation.

In what may be called the normal course there is œdema and redness at the site of inoculation varying in extent, and several correspondents have noted a curious migration of the erythema downwards towards the elbow, and even reaching to the wrist. Blotchy erythema may occur about the joints, and purpura has been noted.

CASES WITH UNTOWARD EFFECTS, LOCAL OR GENERAL.

(a) Locally, the redness, swelling, tenderness rarely persists for more than a day or two, and may be equally marked at both inoculations, or may be slight at the first and abundant at the second, or *vice versa*. The local process may go on to suppuration. How rare this is may be judged from the experiences of the Canadian contingent already referred to, in which only one abscess occurred among some 31,000 cases. This is, indeed, a remarkable record, so I doubt if there is any hospital in the kingdom in which during a year's experience abscess does not follow some form of hypodermic injection. I have had no report of severe sepsis following the local abscess. Lance-Corporal Goatley, whose case has been exploited by the "antis," had a septic wound, which proved, on investigation by Surgeon-General WHITEHEAD, to be an abscess following ordinary vaccination for small-pox, and the report states that the bad arm directly followed from his own neglect. And I may state that he was not discharged from the army for ill-health due to the vaccination.

(b) General.—The inoculation fever and its symptoms rarely last more than a couple of days; but in a few cases unpleasant, or even serious, complications may follow.

With the fever there may be pains in the joints, superficial redness, and even effusion. A patient was admitted to the base hospital, Oxford, with effusion in the left knee, following antityphoid inoculation three weeks previously. It resembled a gonorrhœal synovitis, but there was no urethral discharge. I have already referred to the abdominal pains on pressure in the caecum region and the coincidence of appendicitis in two cases. Jaundice has been noticed in a few instances. There were four in the North Midland Division, coming on about a week after inoculation (BOYD). Symptoms suggestive of enteric, and enteric itself, may follow inoculation.

Dr. WALTER BROADBENT, of Brighton, sends a report of a case: Second inoculation on October 13th, followed by headache and pains in the limbs on the 14th, then fairly well until the 20th, when he had headache, a temperature of 103·4°; on the 21st the temperature ranged from 101° to 102°, on the 22nd from 98·6° to 102°, then gradually fell to normal. On the 26th the tongue was very furred, there were no spots, but there was a positive Widal reaction on the 24th. The case was not treated as enteric.

In a case, the notes of which were sent by BOYD, the second dose, given on October 16th, was followed by sickness and giddiness. On October 19th and 20th he had diarrhœa, for which he saw the regimental medical officer. On October 23rd he was seen by the surgeon of the 1st North Midland Field Ambulance, who found him with a temperature of 101·5°, constipation, rose spots, slight abdominal tenderness, large spleen. After consultation, it was decided that it was a typical typhoid case, and he was sent to the 2nd General Hospital, London.

Occasionally septic fever follows unassociated with the local lesion. A case of this type, under the care of Colonel HOOD and Dr. HOBHOUSE at Brighton, I had the privilege of seeing at the height of his illness. I am indebted to Dr. HOBHOUSE for the notes:—

On October 23rd I saw at Brighton, with Dr. HOBHOUSE and Dr. HOOD, Private Walter Fuller, aged 23, No. 8 Bedfordshires, who had his first inoculation on October 3rd. Slight headache on the 4th, with fugitive pains, but he did not feel badly until the 7th, when there were fever and pains in the joints. On admission to hospital on the 9th the temperature was 102·5°. On the 11th his temperature was 104°, much pain, particularly in the joints, slight swelling and redness of the ankles and the smaller joints of the hands, with great stiffness and inability to use the muscles. On the 17th he began to have pain in the chest, with signs of involvement of the right base. On the 18th the leucocyte count was 15,300 per cubic millimetre, the pains in the chest were worst, he had cough, and the consolidation in the right lower lobe had increased. The Widal reaction was markedly positive. Between the 16th and the 23rd the temperature rose to about 103° each day, there were pain and swelling in the joints, redness over the ankles and knuckles, and much disability. When I saw him on the 23rd he looked very ill, the respirations were 40, pulse 100, the small joints of both hands shewed swelling with slight erythema, tenderness on pressure and on movement, redness over the left ankle, moderate effusion in the left knee-joint and right elbow, consolidation of the right lower lobe, and left pleural effusion reaching to the fourth rib in front. The heart sounds were clear; the spleen was not palpable. There was no redness or swelling at the site of inoculation. The patient remained very ill for the following week, although the temperature was lower, rarely going much above 102°. There was a to-and-fro pericardial murmur. The patient then began to improve, and on October 30th the temperature for the first time fell to 99°. Between October 30th and November 5th it fluctuated around 100·5°, and then fell to normal. The smaller joints remained painful, and it was not until November 11th that he began to use his hands and arms. He is now convalescent.

In the same ward I saw, with Dr. HOBHOUSE, a man with dermatitis in the region of one axilla, which had spread rapidly after inoculation. He had symptoms suggestive of peripheral neuritis, stiffness of the arms, and loss of the knee-jerks. He had had zinc ointment used for a very large area, which Dr. HOBHOUSE thought might possibly be the cause of the neuritis.

The importance of avoiding exposure for a day or two after inoculation is emphasised by the fact that cases of pneumonia have been reported by several observers. In the North Midland Division series, among nearly 16,000 instances, in two cases lobar pneumonia followed within twenty-four hours (BOYD). Pneumococci were present in the sputum in both cases.

Private G. B. Jones, 12th Sherwood Foresters, reported by Dr. WALTER BROADBENT, was inoculated October 6th; chill on the 7th, and on the 8th was admitted to the 2nd General Eastern Hospital with pneumonia of the middle and lower lobes on the right side, and the lower lobe on the left, with a temperature of 103°, pulse 120, and much delirium. He had a very severe illness, and died on October 14th.

Reports of death as a result of the inoculation are false. Dr. SELBY wrote from Aldershot (October 17th, 1914):—

This morning I was trying to persuade my Kitchener army men to be inoculated, when I was confronted by one man who said he went down to Shorncliffe last week-end and that there they had told him that three men had died within twenty-four hours of inoculation.

I wrote to Colonel WILSON, who replied (October 21st, 1914) that there had been no death from this cause, and giving particulars of the fatal cases from accident or disease since the formation of the camp.

The Beaujon Hospital nurse, Paris, whose case is so often quoted, died of typhoid fever a month after the last inoculation. She might very possibly have contracted the disease previously. The Neckar Hospital nurse received therapeutic injections of typhoid serum during the course of the disease, not a protective inoculation.

Private Pantzer of the National Guard, Brooklyn, died of malignant endocarditis and the inoculation had nothing to do with his fatal illness.[8]

II.

Perhaps the best chapter in British sanitation is that which deals with typhoid fever. While a decrease in the incidence of the disease has been more or less general throughout civilised countries, nowhere else has the fall been so progressive and striking. Twenty years ago the death-rate per 1,000,000 of inhabitants was about 300; in 1912 it had fallen to 44, the lowest ever recorded; indeed, up to 1904 the rate had never fallen below 100. Enteric fever may be said to be in its "last ditch," but that it is still putting up a strong fight is indicated by 1,600 deaths in England and Wales in 1912. It prevails less in London than in the Midlands and in the South, and is much more frequent in the North, in both urban and rural districts. In certain urban districts the highest case-rate per 100,000 of the population was 34. In many of the large cities in the North, as in Liverpool and Glasgow, in which the disease was very prevalent, the fall has been progressive and rapid. In the former city in 1895 there were 1,300 cases. In 1911 it had fallen below 200. In Glasgow the case-rate per 1,000,000 has fallen from 1,386 in 1891 to 232 in 1913, and the death-rate per 1,000,000 from 218 in 1891 to 36 in 1913. General betterment of sanitation, particularly improved housing, better diagnosis, greater care of the individual cases—to these factors may be attributed a large part of this decrease. But there is another to which the attention of the medical officers of health has been strongly directed —namely, the removal of local sources of infection by the isolation of the sick in hospitals,[9] in which in some cities the proportion of cases treated has risen from 30 or 40 per cent. to 80 and 90. It has been well said that enteric fever is the sanitary index of a country; and that to-day our camps are not hotbeds of the disease is the result of more than half a century of intelligent and efficient sanitation.

Neither the profession nor the people at large appreciate fully the extraordinary sanitary advantages enjoyed by this country. In medical practice, if I were asked to state the most striking difference between England and the United States and Canada, I should say the absence of enteric fever in hospital and private work. The tragedy of typhoid fever was ever present, and one felt constantly outraged at the wantonness of the sacrifice. In full measure the tragedy was brought home to the United States during the Spanish-American war. There never has been in history a campaign so fatal to an army not yet in the field. Listen for a moment to the story of what may happen after mobilisation in a typhoid ridden country. Returning to the United States from a visit to England in the autumn of 1898, I found but one subject engaging the attention of the profession—the appalling outbreak of typhoid fever in the volunteer army, distributed in seven camps in different parts of the country. The figures published by REED, VAUGHAN and SHAKESPEARE in their elaborate report, of which a good epitome is given by Dr. CHRISTOPHER CHILDS[10] shew that in six months, among 107,973 men, there were 23,738 cases of typhoid fever and 1,580 deaths. At Camp Alger, near Washington, with a mean strength of 21,988 men, there were 1,951 cases of typhoid fever. Never have I seen so many cases of fever concentrated together, barrack after barrack filled with the victims of neglected sanitary precautions. The lesson drawn by the authors of the report on this epidemic was that the disease was not water-borne, but that nearly two-thirds of the cases were examples of "connectible attacks"—that is, due to infection within the tent or from adjacent tents. It was the first great epidemic to call attention to the importance of local infection by means of fingers, food and flies. Two other points were brought out—the frequency with which erroneous diagnosis was made, particularly in the southern camps, where many cases were supposed to be malaria; and the large number of minor attacks indicated by nothing more than transient malaise, slight fever, or a gastro-intestinal attack.

RECOMMENDATIONS.

More than three months have passed, and the reports from the camps indicate that nowhere is typhoid fever prevalent. That isolated cases have occurred should make the medical officers of health and the military surgeons redouble their efforts to prevent the spread. These should be watched with the utmost care, since, as Dr. CHILDS points out, epidemics in camps are usually preceded by scattered cases or by the unusual prevalence of diarrhœa. *Watch the common ailments,* should be the motto of the camp surgeons. The following measures are indicated:—

1. Every recruit should be asked whether he has had typhoid fever, or if during the previous twelve months he has lived in a house with a case of fever. An affirmative answer should mark the man for laboratory study. This may seem an irksome precaution, but in preventive medicine nothing necessary is irksome.

2. A realisation of the extremely protean character of typhoid fever, so that mild cases of enteritis, obscure forms of bronchitis and pneumonia, and mild cases of fever should be watched with care.

3. Every typhoid patient should be regarded as a focus of infection, and should be suspected as long as the bacilli are present in the discharges. The cases should not be treated in the general wards with other cases. Measures should be taken in the larger camps and in the garrison towns to segregate the cases.

4. No typhoid patient should receive a clean bill of health until he has been shewn by bacteriological examination to be harmless.

5. Ample provision should be made for the careful bacteriological examination of all suspected cases.

III.

Fever in various forms has proved more destructive to armies in the field than powder and shot. It has been well said that bullets and bacilli are as Saul and David, "Saul has slain his thousands and David his ten thousands." The story of the destructive character of fevers has never been so well demonstrated as in the great Civil War of the United States, during which malaria, dysentery, typhoid fever, and other diarrhœal diseases were fatal foes. Woodward's *Report of the Medical History of the War of the Rebellion* is a perfect storehouse of information on camp diseases. It is not easy to pick out the exact percentage of typhoid fever, as a large proportion diagnosed as diarrhœa and many of malaria belong to this disease; but the official figures for the army of the North are sufficiently appalling—79,455 cases and 29,336 deaths! There is the same story in the Franco-Prussian war; among the German troops there were 8,000 deaths from typhoid fever, 60 per cent. of the total mortality! It is said that the typhoid fever existed in every army corps at the outbreak of the war, and the campaigns were carried on largely in infected regions. I have already referred to the terrible experience in the Spanish-American war among the volunteer troops in the home camps. The sad memories of the South African war still haunt the memory. That was a war which brought out many new details in campaigning, but the sternest lesson taught is the one we are now considering, as it, too, was a war in which the bacilli counted for more than the men. Of the 22,000 lives lost, the enemy is debited with only 8,000; preventable febrile diseases for 14,000. And amongst these, as usual, typhoid fever headed the list, 57,684 cases, of whom 19,454 were invalided, and 8,022 died. The *Bacillus typhosus* alone did more damage than the Boers. Here again, as in the Spanish-American war, it was not so much water-borne typhoid as camp infection by fingers, flies, dust and food.

We are now in the fourth month of the war, and, so far as one can gather from the somewhat meagre reports, the health of the troops at the front has not been damaged to any extent by fever, and, so far, the sad losses have been from bayonets and bullets. On active service the soldier may take typhoid fever with him, or he may find it in the country. A large body of men has a certain percentage of carriers, any one of whom may act as a focus of distribution. The conditions in camp life are peculiarly favourable to case infection; thus it would be impossible for a carrier cook not to contaminate the food of an entire company. Of equal moment is the state of the country in which the troops are working. During the Spanish-American war it was not possible in the United States to locate a camp in a typhoid-free position. In this country it is not possible to pitch a camp in an infected district. In South Africa both conditions prevailed; infection was brought by the soldiers, and was abundant in the country. It seems not unlikely that the troops in France and Belgium are reaping the benefit of the past ten years of active campaign against typhoid fever. Details are not at hand as to the prevalence of the disease in the eastern and north-eastern regions of France, but I am told there has been a great reduction in the incidence of the disease in Belgium, and that the troops have heretofore suffered but little. The Rhenish provinces should reap the benefit of the remarkable antityphoid campaign of the past ten years. Certainly it is very gratifying, particularly at this season of the year, that comparatively few cases have occurred. Among 2,000 German, English and Belgian troops who have been, or are at present, in the base hospital at Oxford, there have only been five cases of typhoid fever; and this, I believe, to be the experience in other large hospitals throughout the country. It will be a great triumph to go through this war without a devastating experience of typhoid fever. In the fighting line it is not possible always to ask the soldier to carry out sanitary precautions, and in a very infected country, even with the best of intentions, he cannot avoid exposure. Here we may expect to find the protective value of inoculation, and it is very satisfactory that the value of the measure has been so generally recognised by officers and men. An immense proportion of those who go with the Expeditionary Forces will have been protected—for a period at least. While with our present knowledge we cannot but regret that the inoculation has not been made compulsory, let us hope that a sufficient number have taken advantage of the procedure to make impossible a a repetition of the enteric catastrophe in South Africa.

In the midst of this great struggle we stand aghast at the carnage—at the sacrifice of so many lives in their prime—

> That many men so beautiful,
> And they all dead did lie.

The bitterness of it comes home every morning as we read in the Roll of Honour the names of the much loved sons of dear friends. Strange that man who dominates Nature has so departed from Nature as to be the only animal to wage relentless war on his own species.

But there are wars and wars, and let our thought to-night be of the other army waging peaceful battles against our true foes. No one has so well contrasted the work of these two armies as the poet laureate of the profession, Oliver Wendell Holmes—

> As Life's unending column pours,
> Two marshalled hosts are seen—
> Two armies on the trampled shores
> That Death flows black between.
>
> One marches to the drum-beat's roll,
> The wide-mouth clarion's bray,
> And bears upon a crimson scroll,
> "Our glory is to slay."
>
> One moves in silence by the stream,
> With sad yet watchful eyes,
> Calm as the patient planet's gleam
> That walks the clouded skies.
>
> Along its front no sabres shine,
> No blood-red pennons wave;
> Its banner bears the single line,
> "Our duty is to save."

We shudder at the needless slaughter of the brave young fellows—allies and foes alike—but think of the slaughter which goes on in our homes, just as cruel as, often more cruel than, that of the battlefield! Tuberculosis alone will kill more than ten times as many this year in Great Britain than will die abroad for their country. Comparing the death-rate in England to-day with that of fifty years ago we may say that, as a result of the work of the other army, more will be saved from death by enteric fever in 1914 than will be killed this year in the war. Eberth's *Bacillus typhosus* will kill in 1914 in the United States more than will German shrapnel and bullets in the Expeditionary Force. Moving in silence, the great army of sanitation, with a general staff and leaders of all lands and languages, claims allegiance only to Humanity. In war it has not often fought winning campaigns, but the new knowledge is full of such promise that even the vanquished may be victors.

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REMARKS ON THE DIAGNOSIS OF POLYCYSTIC KIDNEY

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Polycystic kidney in the adult is not often recognized. It is a rare disease, but, following the law of dual coincidence, there are two cases at present under observation. In the patient before you, a woman, aged 52, sent by Dr. Hayward, of Abingdon, the diagnosis has already been made by Dr. Thompson, the house physician. She is thin, semicomatose, with purpuric spots about the face, and there is a blood-stained fluid oozing from her mouth. She is very apathetic, and it is difficult to get her to reply to questions. Interesting and, in my experience, unique features are seen on inspection of the abdomen. It is enlarged, particularly in the flanks, which bulge. But what catches the eye at once, particularly on the right side, are large, hemispherical projections between the navel and the costal borders. On the right side there is a whole series—one as large as an orange above the level of the navel, while below, extending to Poupart's ligament, are half a dozen, ranging in size from a small marble to a large walnut. On the left side they are smaller, but very distinct, particularly as the tumors descend on inspiration. It is a very remarkable pattern of abdominal tumidity—the bilateral swelling, the marked prominence of the flanks, and the hemispherical projections seen beneath the thin abdominal wall. One could not go far wrong in making the diagnosis on inspection alone of bilateral cystic kidneys. On palpation large tumors can readily be felt passing posteriorly deep into the flank, and firm, resistant cysts of various sizes project from the surface. The heart does not appear to be much enlarged, the arteries are sclerotic; the urine is very scanty, with a low specific

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[1] Radcliffe Infirmary, Oxford, November 23, 1914.

gravity, and contains numerous hyaline tube casts. The history of the case is remarkable. At the fourteenth year she had the first attack of hæmaturia, with colic, and naturally the diagnosis was made of stone. These have occurred at intervals, sometimes of a few months, sometimes of a year or more, but she has had fairly good health, and has been able to work hard. About two years ago she had a uræmic attack. Last year, for the first time, the tumor on the right side was detected. She had felt the abdomen increasing in girth; she was at that time much stouter, and a well-known gynæcological surgeon suggested that it might be an ovarian tumor. Within the past few weeks she has had constant vomiting, has been very drowsy; a purpuric rash has broken out, and there has been slight bleeding from the gums. She has grown progressively worse, and is in a very critical condition.

[The patient died the next day, unfortunately, before a photograph was obtained of the abdomen. The post-mortem showed enormous bilateral cystic kidneys. The large cyst on the right side extended into the pelvis, and was in contact with a small pedunculated fibroid of the ovary—a very puzzling condition, I should think, for a gynæcologist. The colon was completely pushed aside and lay to the left of the kidney. As is often the case, the liver contained numerous cysts; one on the upper surface of the right lobe was larger than the fist, and was filled with a clear fluid. The heart was not enlarged, but the arteries were sclerotic.]

The other patient, a woman, aged 39, has been admitted once or twice to the surgical side, where, too, the diagnosis has been made. She is, as you see, very healthy looking, not thin, and with a good color. About ten years ago, after an aching feeling in her right side, she passed two stones, with hæmaturia. Since then she has had several attacks of pain, associated with passage of blood, and twice she has passed small calculi. In the intervals the urine has always been clear, and it now has a specific gravity of about 1.014, and is without albumin.

On inspection of the abdomen, the flanks bulge, more to the left than the right, but there is no special prominence in front. On the right side a large tumor occupies the flank, passes high beneath the costal border and into the epigastric region, and below reaches to the level of the anterior superior spine. The colon can be felt passing over the tumor, the surface of which presents numerous irregular bosses or projections. On deep palpation from behind the tumor mass can be moved forward, and lifts the skin. The left side is occupied by a smaller mass with similar characters. The liver is not enlarged. The superficial arteries are palpable, the blood-pressure is only 130 mm., the apex beat cannot be felt, the heart does not appear to be large, and the aortic second is not specially accentuated. There are no other special features on examination. Her eyes are normal. The X-ray picture shows, on the right, three or four small shadows, suggestive of stones, far away from the kidney position, but quite within the limits of the tumor mass.

The pathology of polycystic kidneys has been much discussed. They are often congenital, and the tumors may be at birth of enormous size. They may be associated with other anomalies. They may be quite small at birth, as in a child with several congenital malformations, in whom both kidneys were slightly enlarged and uniformly occupied by small, just visible cysts, lined with epithelium. A very remarkable feature is the hereditary character. In 1902 I reported the case of a man, aged 39,[2] whose mother died of the same disease. As the subsequent history of the case has never been given, I may state that between 1902, when I saw him, and 1906, when he died of uræmia, he had many attacks of hæmaturia, and the kidneys increased greatly in size. The right kidney weighed 4370 grammes, the left kidney 5270 grammes. Three cases have been reported in one family, and a woman has been known to give birth to five children in succession with the disease. The origin of the condition has been much discussed, but the view put forward by Koster is probably correct, that in an error of development there is failure in the union of the secretory and collecting tubules, which develop separately. Very strong confirmation of this view has been recently brought forward by Forssman,[3] who, studying the problem by the method of reconstruction, arrives at the conclusion that there is a failure of the union of the collecting canals, which develop from the ureter section, with the tubules of the metanephric portion. His

[2] *American Medicine*, vol. iii, p. 951.

[3] *Ziegler's Beiträge*, vol. lvi, 1913, p. 511.

paper is illustrated by many figures showing an interruption in the development and the failure in many places of the union of the two systems. An extraordinary feature is that they may remain stationary for years, and then somewhat rapidly increase in size. This has been the case with two patients I have studied, and Dr. Alfred King, of Portland, Maine, noted within three years rapid growth. They may remain of very moderate size until middle life. The condition is consistent with robust health for many years.

Early and common symptoms are pain and hemorrhage, which lead to the diagnosis of stone. Hæmaturia may be a predominant feature for years, and it has to be borne in mind that this is one of the causes of obscure recurring hemorrhage. In 1907 I saw a lady, aged 60, who had led a life of unusual physical vigor. From childhood she had had at intervals hæmaturia, for which she had consulted numerous physicians on the continent and in this country. She had many letters about her case, in which she herself took a very intelligent interest. The bleeding had recurred at intervals of about eight months. She did not think that from her girlhood she had ever passed six months without an attack. One of her physicians—I suspect Sir William Gull—told her not to bother as it was of no more moment than nose-bleeding. I could not get from her that he used the term renal epistaxis, which has been attributed to him. When I saw her the diagnosis was simple enough—enormous bilateral tumors, with irregular surfaces, sclerotic arteries, colossal heart, with apex beat in the axilla, low specific gravity of the urine, and oncoming uræmia, of which a few weeks later she died.

Hæmaturia has been present in five out of the six cases in adults of which I have notes. The urine usually presents the features characteristic of chronic interstitial nephritis—constant low specific gravity, with a slight trace of albumin, hyaline tube casts, and there may be constantly a small number of red blood-corpuscles. Associated with these are the usual cardiovascular changes of chronic nephritis—sclerotic arteries, high tension, except in the last stages, and hypertrophy of the heart. These features have been well marked in four of the six cases. In one, as I have already mentioned, the enlargement of the heart was enormous. I do not know that I have ever felt an apex beat so powerful or so far to the left. On the other hand, in the cases at present under observation, the cardiovascular changes are not marked, and at post-mortem in the first case the heart was not at all enlarged.

The physical signs are distinctive. No other condition gives the same picture of bilaterally enlarged kidneys with numerous elevated projections, and usually one kidney is much larger than the other. Occasionally, when unilateral, it would be difficult to distinguish the condition from hydronephrosis. In the second case the passage of calculi would suggest an ordinary hydronephrosis, but I do not think it at all likely, as the urine is clear, except during the spells of hæmaturia, and she has never passed pus. The type of dendritic calculus may be associated with progressive increase in the size of the kidneys and a gradual onset of chronic interstitial nephritis, with sclerotic arteries and enlarged heart. There may be no colic, extraordinarily little pyelitis, and progressive hydronephrosis may follow. In such cases the tumors are not very large, and I think it much more likely that this patient has bilateral cystic kidneys complicated with calculi.

When affecting one kidney the tumor has been mistaken for an ovarian. In rare instances, as I have already mentioned, it is unilateral, but, as a rule, both kidneys are involved, so that removal of one deprives the patient of so much valuable secreting tissue. A fatal uræmia has followed the removal of the larger of two cystic kidneys, so that surgeons now make it a rule to examine both organs before attempting to remove one.

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ON

CEREBRO-SPINAL FEVER IN CAMPS AND BARRACKS.

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

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SLIGHT outbreaks in two of the camps in this country have aroused interest in this disease, to which soldiers have been peculiarly liable.

Few infections have so remarkable a history. Belonging to the *nova febrium cohors* of Horace, it appeared (or revived?) in the early years of the nineteenth century. It is not likely that an affection with such striking symptoms could have been overlooked by the seventeenth and eighteenth century physicians. Geographically it has a world-wide distribution, as may be seen by reference to vol. ix of Series I and vol. x of Series II of the *Index Catalogue* of the Surgeon-General's Library, in which epidemics are noted in all quarters of the globe, with special prevalence in France, parts of Scandinavia, and the United States. These islands have enjoyed a singularly happy freedom. Dr. Ormerod's list in vol. i of Allbutt and Rolleston's *System of Medicine* shows how slight and unimportant have been the outbreaks until the Glasgow epidemic of 1907, with 1,000 cases and 595 deaths (Chalmers); and that of Belfast, with, for the eighteen months ending June, 1908, 725 cases, with 548 deaths (Robb).

There has been lately an increase of the disease in England. Dr. Newsholme has kindly furnished me with the figures taken from the investigations of Dr. R. J. Reece. In 1912 there were 272 cases; in 1913, 304; and in 1914, 310. This notable increase above the 30 to 40 cases annually in the eighties and nineties may be accounted for in part by the more accurate diagnosis, and the existence of a meningitic type of poliomyelitis, but there appears to be no doubt that sporadic cases have become more frequent. From inquiries at some of the London hospitals I cannot find that there has been an increase during the past few months. Both of the present outbreaks in camps are in the southern counties. There was a local epidemic in Bristol and the neighbourhood in 1913, reported by Michell Clarke and Symes.[1]

Waves of epidemics occur, of which we are in the fifth since 1805. The present period began about 1893, and has been characterized by some of the most severe epidemics on record, notably that of New York, and for the first time in its history the disease became serious in this country.

The disease spreads slowly, or not at all, from foci of prevalence in various parts of a country. For example, in 1893 it broke out in two or three mining towns in Western Maryland, dragged on for the winter months, did not extend, then disappeared, and we heard nothing more of the disease in the State until 1898, when an outbreak occurred in Baltimore and Washington. In this year it prevailed in a mild form in twenty-seven States of the American Union. In 1904–5 a very severe epidemic occurred in New York, while Philadelphia, less than 100 miles distant, was not attacked. The cases may be confined to a gaol or barrack, or to a few scattered villages, as in the outbreak a few years ago in the Eastern Counties, or to a single house. It has prevailed chiefly in the winter and spring months, and an epidemic rarely lasts into the summer.

With a higher death-rate than any acute infection except plague and cholera, the total mortality is not great, as the case incidence in the community is low. With these two diseases it shares the malign capacity to kill within twenty-four hours. Death has indeed followed within six hours of the onset. During the outbreak in 1898 a healthy young man was attacked at 4 p.m. with pain in the head, dizziness and vomiting. At 6 p.m. he had a convulsion; at 10 p.m., when I saw him, the temperature was 105°, a pin-point purpura was beginning in the hyperaemic skin, the neck was drawn back, he was unconscious, and death occurred a little after 4 a.m., just twelve hours from the onset. Among types of inflammation of the meninges this is the only one from which recovery takes place, in from 25 to 50 per cent. of the cases.

The meningococcus, first described by Weichselbaum, has well-defined cultural and morphological properties, and, like the pneumococcus, has various strains. It is found in the cerebro-spinal exudate, in the blood, in the joints, in the visceral lesions, and in the secretions of the naso-pharynx. A curative serum has been prepared with which good results have been obtained, but in the preparation it is probable that sufficient attention has not been paid to the strains of the germ. Prophylactic vaccination has been carried out on a small scale, and Sophian and Black have found immune bodies in the blood more than two years after inoculation. The meningococci are found in the naso-pharynx of patients, but what is of special importance is the discovery that persons in contact with the sick may harbour the germs in the nose and throat. During outbreaks carriers have been found in large numbers among those living in close contact with the sick; in fact, the intensity of an epidemic appears to bear some proportion to the number of the carriers. As a rule, the germs disappear from the naso-pharynx of healthy contacts in the course of a few weeks. Like the pneumococcus, the germ may be found in the naso-pharynx of healthy persons not exposed to infection—in 158 soldiers among 9,111 in the Munich garrison at a time when the disease was not prevailing!

To these main facts in the story of epidemic cerebro-spinal fever there remains to add another—namely, the constant sporadic presence of the disease as the posterior basic meningitis of children, and as an acute meningococcus meningitis of young adults. A large proportion of the 310 cases for 1914 certified in this country were doubtless of these types, though the pneumococcus and the streptococcus may also cause primary meningitis. The posterior basic form of Gee and Barlow occurs in children under 2 years of age, but in young adults the meningococcus meningitis is not very uncommon, and during an epidemic wave cases may occur in places far distant from the centre of prevalence. Thus in 1893, when meningitis was prevailing in Western Maryland, but not in Baltimore, two young adults were admitted to my wards with the disease; and 5 cases occurred in one household in the city—the mother, two sisters, and two brothers, one of whom came under my care.

In certain characters cerebro-spinal fever resembles pneumonia—in the epidemic localization in gaols, barracks, and houses; in seasonal peculiarities, in the fibrinous quality of the pathological exudate, and in the prevalence of the organism in the naso-pharynx of healthy persons. On the other hand, there are striking differences—in the age incidence, in the dominance of sporadic cases, and in the character of the complications. Briefly, then, the meningococcus is a germ of low virulence, widely spread in the community, and of intense virulence in an individual once it has passed the portals of protection. It is doubtless carried from one person to another, not necessarily from patient to patient, as nurses, doctors, and attendants are very rarely attacked, but in a large proportion the germ is transmitted by a healthy carrier. That the carrier does not always, as has been suggested, harbour a mild, non-pathogenic type is shown by the occurrence of meningitis after the presence of the germ has been determined. How the germ gains access is still under discussion — whether by direct invasion of the meninges from the naso-pharynx through the ethmoidal or sphenoidal routes or by the blood stream. I think the latter the more likely, as no evidence has been found of special involvement of the tissues in either of the routes suggested. Then the fulminant form kills with the features of an acute septicaemia. Since 1899, when Gwyn first isolated the meningococcus from the blood of one of my patients, the organisms have been frequently found in blood cultures.

The localization in the meninges is no proof of direct invasion, as tuberculous meningitis, obviously a blood-stream infection, presents the same peculiarity.

Of the causes of the outbreaks, whether increased virulency in a widespread germ, or increased susceptibility under changed atmospheric or telluric conditions, we are as ignorant as when Sydenham summed up the experience of twenty years' close study of the *genius epidemicus* of London:

> Wherefore I conjecture that diseases have certain periods according to the occult and unaccountable alterations which happen in the bowels of the earth, to wit, according to the various age and duration of the same.

In cerebro-spinal fever we may be witnessing the struggle of a new disease to win a place among the great epidemics of the world. In the past decade it has everywhere shown an ominous activity. Again, Sydenham touches the marrow of the matter in a famous passage in which he refers to the briefness of our experience in comparison with the long ages of the world.

> And as there have been other diseases heretofore which are either now utterly extinct, or at least, being almost wasted by age, fade away, and very rarely appear . . . so the diseases which now reign will vanish in time, and give place to other kinds, whereof indeed we are not able so much as to guess. This may be so, whatever we, who are so short-liv'd, think of it, who are born as it were one day and die another; nor are the most ancient authors that have written observations of diseases of much longer age, if they are compared with the beginning of the world.

Our present interest relates to the disease as met with in barracks, camps, and campaigns, and this comforting fact comes out of a review of the outbreaks—that while soldiers are peculiarly liable, cerebro-spinal fever has never been a great war pestilence. Jaeger (to whom we are indebted for important studies on the meningococcus) has published a monograph dealing with the occurrence of the disease in armies, and for this purpose has tabulated the epidemics of the nineteenth century in different countries. France, which has suffered most severely, had sixty-two epidemics, of which forty-three (69 per cent.) were confined to troops. In Germany there have been many small outbreaks in garrisons, particularly in Würtemberg and Bavaria. The incidence of the disease has risen during the past twenty-five years. In Italy the outbreaks have been chiefly in the military population. In these islands there has been no severe outbreak in garrison or camp. In 1868 four cases occurred within three weeks at the Shorncliffe Camp, and in 1876 two cases were reported among the militia at Oxford. Jaeger's analysis shows an increase of the disease in the European armies since 1870. The epidemics are usually small, restricted to a garrison, sometimes to a single barrack in a town.

It is reassuring to find that in the great campaigns of the nineteenth century cerebro-spinal fever played no part as a camp disease. There is no reference to it in the Napoleonic, the Crimean, the Italian, or the Danish wars, In the Franco-Prussian wars there were a few cases. chiefly about Paris. Isolated cases occurred in the Russo-Japanese war, but no serious epidemic, and the same is true of the South African war. The only exception in the history of the century is the Civil War in America, during which there were outbreaks in both the Northern and Southern armies in '61, '62, '63, none of them, however, very widespread, and as a camp disease it did not enter into the same category with typhoid, dysentery, and malaria.

Meningitis is a rare disease among the troops in these islands. Sporadic cases occur, but neither at home or abroad has it ever prevailed as an extensive epidemic, so far as I can find, in any camp or barracks. In 1910–11 there were 10 cases, with 8 deaths; in 1912 there were 6 cases, with 5 deaths; no differentiation is made between the forms of the disease. I have not heard of any cases among the Expeditionary Force. The existing outbreaks are not extensive, in one less than 40 cases occurred in four months among more than 30,000 men. Details of the others have not yet come to hand.

The German troops from the south-west may carry the disease into the field, and the French army has always centres of infection. Metz and Strassburg have a bad name in the history of the disease; but we may hope that the experience of 1870–71 may be repeated.

In the outbreaks among the troops there have always been three strong predisposing factors: overcrowding in camps or barracks, the cold winter weather, and over-muscular exertion among young recruits. Two of these conditions have prevailed in this country during the past three months. The weather has been atrocious, and an enormous number of young recruits have been in active training. One cannot say that there has been special overcrowding, but a great many men have been in tents, in the ordinary regulation form of which nine men live in close contact, and I can testify from personal examination that the ventilation is not always good. It is this very intimate contact that seems to favour the communication of the disease. With fresh air, sunlight, and scrupulous personal cleanliness, the epidemics, as a rule, quickly subside.

I may add that stringent preventive measures have been taken—isolation of the sick, systematic examination of the contacts, and the disinfection of the naso-pharynx of any carriers, which should suffice to limit the outbreaks. In a circular issued a year or two ago in the French army Vincent recommends the following mixture as an inhalation: Iodine 12 grams, guaiacol 2 grams, thymol 35 cg., alcohol 200 grams, with 6 grams of potassium iodide, used five or six times a day. Disinfection of the pharynx is carried out by swabbing with a 3 to 5 per cent. solution of glycerine and iodine. In the recent Texas epidemic Sophian found that hydrogen peroxide 1 per cent., with argyrol 9 per cent., used as a spray, destroyed the meningococcus quicker than any other measure. Urotropin, which is secreted into the cerebro-spinal fluid, has been recommended by Cushing as a prophylactic.

The reader is referred to Stillé's monograph, 1867, for the fullest details as to symptoms; to Hirsch's *Geographical Pathology* for the epidemics; to Jaeger's *Die Cerebrospinalmeningitis als Heeresseuche*, Berlin, 1901, for an exhaustive consideration of the disease as it affects soldiers; to Koplik's article in my *System of Medicine;* and for bacteriology and treatment to the recent publication of Sophian, *Epidemic Cerebro-spinal Meningitis* (London, Henry Kimpton, 1913), and to Heiman and Feldstein's *Meningococcus Meningitis* (London, J. B. Lippincott Co., 1914).

REFERENCE.

[1] BRITISH MEDICAL JOURNAL, June 13th, 1914.

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Remarks

ON

ARTERIO-VENOUS ANEURYSM

Made at a Symposium on the Subject at Radcliffe Infirmary, Oxford, on March 26, 1915

BY

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GENTLEMEN,—Better than any other disease aneurysm illustrates how borderless are the boundaries of medicine and surgery. Here am I talking on the most surgical of all its aspects, while very likely not far away a surgeon is practising the best possible prevention against internal aneurysm in giving a syphilitic patient an injection of salvarsan! Aneurysm has been a medico-chirurgical affection ever since some bungling young "minutor" first nicked the brachial artery in performing venesection. One of the earliest and most interesting references in literature is to an instance of this kind. Galen was called in consultation by a young and inexperienced surgeon who had opened the artery at the bend of the elbow instead of the vein, and the blood spurted out "clarus, rubens, lucidus et calidus."

"I took in the situation at once; there happened to be an elderly physician with me, so we prepared a medicine, viscid, conglutinable, and obstructive, and placing it strongly against the lips of the wound bound over it a soft sponge. The surgeon who had opened the artery wondered, but said nothing. When we went out"—note the professional touch!—"I said to the surgeon that he had opened the pulsating vessel, and charged him not to dress the wound before the fourth day, and not without me."

[1] In which Colonel Dodds-Parker, Major Mallam, and Captain Bevers took part.

The cure was complete, and Galen remarks that this was his only successful case of the kind, as in all others aneurysm had followed. This account, taken from Symphorien Campegius "Claudii Galeni Pergameni Historiales Campi, Basilae," 1532, p. 43, is doubtless of the case referred to in the "Methodus Medendi."[2] The only other references to aneurysm in Galen are in the "De Tumoribus praeter Naturam"[3] and in the "De Curandi Ratione per Sanguinis Missionem,"[4] in which he refers to the possibility of gangrene.

Historical Survey.

Rational surgery was one of the gifts of the Greeks, but in the 800 years between Hippocrates and Oribasius few names have survived specially associated with this branch of medicine. Who among us off-hand could recall more than two or three in addition to Hippocrates and Galen? Yet in this period scores of important schools flourished with great teachers of surgery, men honoured in their generation and the glory of their times. As one reads the partial list in Haller's "Bibliotheca Chirurgica" and scans the few golden remains of their writings fortunately preserved by encyclopædists such as Oribasius and Paul of Ægina, the truth of Sir Thomas Browne's remarks comes home: "Who knows whether the best of men be known, whether there be not more remarkable persons forgot than any that stand remembered in the known account of time?" Two of these comparatively unknown men created the surgery of arteries, Rufus of Ephesus and Antyllus, the Cosmas and Damien of Greek surgery.[5]

[2] Linacre's edition, 1517, f. lxii., v.

[3] Junta, fifth edition, 1576, iii., p. 84.

[4] Ibid., vi., p. 21.

[5] These practitioners, who became the Christian saints of surgery, suffered martyrdom in Cilicia in the third century. In their Western Mother Church, on the Roman Forum, I have seen the little parcel said to contain the instruments with which they performed the most famous operation in hagiological surgery, substitution of the healthy thigh of a just-dead man for one that was gangrenous.

Rufus of Ephesus.

To generations of practitioners unworthy to hand him ligatures Rufus of Ephesus (Reign of Trajan, early part of second century A.D.) was known by the "pilulæ Ruffi," "the pills I would not be without" —"pilulæ sine quibus esse nolo"—still in the British Pharmacopœia as the pill of aloes and myrrh. In the brilliant Ionian profession of the early days of our era Rufus doubtless had predecessors and teachers, but he stands out a strong, clear figure, a great "magister chirurgiæ," a title justly earned by his remarkable contribution to the surgery of hæmostasis. We know it only through a section in Aetius, a sixth-century physician.[6] Nothing is lacking in a description, which might be transferred to any modern textbook—digital compression, styptics, the cautery, torsion, and the ligature—only I am sorry not to find, as is sometimes said, a description suggestive of arterio-venous aneurysm, though he speaks of the possibility of traumatic aneurysm.

Through the Arabians the name of Rufus was on the lips of every mediæval physician, and we find him among the favourites of Chaucer's well-read Doctor. In one of the earliest and most beautiful of medical manuscripts, the famous "Juliana Anicia Dioscorides" (A.D. 525), of the Vienna Library, he is figured with Galen, Hippocrates, and others.

Antyllus.

Upon the other great surgical figure of antiquity, Antyllus, so blindly has oblivion scattered her poppies, to quote Sir Thomas Browne again, that not a fact of his life is known; yet through the mists of 18 centuries he looms large as one of the most daring and accomplished surgeons of all time. A resector of bones and joints, one of the first to perform tracheotomy, the founder of the surgery of fistula, a successful operator upon cataract, and we may say the creator of the surgery

[6] Tetrabiblos, lib. xiv., cap. 51.

of the arteries—these are among his known achievements. His remains are chiefly in the works of Oribasius, the physician and friend of the Emperor Julian.

Nowhere are we impressed with the note of directness so characteristic of the Greek (see R. W. Livingstone's "Meaning of the Greek Genius," second edition, 1915) as in the brilliant account given by this author of aneurysm, of which he was the first to recognise two forms—one by dilatation, the other following wound of the artery. So far as I can gather, he was also the first to describe the thrill or bruit so characteristic of the latter form. No ancient writer has anything like the same accuracy of pathological description, and you may search the surgical literature for centuries before there is found such a gem as the account of his method of operation still in use, and by which his name has been permanently enshrined. Not finding one in English, I asked Mr. Livingstone, of Corpus Christi College, to give us a complete translation of the fragment.

About Aneurysms (from the works of Antyllus[7]*).*

There are two different kinds of aneurysms. The one kind occurs when there is a local dilatation of an artery (this was the origin of the name aneurysm or dilatation). The other kind arises from the rupture of an artery and the discharge of the blood into the flesh beneath it. Aneurysms due to the dilatation of an artery are longer than others; those due to a rupture are rounder. In the former there is a thicker layer of tissue; in the latter you can hear a certain crepitation if you press them with your finger; while in aneurysms due to dilatation there is no sound.

It is foolish to follow the practice of the ancient surgeons and decline to treat any aneurysm, but it is dangerous to apply surgical treatment to all types. So we will excuse ourselves from treating aneurysms in the armpit, groin, and neck on the ground that the vessels are large and that it is impossible or dangerous to isolate and tie them. We also decline exceptionally big aneurysms, even if they occur elsewhere. But we will operate as follows on aneurysms in the extremities, the limbs and the head.

[7] Oribasius, iv., p. 52 (ed. Daremberg).

If the aneurysm results from dilatation, we will make a straight incision in the skin the whole length of the vessel; then, after separating the edges of the incision with hooks, we will carefully sever all the membranes between the skin and the artery. Then pushing aside with blunt hooks the vein adjacent to the artery, we will expose the dilated portion of the artery on all sides. Next, we will introduce the head of a probe underneath, and, lifting the aneurysm, insert along the probe a needle with a double thread, so that it passes beneath the artery. We will cut the thread at the eye of the needle, making two threads and four ends of thread; then, taking the two ends of one of the threads, we will pass them gently to one end of the aneurysm and tie them with precision. Similarly, we will pass the other thread to the opposite end of the aneurysm, and then tie up the artery, so that the entire aneurysm lies between the two ligatures. Then we will lance the aneurysm with a small incision at its centre; in this way its contents will all be evacuated without any danger of hæmorrhage. Those who tie the artery, as I advise, at each extremity, but amputate the intervening dilated part, perform a dangerous operation. The violent tension of the arterial pneuma often displaces the ligatures.

If the aneurysm originates in the rupture of an artery, isolate with your fingers as much of the aneurysm as you can, including the skin. Then below the isolated part introduce a needle with a double thread of flax or of gut; after passing it through cut it at the needle's eye, forming two threads. Take hold of the two ends of one of these and pass it to the right, there tie it tightly, so as not to slip. Pass the other end similarly in the opposite direction—to the left. If there is any fear of the threads slipping, pass a second needle with a similar double thread through the same spot, intersecting the first thread and crossing it in the form of the letter χ (chi). Cut the threads as before, and tie them like the first ones, so that four threads form the ligature. Then open the tumour at its top, and, after evacuating the contents, remove the superfluous skin, leaving the part tied by the threads. In this way the operation is effected without hæmorrhage.

And I must read Mr. Livingstone's comment:—

It certainly is a beautiful piece of lucid writing. I felt that if I was alone on a desert island with someone suffering from aneurysm, and the tide had washed ashore sufficient ἄγκιστρα, &c., that I shouldn't have minded trying the operation. And Antyllus had real literary power. What an admirable phrase is ἐκπτύεται, the "spitting out" of the ligature by the throbbing artery: I don't think you can get it in English, and I fell back on a lame substitute, "displaces."

Not unjustly does Paul Broca in his great monograph, "Des Anévrismes," claim that not only did Antyllus create operative medicine but the pathology of aneurysm: "À chaque ligne on reconnait l'écrivain qui parle de ce qu'il a vu, de ce qu'il a fait."

Decay and Revival of Vascular Surgery.

Aetius in the middle of the sixth century describes the method for cure of aneurysm at the elbow, known later as that of Anel (1710), ligation of the brachial artery three or four fingers'-breadth below the axilla, followed by opening the sac, which was allowed to heal by suppuration. A curious error of Sprengel has led to the connexion of the name of Philagrius, a fourth century surgeon, with this operation. In the fragments of this writer given by Aetius aneurysm is not mentioned, but Sprengel never noticed that the extract on aneurysm which follows directly after one upon ganglion by Philagrius did not belong to this author but to Aetius himself.

A casual perusal of the fragments of the Greek surgeons of the first three or four centuries of our era as given in Gurlt's "Geschichte der Chirurgie" gives the impression of a great and fruitful period with scores of men whose qualifications were those demanded by Thomas Fuller for the good operator—the eagle's eye, the lion's heart, and the lady's hand. Then came the tragedy, the death in the West of the science of the Greeks. The Church took over their philosophy, the Arabs absorbed much of the best of their medicine and added to it, but surgery as a progressive science and a successful art died with its founders, the great Greeks of the Græco-Roman Empire. So far as the surgery of arteries is concerned we might take a jump of a thousand years or more were it not for an Arabian, Albucasis of Cordova (tenth century), who wrote a famous surgical treatise, of which we have in the Bodleian the two earliest manuscripts. A young scholar of Wadham and student of Christ Church, John Channing, in 1778 issued from the Clarendon

Press a beautiful edition. The description which he gives of aneurysm with its treatment is practically that of Antyllus. He notes the stridor to be felt, which indicates that he was probably dealing with the arterio-venous form.

In vascular surgery the men of the Middle Ages and of the Renaissance, Henri de Mondeville, Guy de Chauliac, and even Ambroise Paré, were blind followers, who never even approached the position of their masters. Not much more than a century has passed since men of the John Hunter type took up vascular surgery where Rufus and Antyllus had left it, and only to this generation of experimental surgeons, such as Eck, Ballance, Matas, J. B. Murphy, Halsted, Carrel, and Guthrie, could the best of the Greeks go to school. You may think perhaps, that I am scarcely just to the great mediæval surgeons, particularly to such a master as Ambroise Paré, who reintroduced the ligature, but in vascular surgery, the touchstone of the position of the art, they never wholly regained what the profession had lost.

Our modern knowledge dates from William Hunter, in whose "Medical Observations and Enquiries,"[8] in a paper on Aneurysm of the Aorta he asks, "Does it ever happen in surgery when an artery is opened through a vein that communication or anastomosis is afterwards kept up between the two vessels?" He then describes, in a case following bleeding, the swelling, enlargement of the veins, and "a tremulous jarring motion" strongest at the part that had been punctured. In a subsequent paper, 1761,[9] he described two cases very fully, and recognised the enlargement of the arteries and of the veins and the characteristic hissing noise "as if there was a blast of air through a small hole and interrupted, answering precisely and constantly to the stroke of the heart or diastole of the artery."

It is true that in the seventeenth century Sennertus, the distinguished Wittenberg professor, noted in this form of aneurysm the characteristic thrill which he compares to the boiling of water, "quasi bullientes aquae," not only palpable but

[8] London, vol. i., 1757.

[9] Further Observations upon a particular Species of Aneurysm Medical Observations and Enquiries, London, 1761.

audible, as if the vital spirits were passing through a narrow orifice.[10]

RARITY OF ARTERIO-VENOUS ANEURYSM.

It is remarkable how few specimens of arterio-venous aneurysm of the external vessels are in the museums of this country. I have only been able to get references to some half dozen cases. One is astonished not to find any in the Army Medical Museum, Millbank, or at Haslar or Greenwich. Nor is there an example in William Hunter's Museum at Glasgow. The Royal College of Surgeons of England has only three, including a recent uncatalogued one sent by Sir G. H. Makins. Its most remarkable specimen was sent in 1867 by Dr. Beaumont, of Toronto, an old teacher of mine. I was not a little surprised and greatly pleased to find a pathological memorial of this fine old St. Bartholomew's man, a fellow pupil of Paget, who went out to Toronto in the early "forties" and became professor of surgery in the newly founded King's College. It is an admirable specimen as illustrating the late changes in the veins. The case is fully described by Beaumont in the *Medical Times and Gazette* for July, 1867. A man, aged 45, had 11 years previously been stabbed in the upper part of the thigh. There was a very large pulsating tumour in the upper part of the right thigh, fully six inches in extent in either direction and extending nearly to Poupart's ligament. The patient died under chloroform, which was administered for the purpose of ligaturing the external iliac artery. The specimen shows a venous sac as big as a small cocoanut, measuring 14½ by 12½ inches, very thin walls containing some old laminated fibrin, and the walls were in places calcified.

The truth is, this is not a country of brawls and dirks, and pistol wounds are rare in civil life. It is strange that no specimens found their way to the museums from the South African War. The

[10] Opera, Ludg., 1676, p. 51.

Army Medical Museum, Washington, has only two examples (Lamb).

The rarest of all forms, arterio-venous aneurysm, is occasionally met with in the medical clinic as when a small aortic aneurysm opens into the superior vena cava, while on the surgical side trauma is responsible for 99 per cent. of those connected with the external vessels. Until the recent wars stab wounds accounted for the large majority of cases, but in the Japanese, the South African, and the Serbian wars the high-velocity bullet heads the list of causes.

Personal Experience of Wounds of Arteries.

Naturally, as a physician my experience with wounds of arteries has been very limited—until recently only 10 cases, in 5 of which arterio-venous aneurysm followed. The other 5 cases came in medico-legal post-mortem work in Montreal, and they may be just mentioned for their interest.

1. A soldier during the vaccination riots in Montreal gave a man a prod with his bayonet, which passed through the top of the left lung and cut the subclavian artery just as it leaves the arch to curve over the pleura.

2. A man in a brawl received a stab with a penknife at the root of the neck, followed by a traumatic aneurysm, which was operated upon unsuccessfully; the tip of the knife had cut the vertebral artery between the lateral processes of the fifth and sixth cervical vertebræ.

3. A man received a blow on the head in a tussle, and some days later died suddenly of hæmorrhage from the nose; a fracture of the sphenoid was found with laceration, or erosion, of the internal carotid just where it turns into the sella turcica.

4. A man in riding jerked against the pommel of his saddle and drove a dirk which he was carrying into his femoral artery.

5. A fatal bullet wound of the left internal iliac artery.

The arterio-venous cases I will quote in connexion with their most striking features. Within a few months I have seen as many instances as in 40 years of hospital work: two cases at the American Hospital, Paignton, in one of which Dr. Beal did a successful Antyllus operation; a patient of Mr. R. B. Wright at Chester, to whom I shall refer in connexion with the physical signs; and the two patients we have the opportunity to study to-day—for one we are indebted to the kindness of Captain Mowat, of Sheffield, the other is under the care of Major Ernest Mallam at the base hospital.

Exhibition of Two Cases.

W. W., aged 28, a private, had served in the Northumberland Fusiliers for eight and a half years, was always well and strong and never had a serious illness. On Oct. 19th at about 11 A.M. at La Bassée he received three shrapnel wounds, one in the left thigh. Was in the trenches until 7 P.M. Lost an enormous amount of blood. The fragment entered the left thigh just 3 inches below Poupart's ligament, and the piece is still in the leg. There was a great deal of swelling and a good deal of disability at first. The leg did not change in colour, but he was very weak from loss of blood The wound did not suppurate. Captain Mowat noticed the swelling in the left leg and felt the murmur. He was at Sheffield from Oct. 23rd to Dec. 10th, and gradually got well. Captain Mowat took a remarkable phonograph record of the murmur, which I heard a few weeks ago at Sheffield.

Now the man is healthy-looking, of good colour; he limps on the left leg; there is no swelling or discolouration. The left thigh looks a little smaller than the right, particularly in the antero-lateral region. There is a healed wound just 3 inches below Poupart's ligament in the lower end of Scarpa's space, where there is a diffuse swelling not very marked, and then a little groove-like wasting in the line of the femoral artery. The greatest prominence is at the site of the entrance of the bullet. The pulsation is diffuse, but does not extend above Poupart's ligament. The veins are not greatly distended, but the internal saphenous is visible, and those on the left side are larger than on the right.

On palpation the characteristic thrill is felt of maximum intensity over the injury, and it is felt down the course of the femoral. There is a slight firm induration just beneath the scar, but not a definite tumour. Pressure on the femoral stops the pulsation at once. The thrill is felt above Poupart's ligament. There is no pistol-shot sound to be felt. Pulsation in the popliteal and tibials not palpable. On auscultation a machinery murmur of extraordinary intensity is heard of maximum intensity at the site of the injury, propagated down the femoral, heard in the popliteal. The arteries are not sclerotic and the heart sounds are clear.

Major Mallam's case is an exact counterpart.

Bullet wound of the thigh on Dec. 30th, passing through Scarpa's space. Much blood was lost, but the orifices of entrance and exit healed rapidly. A large effusion of blood in the upper region of the thigh at first masked the nature of the lesion, and it was not until the swelling subsided that the characteristic signs of arterio-venous aneurysm were noted. There are now moderate swelling in Scarpa's space, pulsation palpable, thrill felt with greatest intensity at the point of maximum impulse, and a loud machinery murmur.

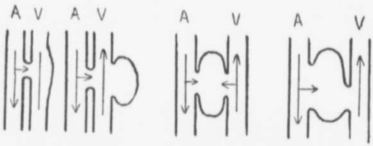
Anatomical Varieties and Resulting Changes.

We need not take time to discuss the anatomical varieties which are all modifications of two types, the simple tangential opening between an artery and a vein—aneurysmal varix, and the formation of a sac communicating with both vessels—varicose aneurysm. The accompanying diagrams (Figs. 1 and 2) from Lexer's "Handbuch der allgemeinen Chirurgie" show all possible forms.

The changes that follow are: (1) The blood current is reversed, to a certain extent, in the veins; (2) the blood pressure is increased in them; (3) their walls become arterialised; and (4) the blood pressure in the artery is heightened on the proximal and lowered on the distal side of the lesion. In smaller vessels very slight changes occur. I show you a drawing of an aneurysmal varix of the anterior tibial vessels from a case in the Strassburg clinic, in which a year after the accident the vein was little if at all dilated. In lesions of the vessels of the neck and arms the venous stasis is much less than in the legs, in which the effect of gravitation is so felt that year by year the changes become more pronounced, until, as in the photographs I show, large varicosities and sacculi are formed. Femoral and popliteal arterio-venous aneurysms may last for years without great involvement of the veins, but in a majority of the cases venous stasis forms the most serious sequel of the disorder.

The changes in the arteries on the proximal side of the lesion are less striking, but sooner or later

FIG. 1.



1A. 1B. 2. 3.

1. Arterio-venous fistula without (1A) and the same with (1B), a venous sac—varix aneurysmaticus. 2. Arterio-venous aneurysm with false intermediary sac—aneurysma varicosum. 3. Arterio-venous aneurysm with arterial sac. Secondary arterio-venous aneurysm.

FIG. 2.

1. 2A. 2B. 3.

1. Arterio-venous aneurysm with false intermediary sac and varix on outer side of vein, due to double injury of the latter. 2. Arterio-venous aneurysm with immediate communication (A), or with false intermediary sac (B), and with a false arterial aneurysm, due to a single venous and double arterial injury. 3. Arterio-venous fistula with opposing sacs, due to a double injury of both vessels.

sclerosis occurs with dilatation, and sometimes with saccular aneurysm opposite the orifice of communication. Even within two months of the injury the femoral artery may be felt to be larger and with stronger pulsation (Paignton case). Remote effects on the general circulation are rare, particularly in aneurysms of the vessels of the head and arms. One of my patients (Case 3) died from heart disease which may have had some connexion with his long-standing lesion. In the leg progressive dilatation of the vessels may lead to serious effects. In the case of Captain Mosher,[11] wounded in the middle of Scarpa's space 1898, at the time of death (1911) the dilated arteries extended from the bifurcation of the common iliac to the lower third of the thigh. Hypertrophy of the heart followed, and death from progressive failure of the circulation.

Physical Signs.

In no form of aneurysm are the physical signs so distinctive. *Inspection* may not show much, as in the cases you have just seen: diffuse pulsation at the site of the communication, moderate swelling, but not necessarily any early venous engorgement.

In the carotids, subclavians, and axillaries the condition may persist for years without much swelling or great enlargement of the veins. On the other hand, in the form that was so common at the bend of the elbow in venesection days the circulation is much interfered with. Even in smaller vessels such as the occipital the venous swelling may be enormous, as in a patient operated upon by Dr. Cushing at the Johns Hopkins Hospital in 1905. This case illustrates, too, the progressive nature of the lesion, as year by year the vessels on the side of the head grew larger, and after seven years they formed a large pulsating mass which had to be resected, after ligation of the external carotid artery.[12] In the leg, particularly in the situation in the cases you have here seen, venous engorgement sooner or later dominates the scene,

[11] Reported in Lagarde's Gunshot Injuries, 1914, p. 281.

[12] Journal of the American Medical Association, Dec. 23rd, 1905.

and after some years the appearance may be very remarkable, as in the following case.

CASE 1. *Illustrating the development of enormous venous sacculi.*—The patient, aged 31, was shown at the Johns Hopkins Hospital Medical Society on Jan. 16th, 1905. In his eleventh year he had a knife wound just above the right knee; not long after pulsation was noticed along the femoral artery, with marked swelling. He has had good health, with very little disability, except from the increasing varicose veins, which sometimes burst and caused troublesome bleeding. The leg presented a very remarkable appearance, as shown in Figs. 3 and 4. The superficial veins were everywhere varicose; those of the antero-lateral aspect of the thigh were of enormous size, extending into the flank, and many of them were filled with thrombi. The course of the femoral, particularly in Scarpa's space, was occupied by a prominent pulsating tumour, the outline of which can be just seen in Fig. 4. Over this there were an intense thrill and a loud humming murmur with systolic accentuation; pulsation was everywhere forcible. Above Poupart's ligament, lifting the entire iliac fossa and extending into the hypogastrium, was a second tumour, in which the pulsation was very strong, a marked thrill, and the same loud murmur. The size of the tumour, which extended fully 8 inches transversely, can be well seen in Fig. 4. It increased in the sitting posture. The patient said this had been present for many years, but had, he thought, increased in size. It felt very solid and firm and the pulsation was extensile and strong. His only serious disability was from the varicose veins.

The tumours both above and below Poupart's ligament were huge venous sacs. When I demonstrated this case a doubt was expressed whether these really could be venous sacs, but there are many specimens, as in the one I refer to of Dr. Beaumont, and cases are recorded showing a similar condition. A recent one was reported by Eisenberg[13] of a man, aged 65, wounded 18 years before in the thigh, and in addition to great dilatation of the femoral vessels there was a sac 3 inches in diameter of the iliac vein above Poupart's ligament. Additional features that may be noticed on inspection are the increased size of the limb; an actual increase in growth has been noted by Broca in the young; the skin may be

[13] Ibid., Dec. 13th, 1913.

FIG. 3.

CASE 1.—Arterio-venous aneurysm of the femoral vessels of 20 years' standing.

FIG. 4.

Same patient as Fig. 3, showing the varicose veins and two huge venous sacculi, one above, the other below, Poupart's ligament.

much rougher, covered with a thicker growth of hair, and in long-standing cases varicose ulcers are common.

On *palpation* the characteristic thrill is felt, vibratory, rough, continuous, and increasing in intensity with the diastole of the artery. Except in its roughness it is quite unlike any other thrill felt in cardio-vascular lesions, and is pathognomonic. It has an interest, too, as one of the oldest of recognised physical signs, having been described by Antyllus. While of greatest intensity at the site of the lesion, it may be widely diffuse and even felt at the finger tips in an axillary or brachial aneurysm, and at the toes in a femoral. In the patient seen with Mr. Wright[14] at Chester a few weeks ago, there was an additional physical sign which I have never before noted, nor in looking pretty carefully through the literature do I see it mentioned—a pistol-shot sound of great intensity, exactly such as one feels and hears in aortic insufficiency. It was an arterio-venous aneurysm of the popliteal vessels caused by a bullet wound on Jan. 29th. The note which I dictated was:—

On palpation an intense vibratory thrill, continuous, with diastolic intensification, is felt over the area of pulsation, not below the middle of the leg. The striking feature is the pistol-shot shock felt during the diastole of the vessel, exactly resembling that which one hears and feels in the femoral in aortic insufficiency. It is felt only over the area of pulsation, not in the femorals, and there is no valvular disease. In addition, one feels the strong, firm, aneurysmal pulsation.

In the second case at the American Hospital, Paignton, there was no pistol-shot sound over the popliteal tumour, but one of great intensity could be heard, without the slightest pressure, over the femoral artery On the other side it could be brought out only with pressure of the stethoscope. In the early stages the tumour may not be large, or where it is simply an aneurysmal varix little or no swelling may be present. If there has been

[14] On March 26th Mr. Wright operated, tying the artery above and below and closing the direct orifice into the vein. There was no sac. The vein was unusually large.

effusion of blood the tumour, as in Major Mallam's case, may diminish considerably in size. Subsequently the diffuse swelling may be largely venous, but a circumscribed tumour may be either sacculi in connexion with the vein or artery, or sacculi at some distance from the original site of the injury, and there is not infrequently aneurysmal dilatation of the artery above the lesion.

On *auscultation* the second characteristic physical sign is heard—a loud, rough, humming-top murmur, continuous, with marked intensification during the cardiac systole. During distension of the vessel the murmur is rough, harsh, and vibratory; during its contraction it has a graver, deeper quality. It may be widely diffused, heard up and down the vessels even to the finger-tips in the brachial and axillary aneurysms, and to the toes in the femoral. It may even be intense enough to be heard at some distance from the site of the aneurysm.

Practically these are the three great physical signs of arterio-venous aneurysm: the dilatation of the veins, the thrill, and the murmur. Other minor features may be mentioned—absence or lessened pulsation below the site of the tumour, the remarkable influence of posture on the venous engorgement, the pulsation in the peripheral distended veins, the frequency with which phleboliths and thrombi may be felt.

Collateral Circulation.

From the surgical standpoint it is important to determine the adequacy of the blood-supply beyond the lesion. Recumbent the legs, for example, may look alike, but within a few minutes after assuming the erect posture the one on the side of the lesion may become dusky in colour, and the veins dilate. It is not easy to determine the blood pressure in the arteries below the lesion. Korolkow uses a modified Gärtner's tonometer, and Matas lays down the rule:—

If the peripheral blood pressure is shown by the manometer (a modified Gärtner's tonometer) to be normal or well sustained after compression of the main trunk above the aneurysm then the obliterative operation may be safely applied. If, on the other hand, the blood pressure falls to zero it is evident that the collateral circulation is inadequate, and that no chance should be taken with the obliterative operation or with any procedure whatever (ligature, extirpation, &c.) which would permanently occlude the parent artery.[15]

Another test is after application of an Esmarch bandage apply pressure on the artery above the aneurysm, and note the state of the circulation and the time taken for the skin vessels to fill. In one of the Paignton cases (popliteal) in the sound leg it took three minutes to obliterate the anæmia caused by the bandage while the femoral was compressed above Hunter's canal, but in the affected leg the skin vessels of leg and foot were filled within a minute! The femoral artery on this side felt larger and had a much more powerful pulsation.

Results.

Left alone, what becomes of these cases? Much depends upon the position of the aneurysm. Those in the upper extremities are more favourably situated than in the lower. The following may happen :—

Non-Intervention followed by Good Results.

1. The aneurysm may remain unchanged for years and interfere little, if at all, with the patient's health and vigour. Particularly is this the case with the cervical and axillary vessels. Case 3 of my series illustrates this in a remarkable way, as for years he rowed in races and lived a very athletic life. Case 2 also illustrates the wisdom of non-intervention.

Case 2.—On April 9th, 1900, Dr. Alderson sent me from Russelville, Kentucky, a man, aged 29. On the night of Jan. 5th he had received four bullets, one in the left

[15] Keen's Surgery, vol. v., p. 273.

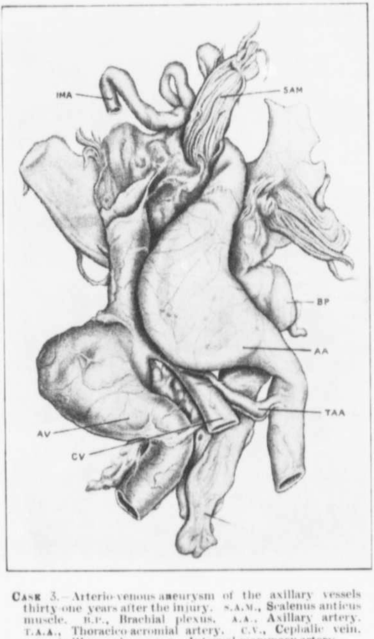
shoulder, one in the back of the left arm, one in the left lower axillary region, and the fourth, the important one, entered the middle of the fold of the left trapezius muscle, passed inwards and downwards in front of the spine, and came out under the right clavicle. All the wounds healed rapidly, but at first he had some difficulty in swallowing. The right supraclavicular fossa was occupied by a pulsating swelling extending for about 7 cm. upwards and outwards. There were a marked thrill and a loud humming-top murmur with systolic intensification, which was heard up the neck and down the vessels of the arm. The bullet could be felt just below the clavicle. The tumour had increased, and the question was whether it was safe to leave him alone. This was the policy I urged strongly. Twice he narrowly escaped operation. Two years afterwards I heard from him and he remained well; the tumour was somewhat smaller, but the bruit was still a little troublesome. Five years after the accident I heard again. He had remained well, the tumour had not increased in size, and he was able to use his arm and do everything.

Spontaneous Healing.

2. Spontaneous healing may occur, the orifice closing between the artery and the vein. This must have happened in Case 3, as a careful dissection by Professor J. J. Mackenzie, of Toronto, failed to demonstrate any communication between the greatly dilated vessels. As such a mode is rare, I give an abstract and a sketch of the dissection. (Fig. 5.)

Case 3.—I reported the case originally in the *Annals of Surgery*, 1893. In 1878 the man, in running down a sloping grass plot, fell and forced a lead pencil into the arm-pit; a gush of blood followed and the arm became black and blue to the wrist. The aneurysm involved the axillary vessels. He subsequently lived a very athletic life, rowed in the Argonaut Boat Club, and served in the South African War, where he came under Sir G. H. Makins's care. He was invalided in consequence of a sudden pain on the left of the head and neck, and the patient was positive that the tumour had enlarged. He wrote to me on Oct. 17th, 1904, saying that he had marched 610 miles in 32 days and fought 16 battles, with the result of increasing his aneurysm very materially, particularly at the base of the neck. He died in May, 1909, 31 years after the accident, of gradual heart failure.

FIG. 5.



CASE 3.—Arterio-venous aneurysm of the axillary vessels thirty-one years after the injury. S.A.M., Scalenus anticus muscle. B.P., Brachial plexus. A.A., Axillary artery. T.A.A., Thoracico-acromial artery. C.V., Cephalic vein. A.V., Axillary vein. I.M.A., Internal mammary artery.

There are many cases in which the condition has lasted quite as long as this with equally good health; but the special point of moment in this case is that in the careful dissection of the vessels made by Professor Mackenzie no communication could be found between the greatly dilated axillary vessels. The final report in this case was given in THE LANCET of Nov. 1st, 1913. Closure of the orifice is exceedingly rare. Another case is reported by Pluyette[16]:—

A man, aged 33, applied in October, 1904, with a traumatic arterio-venous aneurysm of the right subclavian produced by a revolver bullet. The physical signs were of the usual character. On Nov. 15th he returned to the hospital, having had severe pains in the right hand and arm during the night. The parts were cyanosed, the pulse was scarcely palpable, but what was most remarkable was the disappearance of the thrill and murmur over the site of the aneurysm. There was pain in the course of the arteries, particularly the axillary and the brachial. The radial appeared to be large and hard, and there was no pulsation. It seems to have been an instance of cure by the formation of a thrombus in the arteries.

Occurrence of Sudden Death.

3. Sudden death may occur, either from heart failure or from embolism. Nothing was found to account for the sudden death in Case 4 of my series.

CASE 4.—A man, aged 29, admitted in November, 1904, had received 15 years previously a pistol shot in the lower third of the thigh; following this a tumour appeared, which had been present ever since. There was much disability owing to enlargement of the leg, with great distension of the veins, much lividity, and a persistent ulcer above the ankle. He died suddenly, apparently of syncope. Clinically there was a large pulsating tumour at the lower end of Scarpa's triangle, not easily compressible, with a continuous machinery murmur and a thrill transmitted up and down the leg. Anatomically the condition found by Dr. Rufus Cole and Dr. W. G. MacCallum was very remarkable. The femoral artery was dilated, and at the beginning of the lower third of the thigh presented two perforations separated by a narrow bridge of tissue; the femoral vein just opposite showed a

[16] Bulletin et Mémoires de la Société de Chirurgie de Paris, 1906.

perforation at the same level. A probe could be passed from the artery into the vein through these apertures. On the inner side and in front of the artery and vein, and communicating with both, was a sac 12 cm. in diameter formed of dense fibrous tissue and lined by a granular, deeply pigmented clot. "This sac does not form the communication between the vessels, although the probe passes readily through either into it, nor are they (i.e., the sac and the vessels) directly united, but rather by way of a small space or vestibule which lies in front of the orifice of the sac." The veins were enormously distended both above and below the level of the communication.

Evidently this large venous sac, which communicated freely with the artery, formed the pulsating tumour to be felt in the front of the thigh.

4. *Rupture* may occur with fatal hæmorrhage, of which a number of cases are recorded.

Disability from Varicose Veins and Thrombosis.

5. In the crural vessels progressive disability may result from the varicose veins, thrombosis, and ulceration. When left too late the condition of the vessels is unfavourable to operation and specially favourable to thrombosis—the surgeon's chief danger. These accidents are well illustrated in the following case.

CASE 5.—A man, aged 34, whom I saw with Dr. Halsted and Dr. Bloodgood, was admitted in May, 1897. Eight years before he was shot in the popliteal space. He did not notice the tumour for a year. It was a large spindle-shaped mass filling the popliteal space, with a well-marked continuous thrill felt over the tumour and far down the leg. The femoral artery was ligatured in Hunter's canal. The leg became gangrenous and had to be amputated. On dissection, just where the femoral becomes the popliteal there was a communication between the vein and the artery, an opening 1 cm. in diameter. Opposite to this on the wall of the artery was a sac measuring 2 by 3 cm. Above the opening the veins were greatly distended and dilated, with thickened walls. At the time of the operation it was noted that some of them were thrombosed and there was a small clot in the artery, and the communication between the artery and the vein was also closed by a small thrombus.

Widespread thrombosis probably accounts for the sudden onset of swelling and disability of a limb many years after the accident. Evidently this happened in the remarkable case reported by Rokitansky.[17]

A man, aged 62, admitted Nov. 28th, 1842, was in 1809 shot in the shoulder. The bullet was removed, but some grains of shot remained. He recovered, but had always a cramp-like feeling in the tips of the fingers of the left hand. For two years there was an increase in the size of the whole arm, which had increased rapidly in the six weeks, and on admission was œdematous and cold, with the skin of a dark red colour. In the arm-pit was an old pulsating tumour the size of a hen's egg, with marked thrill. The subclavian was tied on Sept. 23rd. He died 15 days afterwards of secondary hæmorrhage. There was an arterio-venous aneurysm of the axillary vessels, which were greatly enlarged and sclerotic, and there was a clot in the veins.

And lastly, the vascular tissue involved in the aneurysmal area may take on a nævoid growth. Apart altogether from arterio-venous aneurysm, the entire vessels of a limb, arteries and veins, may take on active growth, as in the extraordinary specimen of macroangiosis of the arm in the Charing Cross Hospital Museum, in which the growth of the vessels followed an injury. This has happened in certain cases of arterio-venous aneurysm of the vessels of the head, and though the orifice of communication may be small, within a few years the vessels (as in Cushing's case already referred to) may become enormously enlarged, much more than can be accounted for by any increase in pressure.

[17] Observation 46 of his great monograph Ueber einige der wichtigsten Krankheiten der Arterien.

Treatment.

It is not my place to speak of treatment, but we all agree, I think, with the conclusion arrived at by Subbotich, senior surgeon of the Belgrade State Hospital, from his experience in the Balkan War, "that arterio-venous aneurysms should be operated upon, as they offer small prospect of spontaneous cure, although they often remain stationary for a long time and cause relatively little trouble." It is a good deal a question of situation and technique. As the cases here reported indicate, with the lesion of the axillary and subclavian vessels good health may be maintained for years without any serious trouble, but there are always risks, particularly of thrombus formation in the distended veins, and even after lasting 30 or 40 years serious trouble may arise. Urgency is greater in the case of the lower limbs, and I should say that it would be very much safer in the two cases we have just seen to operate before the venous engorgement becomes excessive.

A new and truly marvellous technique has been developed in vascular surgery, very largely owing to the work of Alexis Carrel, and the increasingly favourable results in this all-important department of surgery have followed directly upon animal experimentation. It is not too strong a statement to make that up-to-date vascular surgery cannot be done in a hospital whose younger surgeons have not full opportunities to experiment upon animals. The extraordinarily delicate technique of vascular suturing is an art acquired only with much practice. It is a chapter in the history of surgery of which our colleagues may be proud. I was greatly impressed with the statistics given by Matas at the last International Congress of Medicine dealing with operations on aneurysm generally.

Of the 225 cases collected 194 affected the lower limb, 23 the upper limb, 4 involved the carotid artery, 4 the abdominal aorta. Of the whole number, 53·3 per cent. were aneurysms of the popliteal. As to the operation involved, in 150 cases the obliterative operation was done, in 50 the restorative, and in 25 the reconstructive. Of the 225 cases 206 were successful, in 4 cases gangrene followed, and all four operations on aneurysms of the abdominal aorta were followed by death.[18]

Within the next year there will be greater opportunities for vascular surgery than have ever before been offered. The results of the last wars should be carefully studied by our surgeons, those given by Stevenson for the South African, by Saigo for the Japanese, and by Subbotich for the Balkan. The statistics will be found in great detail in the monograph by Monod and Van Vert.[19] They are also given by Sir G. H. Makins in the Bradshaw lecture on Gunshot Injuries of the Arteries,[20] 1913; in Bernheim's (of the Johns Hopkins Hospital) recently issued monograph on "Surgery of the Vascular System";[21] and may I refer the younger army surgeons to the section on aneurysm in "Keen's Surgery" by that modern Antyllus, my old and valued friend Rudolph Matas, of New Orleans.

In conclusion, may I put in a plea for the museums? Specimens should be sent to the Army Medical Museum, Millbank, and to the great Hunterian Collection at Lincoln's Inn Fields; and may I ask that very careful reports of the cases be sent to the Central Committee for preparation of the medical and surgical history of the war, 34, Guilford-street, Russell-square, London, W.C.

[18] THE LANCET, August 23rd, 1913, p. 550.
[19] Revue de Chirurgie, vols. xli. and xlii., 1910.
[20] THE LANCET, Dec. 20th, 1913, p. 1743.
[21] Lippincott Company, 1914.

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Regius Professor of Medicine in the
University of Oxford.

LOOKING for a subject on which to address you, I thought at first of some local topic, as the influence of a University on industrial life, or a problem of public health—smoke abatement, or housing. Of the former I happen to know something in connection with the rapid growth of your scientific departments, and the good work of the Medical School, which has maintained and extended the reputation which Leeds has long enjoyed as a medical centre. I knew, too, that your city had done much to better the condition of the working classes, and that it had an enviably low death rate. Your M.O.H., Dr. Angus, kindly sent me the public health report for 1914, and it was particularly gratifying to see that your death rate was only 15 per 1,000, a reduction of 50 per cent. in fifty years, only 7,000 deaths instead of 14,000, if your rate of the middle of the last century had been kept up. I could not but look at certain figures of a disease in which I am much interested—tuberculosis—and I should like to refer to them, not to discourage you, but to indicate how much remains to be done. There were 782 deaths from tuberculosis—not a specially high rate for a city of this size—but there is a statement which shows that you are doing a great deal to further the spread!

Of 1,428 cases recently visited there were 812, or 57 per cent., in which more than one person occupied the patient's bedroom, and in 640, or 45 per cent., there were others sleeping in the same bed with the patient. That is a bad record—not worse, I am sorry to say, than many other places, not so bad indeed—but it is a striking illustration of the importance of the housing question in connection with the white scourge.

But all local problems sink to zero before the great struggle for national existence in which we are engaged.

> Where the greater malady is fixed
> The lesser is scarce felt;

so I decided to offer a little medicated advice on how to get the best work out of the human machines of the nation in these times of stress and strain.

The other day I asked a battle-bronzed veteran fresh from an inferno of shell fire if he thought any single factor would decide the war. "Yes," he said, "*nerve*; the men who can best stand the racket will win." I must confess to a little surprise, as I expected him to say men, or money, or munitions. I could not get a definition of nerve from him, but he said, "If a fellow after 18 days' of hell has energy enough left to take off his clothes he is full of nerve." I then turned to the Oxford Concise Dictionary, and found the word given as *vigour, energy, well-strung state.* "Ah!" he said, "that last is what I mean; you may have men, and money, and munitions, but unless you have taut, well-strung nerves there is no chance for final victory." The phrase is a good one, dating from the days when English bowmen fought where now not arrows but shell and shrapnel darken the air. It means command of the machine and all its resources. Take in illustration a man on his feet, speaking—command of his legs, command of his thoughts, command of his tongue, all at the same time. Not one of these came to him naturally, but by training. Anyone can do it, but it takes a nerve only acquired by training; and a successful speaker adds by practice such control of the machinery in his head that he translates thoughts into speech without the intervention of hand or pen. Though partly a natural gift, education is the important factor. The nerve of the soldiers and sailors is largely given by training. It is not alone the capacity to draw on all the resources available that enables a man to rise superior, as we say, to an emergency, to mobilise forces which are not called upon in everyday life, but which are on tap. There is with it a consciousness of power, which comes from a knowledge of the machine and of its capacities, with a self-control which never for a moment loses grip of the wheel. In peril it is nerve which enables a man to act promptly and surely. A pilot 6,000 feet up who could swing with the right arm under his machine and do a bit of essential repair had nerve. I saw a surgeon open a big artery accidentally—a terrifying spurt of blood; a glance of the eye brought the assistant's finger on the main trunk of the vessel, and the surgeon coolly turned, scrubbed his hands afresh, and very quietly gave the nurse directions to get ready the necessary instruments. No fuss or fluster; just the quiet nerve in control of the situation the nerve of knowledge. An extraordinary feature in the human machine is its reserve stores of energy. You cannot get 30 horse-power work out of a 20 horse-power motor, but you can change a 50 horse-power man into one of 100 or more. That is because we habitually work at only about 25 to 30 per cent. of our capacity—mental or physical. Take in illustration the most wonderful engine ever built—the heart; in not one of you is it working 25 per cent. of its capacity. Some years ago, at Columbia University, New York, I heard that American Socrates, William James, deliver a remarkable address on "The Energies of Men," in which he contended that our organism has stored up reserves of energy ordinarily not in use, but that may be called upon; deeper and deeper strata of material ready for use, on tap if we care to call upon it. Run a hundred yards, a sense of tire or fatigue comes, and we get short of breath—some of us would be pulled up at 50 yards—and if we go on there comes a moment when we feel we must stop; but force yourself, and something surprising happens. The sense of fatigue passes away, and we are able to go on—a man has got what is called his second wind, he has tapped a new level of energy. And there is the same phenomenon in mental states. Beyond the point of fatigue-distress may be found "amounts of ease and power we never dreamt ourselves to own—sources of strength habitually not taxed at all, because habitually we never push through the obstruction, never pass those early critical points." Our energy budget has really never been exploited. Kipling has the secret in a verse in the famous poem "If":—

> If you can force your heart and nerve and sinew
> To serve your turn long after they are gone,
> And hold on when there is nothing in you
> Except the Will which says to them "hold on."

As with the individual so with the nation. Nerve is a special trait of the Briton, who has always displayed a dogged determination and a capacity to hold on, so well expressed in the lines I have just quoted. The nation, too, has its reserves of energy, upon which in the present trial we must call. We are standing well the change of gear. New and unthought-of levels of energy are available, on tap at *will*. We are being tried—like the crew of a submarine which has the nerve test applied—hatches closed, lights out, ballast tanks filled, and down she goes in the darkness. This is repeated day by day, and any man who shows signs of "nerves" is weeded out.

There is a state the very opposite of that of which we have been speaking, seen in man and nations, and best described by the word *nerves*, a word not in the dictionary. It is slang, but we all know the meaning, the unstrung state, the inability to get work, or the best work, out of the machine, a jumpiness and instability. A man may inherit a weak, irritable nervous system, another may spoil a good one with bad habits or bad training, or a good one may be shocked out of action by the blows of circumstance. In any case, the chauffeur loses control of the machine. How tragic are the cases of "nerves" returning from the front! A shell shock may knock a man out completely, hitting *central* in the big telephone system of his brain; dazed in mind, slow in speech and action, it may be weeks before control is regained. Or only a local group may be hit, the telephone girls in charge of hearing, or of speech, or of sight, or there may be nothing more than a jumpiness, with inability to concentrate in any effort, mental or physical. In addition there are scores of cases in which the condition has passed beyond the stage we can rightly call "nerves."

Unfortunately, it is not a matter for the individual alone. "Nerves" may attack whole communities. We are all apt to be swayed by states of mind which are rarely associated with any clear consciousness of their causes. They may be nothing more than moods, but they spread like measles, or any other infection. What a contagion is fear, a state in which the nerves are unstrung. How its voice rings through history. The spirit of fear may come on a people like pestilence, and in the Middle Ages was responsible for that black record of witches and witchcraft. Waves of emotion play on man's nerves as the wind on an Æolian harp.

Even strange bodily states may be induced, as in the mania of the Middle Ages, which sent the population of whole districts dancing wildly over the country. The herd instinct, so dominant in animals, is present also in man, and the psychology of the crowd has become a favourite study. In a great crisis like the present, we are all a bit surcharged emotionally. Feed a frog with small doses of strychnine, and to the slightest touch it responds with an unnaturally violent kick or jump. The daily dose of strychnine which we get each morning now at breakfast-table has made us a bit jumpy, and we, too, like the frog, respond to stimuli in a very abnormal way. We get "nervy," and lose control of the machine. Judgment becomes difficult, and we are swayed by emotions that sweep over the crowd regardless of any basis in truth. We become weak-minded, and believe anything any Ananias says. Who would have dreamt that so early in the war there could have been so many liars in the country as the men and women who saw Russian troops! An instability of this sort leaves us easy prey to the Yellow Press. Think of the legless, armless, eyeless Belgians that crowded their columns—all had been seen by these perverts, few, if any, by the camera. What a triumph of unstrung nerves was that matter of the war babies. Thousands of girls were pregnant in consequence of the conjunction of Mars with Venus in the last quarter of 1914. In one town of 18,000 inhabitants 2,000 were expected! It was gravely suggested that the workhouses should be converted into maternity hospitals. Oxford expected a huge crop, but the rate has scarcely reached normal! The "*Liar*" of Lucian should be reprinted and spread broadcast as the true model for these modern Cretans.

Collectively, we need steadying, more self-control, more cultivation of the *will*, which alone has the key to our reserves of unused energies. We should avoid everything that artificially stimulates, and so irritates the nervous system. It indicated a certain lack of nerve, an oyster-like flabbiness in the nation, not to have followed the King's example in the matter of alcohol. Nothing so weakens the will of the worker, of mind or of muscles, as leaning upon that Egyptian reed. Too much tobacco also increases the irritability of the nervous system, and many of our young soldiers smoke far more than is good for their hearts or brains. Another serious promoter of "nerves" is the combination of gossip, gabber, and gas which we have dealt out by the penny dreadfuls, and too often poured by people into our too willing ears. I wish we could catch and intern one person, a lying knave, an Autolycus, who flits from house to house, in most, alas! very welcome, called "a friend of mine." That appalling third person is responsible for apprehension and mistrust where confidence should reign, and very often for a limp, flabby public opinion instead of "nerve"—that well-strung state so needful for our final victory.

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SCIENCE AND WAR

AN ADDRESS DELIVERED AT THE

UNIVERSITY OF LEEDS MEDICAL SCHOOL

ON OCTOBER 1, 1915

BY

SIR WILLIAM OSLER, BART.

M.D., F.R.S.

REGIUS PROFESSOR OF MEDICINE, OXFORD

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SCIENCE AND WAR

For more than a year tongue and pen have served as safety-valves for the seething emotions of our hearts and heads. The time to keep silence is at hand when all shall be too busy to speak or to write. This was the feeling in my mind when your kind invitation came, but I yielded, interested in your school and its old associations, and, moreover, I had many warm friends here, particularly that Mosaic veteran, our distinguished colleague T. Pridgin Teale. The race is in one of its periodic attacks of acute mania, a bad one, too; Jeremiah of old would say the world is drunken and the nations are mad. So respectable and self-respecting had we become that the bout is a great shock. To discuss the causes would be out of place, but as the effects of the malady concern us directly I propose to speak briefly of the influence of the new dispensation of science on the old practice of war. Let me clear the ground with a few preliminary remarks.

War and History.

'Omnes homines ex natura hostes' is an old saying, and it was the reluctant admission of Plato that the world was foolish 'in not understanding that all men are always at war with one another'.

Montaigne qualifies the statement that war is 'the greatest and most magnificent of human actions' with the remark that 'this science of undoing and killing one another and of ruining and destroying our own kind has nothing in it so tempting as to make it coveted by the beasts', and at the best it is but a testimony of our weakness and imperfection. In a memorable passage he gives a true estimate 'how this great body with so many fronts, and so many motions, which seems to threaten heaven and earth—

Not thicker billows beat the Lybian main,
When pale Orion sets in wintry rain;
Nor thicker harvests on rich Hermus rise,
Or Lycian fields, when Phoebus burns the skies,
Than stand these troops; their bucklers ring around;
Their trampling turns the turf, and shakes the solid ground—

(*Aeneid* vii)

this furious monster with so many heads and arms is yet man—feeble, calamitous and miserable man. "'Tis but an ant hill disturbed and provoked."' What would the great essayist have thought had he known what ultra-microscopic

Lilliputians we really are, dwelling on a mustard seed in the great universe.

Every page of history is red with blood. The primary object of war is to kill or to maim so as to put out of action as many as possible on either side. Read Walter Bagehot's chapter, 'The Use of Conflict,' in *Physics and Politics*, if you wish to get at the essence of the matter: 'The savage virtues which tend to war are the daily bread of human nature.' And he quotes Carlyle: 'The ultimate question between every two human beings is, Can I kill thee or canst thou kill me?'

Our young minds are trained to regard warfare as one of the prerogatives of Jehovah, the Lord of Hosts, who 'teachest my hands to war and my fingers to fight'. With man's conception of a great war in Heaven has passed into current belief one of the strongest of popular dogmas—that of a personal devil. Nurtured on the Old Testament, I recall as a child my terror at the recital of the slaughter of the thousands by the Israelites, when they spared neither man nor beast, woman nor child. After the ears of my understanding were opened it was but small comfort to know that these countless thousands existed only in the imagination of the historian of petty tribes of Palestine. The pride, pomp, and circumstance of war have so captivated the human mind that its horrors are deliberately minimized. The soldier embodies the heroic virtues, and the camp is the nursery of fortitude and chivalry. The inspiration of the nation is its battles. Crecy and Agincourt, Trafalgar and Waterloo, are more notable events in history than Magna Charta, the execution of King Charles, or the Declaration of American Independence.

Mankind in the Childhood of Civilization.

The explanation of this distressing fact is that we are still in the childhood of civilization. Some millions of years divide the Tertiary period, when man broke away from the great ape stock, and the dawn of our modern era, when 'iron, cold iron,' became master of the world. Only with the working of metals did progress become possible. In Time our civilization is but a thin fringe like the layer of living polyps on the coral reef, capping the dead generations on which it rests. The lust of war is still in the blood, we cannot help it. There was, and there is as yet, no final appeal but to the ordeal of battle. Only let us get the race in its true perspective in which a thousand years are but as yesterday, and in which we are contemporaries of the Babylonians and Egyptians and all together within Plato's year. Let us remember, too, that war is a human development, unknown to other animals. Though Nature is ruthless 'in tooth and claw', collective war between members of the same species is not one of her weapons; and in this sense Hobbes's dictum that 'war was a state of nature' is not true. The dinosaurs and pterodactyls and the mastodons did not perish in a struggle for existence against members of their own species, but were losers in a battle against conditions of nature which others found possible to overcome. In our own day the gradual disappearance of native populations is due as much to whisky and disease as to powder and shot, as witness in illustration of the one the North American Indian and of the other the Tasmanians.

The Dream that Wars would Cease.

And yet in what a fool's paradise many of us have been living, flaunting in the face of history our wish for peace—seeking it, ensuing it, with the war drums throbbing in our ears. But let us respect this pious wish since it was not without basis.

For more than a century the world had been doing well—everywhere prosperity and progress. The French Revolution and the founding of the American Republic seemed to lift humanity to a level on which might be realized practically the brotherhood of man. There had been bloody and grievous wars in the nineteenth century, but there were such hopeful features that the new century opened with peace congresses and peace palaces. Remarkable and unheard-of incidents seemed to indicate a change of heart among the nations. Following the Spanish-American War, Cuba, the Pearl of the Antilles, fell to the United States by conquest, only to be restored to its rightful owners. The Philippine Islands remain in trust by the same nation to have and to hold for its inhabitants whenever they are ready. South Africa, conquered at the cost of much blood and money, was made a nation by its conquerors. There were other considerations; commerce knew no boundaries, and commerce was the uncrowned king to whom all paid homage. An intellectual comity had sprung up between the nations, fostered by a growing interchange of literature and maintained by gatherings whose Pentecostal character lent hope to the dream of Isaiah of a day when in the spirit of wisdom and understanding Ephraim should not vex Judah and Judah should not vex Ephraim.

And some of us had indulged the fond hope that in the power man had gained over nature had arisen possibilities for intellectual and social development such as to control collectively his morals and emotions, so that the nations would not learn war any more. We were foolish enough to think that where Christianity had failed Science might succeed, forgetting that the hopelessness of the failure of the Gospel lay not in the message, but in its interpretation. The promised peace was for the individual—the world was to have tribulations; and Christ expressly said: 'Think not that I am come to send peace on earth; I came not to send peace but a sword.' The Abou ben Adhems woke daily from their deep dreams of peace, and lectured and published pamphlets and held congresses, while Krupp built 17-inch howitzers and the gun range of the super-Dreadnoughts increased to eighteen miles!

And we had become so polite and civil, so cultured in both senses of that horrid word, with an 'Is thy servant a dog?' attitude of mind in which we overlooked the fact that beneath a skin-deep civilization were the same old elemental passions ready to burst forth.

The Athenians and Melos.

Professor Haverfield shocked me the other day by remarking that the Greeks, with all their refinement, were a match for the worst of us to-day. This drove me to Thucydides, where I found a parallel with Belgium in the treatment of Melos by the Athenians. He gives the wonderful dialogue in a cold, clear style befitting the hard barbarity of the transaction. The delegates from Athens urged: 'What is right is estimated by the equality of power to compel.' 'The powerful exact what they can, the weak grant what they must.' The Melians wished to remain quiet and to be friends, and to force them to take sides they said would only make enemies of all the neutrals—and then there were the gods! To which the Athenians replied: 'As regards the favour of heaven, we trust that we, too, shall not fall short of it: they always maintain dominion wherever they are the stronger.' It was the case of the Walrus and the Carpenter, and the Athenian delegates retired with the remark: 'We bless your simplicity; we do not admire your folly.' And Book V concludes in a twentieth century 'might is right' fashion: 'They surrendered at discretion to the Athenians who put to death all the male adults, and made slaves of the women and, children ... as for the country, they inhabited it themselves.'

In spite of unspeakable horrors war has been one of the master forces in the evolution of a race of beings that has taken several millions of years to reach its present position. During a brief fragment of this time—ten thousand or more years—certain communities have become civilized, as we say, without, however, losing the savage instincts ground into the very fibre of their being by long ages of conflict. Suddenly, within a few generations, man finds himself master of the forces of nature. In the fullness of time a new dispensation has come into the world. Let us see in what way it has influenced his oldest, and most attractive occupation.

The Influence of Science.

Science is a way of looking at the world taught us by the Greeks—a study of nature with a view to utilizing her forces in the service of man. It 'arose from the simplest facts of common experience, and grew by the co-operation of the mass of men with human intellect at its highest. And when developed it returns again to strengthen the common intelligence and increase the common good. Above all, more perfectly than any other form of thought, it embodies the union of past and present in a conscious and active force.'[1] Man's latest acquisition, it has worked a revolution in every aspect of his life, without so far changing in any way his nature. He is still a bit bewildered, and not quite certain whether or not the invention is a Frankenstein monster. That is a splendid allegory of Kipling's—'The Four Angels' of

[1] Marvin, *The Living Past*, second edition, 1915.

the four elements, who offered themselves in vain to Adam while in Paradise ; but—

As Adam was a-working outside of Eden-Wall,
He used the Earth, he used the Seas, he used
the Air and all ;
And out of black disaster
He arose to be the Master
Of Earth and Water, Air and Fire.

The promise of Eden of full dominion over nature has only been fulfilled in our day. The flower and fruitage has come suddenly within a couple of generations. Even the seed time was but a few years ago, for to the Heidelberg man, looking down the ages from the Glacial period, Aristotle and Darwin are contemporaries, Galen and Lister fellow practitioners. Steam and electricity have upset our week-day relations, and the theory of evolution our Sundays. Like a beggar suddenly enriched man has not yet found himself; and the old ways and old conditions often sort ill with the changing times. New bottles could not always be found for the new wine.

Scientific Progress. Organized knowledge, science, if living, must infiltrate every activity of human life. There was a difficulty in these islands, which of fruitful ideas, inventions, and discoveries have had the lion's share, but failed to grasp quickly their practical importance. The leaders of intellectual and political thought were not awake when the dawn appeared. The oligarchy who ruled politically were ignorant, the hierarchy who ruled intellectually were hostile. Read of the struggles at Oxford and Cambridge in the 'fifties' and 'sixties' of the last century to get an idea of the attitude of the intellectual leaders of the country towards 'Stinks', the generic term for science. It was not port and prejudice, as in Gibbon's day, but just the hostility of pure mediaeval ignorance. Those in control of education were more concerned with the issues of Tract 90 and the Colenso case than the conservation of energy and *The Origin of Species.* To take but one example. What a change it might have wrought in rural England if, in 1840, when the distinguished Professor Daubeny was made professor of rural economy, Oxford could have had great State endowment for an Agricultural College. The seed was abundant, and the soil was good, and only needed the cultivation that has been given so freely by members of the past generation, with what results we see to-day at Oxford and Cambridge and in the new universities.

In Scotland, too, science had a hard fight to break the shackles of ecclesiasticism. It seems scarcely credible that religious tests for professors of the physical sciences were demanded until the 'sixties'. I have a pathetic letter, 1852, to the Secretary of State for the Home Department from the late George Wilson, who wished to be a candidate for the chair of chemistry in Glasgow, but was debarred, not being a member of the Church of Scotland! No wonder science could not pass from the top through such Berkefeld filters.

But all this has changed, and everywhere an enviable academic freedom now exists. The problem of linking university work with the scientific industries is being solved by you here and elsewhere, as in Sheffield, with marked success, and is part of a great and growing movement to which the war has given a fresh stimulus. May I call the attention of those interested to a recent pamphlet, No. 30, of the Board of Education, by Thomas Lloyd Humberstone, entitled *An Experiment on Educational Research*, as it illustrates the type of work to which I refer. In the words of the foundation (which is connected with the University of Pittsburg) the object is: 'The increase of useful knowledge through the application of contemporary science to industrial processes . . . and providing the opportunities for the training of men for high industrial appointments.' It is worthy of careful study. In forty years Germany made science infiltrate every activity of her life, and much good, you may say, has it done her. Well, if in this day of trial she can be independent of the importation of nitrates by the synthetic manufacture of nitric acid, it will pay her a thousandfold the millions she has spent in promoting the interdependence of science and commercial technology.

Scientific Methods of Destruction.

In two ways science is the best friend war has ever had; it has made slaughter possible on a scale never dreamt of before, and it has enormously increased man's capacity to maim and to disable his fellow man. In exploiting the peaceful victories of Minerva, Mars has added new glories to his name. More men are killed, more men are wounded, and consequently more men are needed than ever before in the history of the world's wars. From 1790 to 1913 there were 18,552,200 men engaged in the great wars, of whom 5,498,097 lost their lives (D. E. Smith). In the Balkan wars of 1912–13 there were 1,230,000 men engaged, of whom 350,000 were killed. In the Russo-Japanese War there were 2,500,000 men, of whom 555,900 lost their lives (D. E. Smith). It is estimated that in the present war more than 21 millions are engaged! As weapons have improved the losses will be yet greater, and we may expect that at least five or six millions of men in the prime of life will be killed. Within a few years artillery and high explosives, submarines and air-craft have so revolutionized our methods of warfare that thousands are now destroyed instead of hundreds. The rifle and the bayonet seem antiquated, and one may go from hospital to hospital and not see a wound from the latter, and comparatively few from the former.

The Submarine.

In three directions science has scored in a mission of destruction. What a marvellous adaptation of physics, pneumatics, and mechanics is displayed in a submarine, with which the highest standard of wholesale destruction is reached. In a few seconds a vast battleship, itself a product in every part of scientific genius, is blown asunder and a thousand men and boys sent flying into eternity. Or a colossal liner like the *Lusitania*, laden with harmless non-combatants, is torpedoed without warning and above 1,200 perish miserably, to the inexpressible delight of a kultured nation, whose school children celebrated the event with a holiday.[1] How Mars and Neptune must chuckle at the

[1] Owen Wister, *The Pentecost of Calamity*, p. 55.

truly Olympian scale on which we do these things to-day.

The Modern Battle-ship.

And the new guns and modern explosives! Chemistry, electricity, physics, optics, mathematics, every aspect of the subtlest human study has contributed to their perfection. What a divinely adapted organism of destruction is a modern battleship! And the gusto with which we receive news of a naval triumph is only equalled by the keenness of the delight with which the spectacle is witnessed. Listen to these newspaper extracts:

> After the action, to see our innocent-looking ships leave the spot where the German ships sank was a sight for the Gods. . . . It was a fine sight to see the *Lion* demolish one cruiser. . . . For fully ten minutes she belted away without getting a single hit. Then the *Lion*, which was leading the line, hoisted 'Open fire', turned slowly and majestically round and fired her broadsides—once. It was quite sufficient. Up went a cloud of smoke and steam from 'the target', and when it cleared off her aft funnel was at a rakish angle and a huge rent appeared the length of her side. . . . So once again the *Lion* turned, and this time fired but five shots from her huge turrets. Amidst a shower of splinters, smoke, and fire, the German disappeared. We steamed over the spot where she sank but . . . not a single living thing was to be seen.

Dante and Milton in their descriptions of hell are quite outclassed by the description of what happens on a battleship in action outclassed by an enemy's guns. Here is perhaps the greatest single victory for science in war, from one standpoint. In the making of a 15-inch gun that will throw with accuracy a ton of metal a dozen or more miles is found a combination of brains and machinery such as does not exist in any other human product, and, let us add, such a combination of brains and courage does not exist in the working of any other machine. And to us the courage seems to hallow the shambles!

This is the day of Nisroch, Chief of Ordnance to Satan in the great war of heaven, inventor of—

Hollow engines long and round.

. . . . . .

Such implements of mischief as shall dash
To pieces and o'erwhelm whatever stands
Adverse, that they shall fear we have disarmed
The Thunderer of his only dreaded bolt.

(*Paradise Lost*, Book VI.)

The Enormous Power of Present-day Artillery.

On land the field-guns, howitzers, and machine-guns have increased enormously our killing capacity; so much so, indeed, that in self-defence the armies have taken to earth, and from the North Sea to the Alps Europe has become a rabbit warren. High explosives, long-range accuracy, and quickness of fire have made the artillery arm the most effective of the Service. Every device of science has been pressed into use, and the aeroplanes with their observers and cameras have plotted the entrenched lines to checker boards, on to any square of which a rain of shell and shrapnel may be poured. The high-explosive shells, the 'Jack Johnsons', and the 'Black Marias' have played a great rôle in the present war, and not only do they kill and maim, but the shell-shock from commotion puts a large number of men out of action. Against the great Krupp howitzers the forts of Europe have gone down like card-board houses.

Artillery and quick-firing machine-guns follow hard upon the torpedo as agencies of destruction. Against an oncoming enemy 20 per cent. of men and 60 to 80 per cent. of horses are hit by separate bullets within the 'mown area'. There was a grim description the other day of the carnage at Novo Georgievsk among men advancing in close formation. A tract of land four miles long and one and a quarter miles broad was covered by thick layers of the dead, heaps upon heaps, with hundreds of men standing upright, stiffened in death among the prone corpses. A super-Dreadnought could not do more.

But there are worse things than killing. At sea it is a short shrift—there are not many sailors in hospitals; but on land the shrapnel, shell, and hand-grenade fill the wards with maimed and mutilated men. A rifle bullet nowadays goes through a man, kills if it hits a vital spot, but very often leaves a nice clean wound which heals promptly, though head, chest, or abdomen may have been perforated. The shrapnel and the hand-grenade tear, bruise, and break, lacerating flesh and joints, blowing away limbs or parts of the face or head, causing wounds not only terrible in themselves but certain to become infected with clothing and earth. Even the bones of a man's comrade have been blown into him. Never since the primal tragedy, when man first shed man's blood, has there been such a carnival of carnage as that which science has made possible during the past year. And add the dumb and deaf, the paralysed, and the insane from shell explosions and shock!

Irrespirable Gas.

But there is worse to follow—the climax of the adaptation of modern knowledge to war. I had a dream not long since that explorers in Central Africa had accidentally opened a vein of deadly radium which flowed slowly but imperceptibly like an unseen lava over the surface of the earth, killing by the exhalation of an irrespirable gas. It had crossed beneath the Mediterranean, swept through Europe, and had reached England. Convocation had been summoned by the Chancellor and the members of the University in academic cap and gown awaited the end of all things. On came the irresistible and deadly vapour, swept down the ranks, reached me, and I awoke—gasping for breath.

Theoretically all is fair in war, but by common consent certain practices regarded as cruel are tabooed, such as the use of explosive bullets. Not so in the present war. Never before has anything been used by man to kill his fellow man equalled in diabolical capacity for cruelty the use by the Germans of irrespirable gas. Had it been a suddenly asphyxiating vapour, such as may have been the breath of the angel of death as he passed over the host of Sennacherib, the action would not perhaps have been thought any more reproachful (in war) than wholesale drowning by the torpedo. But this was a very different matter —agonizing suffocation to those who could not escape; many for days gasped out their lives in a slow process of strangulation, others had a lingering illness with urgent dyspnœa, cough, and inflammation of the lungs. The worst types of cases were, I am told, appalling to witness—some who reached England were bad enough.

Air-craft. It is not a little remarkable that the aspect of the war which caught the popular fancy and from which so much was expected has proved comparatively harmless from a killing standpoint. 'The rain of ghastly dew' of Tennyson's vision, which the Wright brothers and Zeppelin have made possible, is more destructive of property than of life. But the mastery of the air is one of the greatest of the conquests of science. How Leonardo da Vinci would have rejoiced, in this day predicted so confidently by him, to see flocks of wonderful bird-men as much at home in the air as eagles. The development of air-craft and air-guns has added a new arm to the Service, but battles of the airy navies grappling with each other or attacked by shells from land leave few wounded, and the total killed so far is small. An enormous value for observation and the shock of righteous indignation roused all over the world by the Zeppelin murders of women and children have been, so far, the chief assets of the air.

The bombarding of air-craft is a wonderful sight. Motoring near —— the other day, one of my companions, Colonel McCrae, called out, 'Look up; there they begin.' His practised ear had caught the sound of an air-craft gun. Far up against a white cloud was a round puff-ball of black smoke, looking the size of the moon, and just beyond it a black speck moving swiftly by the edge of the cloud. Then near to it a spit of fire of an exploding shell, and another puff-ball of smoke. Flash followed flash, and within five minutes we counted forty-two black balls of smoke, silhouetted against a big cloud which resembled a huge slice of 'spotted-dog' bread. The shells seemed to explode all about the aeroplane and the gunners had the range, but it was impossible to say how close the shots came; evidently the aviator found the place too hot, as he disappeared into the cloud. Half an hour later we saw a still more exciting contest. The bird-man was evidently taking observations and moving in different directions. Many volleys were discharged at him and the whole sky in the neighbourhood was spotted with shrapnel puffs, among which the aeroplane moved in and out quite unconcernedly —so it appeared. On either side of the road were peasants working in the fields and close by a steam thrashing-machine with its staff, but no one stopped work or even looked up at a scene that custom had made stale.

Science as a Beneficent Force.

Enough of this. Let us turn to the other side of the picture; let us see what science has done in a mission of salvation amid the horrors of war. Three things, first, in organizing the transport and care of the sick and wounded.

Care of the Wounded in Napoleon's Time and To-day.

In no work do we get such a picture of the grim details of war as in the *Mémoires* of the famous Baron Larrey, Napoleon's favourite surgeon (Paris, 1813). The retreat across the desert from Syria and the retreat from Moscow mark the most terrible sufferings ever experienced by armies. Larrey was not only a great surgeon, but a lover of the soldier and devoted to his comfort. From his campaign on the Rhine, in 1789, we may date the beginning of the modern rapid transport of the wounded from the firing line. Previously the custom was to collect the wounded as soon as possible after the combat, which meant that they were often 24 or 36 hours on the field without assistance. Let me give his own words, as they are memorable: 'La prise de Spire nous en ayant donné un assez grand nombre, j'eus la douleur d'en voir mourir plusieurs, victimes de cet inconvénient; ce qui me donna l'idée d'établir une nouvelle ambulance qui fût en état de poster de prompts secours sur le champ de bataille même.'[1] This was the origin of the famous *ambulance volante,* from which have evolved our modern methods of rapid transport. What would Larrey think of the flying ambulance of to-day—motor and train? One thing could not but please him—the development of the ambulance corps on lines laid down by him and the big motor ambulance modelled on his *grandes voitures* with four horses which held four wounded recumbent.[2]

Through the bitter experiences of the Napoleonic wars, of the Crimea, of the American Civil War, and more particularly of the recent campaigns, there has been evolved a wonderful machinery, replete with science, for the transport and care of the sick and wounded. There must be suffering —that is war—but let us be thankful for its reduction to a minimum, through the application in every direction of mechanical and other pain-saving devices. We all know the work at the big base hospitals at home, and let us not forget the deep debt of gratitude due to Lord Haldane and Sir Alfred Keogh for perfecting their organization years before the war broke out. I wish the public could know more of the heroism and devotion of

[1] *Mémoires,* tome i, 58.
[2] Ibid., p. 150.

the men and women serving the field ambulances and casualty clearing stations, the perfect service rendered, the duties done in loyal and loving charity. Let us see what happens to the poor fellows on their way to a base hospital in France.

A Hospital Camp.

Come with me 'somewhere in France', to the top of a high down overlooking the sea. At our feet lies a city of tents, spread out for miles between the dunes and the downs, white and spotless against the evening sun. Lines are seen dividing sections of the encampment, and the scene reminds one of the description of the tents of Israel pitched in Moab and putting Balaam and Balak to sore perplexity. Figures in white and in khaki flit about, and now and again a motor lorry passes up the main line, but it is a peaceful scene on a summer's eve—in Picardy.

The camp is one of several big groups of British general and stationary hospitals. This one is made up of Durbar tents, in five or six separate units of from eight hundred to a thousand beds each. It was a novel experience, as I had never seen so many men under canvas, and the hospital wards were in big tents holding usually from twenty to thirty patients. The inner lining of the tent was of a coloured Cawnpore material with attractive patterns. More beautiful wards cannot be imagined, so rich and varied in colouring, but I hasten to add that I did not see them in wind or rain. And to the call of country and humanity are come men and women from all parts of the English-speaking world—seasoned old veterans of the Army Medical Corps, consultants from London and Edinburgh, specialists of distinction, general practitioners, men from Australia and Canada looking after their special hospitals, with units of our brothers from Harvard University and from Chicago. Some of these groups, as that from McGill University, Montreal, have brought over a complete staff, with nurses and orderlies and all the necessary apparatus for a 1,040 bed hospital. Other Canadian University units have come from Toronto, Kingston, Laval, and Dalhousie. At home the members of these staffs are busy teachers and practitioners. The nurses have come from all parts of the Empire, and two groups from the United States—ministering angels all to the sick and wounded. Nothing could illustrate better the spirit of self-sacrifice and devotion which the great war has awakened all over the world.

Reception of a Convoy of Wounded.

But a message has come to the camp—'A convoy to-night!'—and word is sent to the wards to prepare beds for the number given in the message. Promptly at the hour stated a magnificent ambulance train pulls up at the station near by—fifteen big steel hospital carriages of the latest construction, presented by the United Millers' Association of Great Britain. Twenty-eight motor ambulances are in attendance from the various hospitals, and the work of unloading begins. A more orderly, well-arranged business it is not possible to imagine. The cot cases are first lifted on their stretchers from the car and put in the ambulance—four in each, taking, as I timed it, a minute each. And all done so quietly, no talking, no fuss.

I went in the ambulance with the four men I had seen lifted out. Let us follow them to their beds. First, an Irishman with a bullet wound in the scalp. 'Begorra,' said he, 'I did not duck in time, but me mate 's in Paradise to-day—a Saxon got him in the ear'; a Londoner with typhoid fever; a Lancashire lad with appendicitis; and a Cheshire man with a bad shrapnel wound in the leg. By the way, all were smoking! They had been about six hours in the train, very comfortable and well fed; the wounded had been hit early in the morning. They reported that the only serious discomfort was getting to the dressing station. It took seven minutes in the ambulance to the hospital. The patients passed quickly through the admitting tent, where their tallies were copied and the ward assigned. The four were in bed and the two wounded had had their dressings changed, and all had had hot *bouillon*, in just twenty-seven minutes from the time the first was lifted out of the ambulance train.

I mention these details as they illustrate one aspect of science in organization. And it is nice to know that in all stages of the transfer of the sick and wounded, both by sea and land, the arrangements have been as satisfactory as the exigencies of war have permitted.

Progress of the Wounded.

I saw the four again the next day. The Irishman's wound in the head only needed scouring and a few stitches; another inch lower and he would have joined his mate. The shrapnel leg was serious, torn flesh, broken bones, clothing and dirt in the wounds. He had been carefully dressed and was comfortable, but with a slight rise of temperature. An X-ray picture was taken to locate the pieces of shrapnel and the site of the fractures. In an operating room as well equipped as any in London the foreign bodies were removed, the bones placed in apposition, and the limb dressed. I saw him two days later, and though he had slight fever he was comfortable, the wounds were healthy, and the outlook for his leg was good.

The appendicitis case was as simple as any in civil life. The typhoid case was not so simple. In the first place, the man had no right to have typhoid fever, as he had been inoculated twice within the year. And now came the test whether the hospital had an up-to-date scientific equipment. The laboratory was not large, but the man in charge knew his job. Just as a patient who has recovered from one attack of typhoid fever may have a second attack within a year, so an inoculated man may get a fresh infection, but this is rare. The reaction of the patient's blood serum to ordinary typhoid was present, as it should be in any one after inoculations—so that was no help. Only a set of cultures from blood and stools could determine whether he had a fresh attack of ordinary typhoid fever or an attack of a similar, indeed identical, disease, caused by an allied germ, either paratyphoid A or B. After all, bacteriology is only a department of horticulture, and with the new method of growth of germs on solid media the strains of the typhoid germs are as readily determined as are the strains of sweet-pea. They have what are known as agglutinative reactions with the blood serum that are perfectly distinctive and to be seen with the naked eye. It was a tedious business, but plain enough at the end—a paratyphoid B infection against which the original inoculation was as powerless a protection as is small-pox vaccination against chicken-pox.

If the foes of our own household, the 'anti's', would spend a few days at a hospital for infectious diseases, see the modern methods, and learn a few elementary facts about immunity, they could not but be impressed with the applications of scientific horticulture to disease, and be lost in admiration of a technique of extraordinary simplicity and accuracy.

The Prevention of Disease.

The second great victory of science in war is the prevention of disease. Apollo, the 'far darter', is a greater foe to man than Mars. 'War slays its thousands, Peace its ten thousands.' In the Punjab alone, in twelve years, plague has killed two and a half millions of our fellow citizens. This year two preventable diseases will destroy more people in this land than the Germans. The tubercle bacillus alone will kill more in Leeds in 1915 than the city will lose of its men in battle. Pestilence has always dogged the footsteps of war, and the saying is true—'Disease, not battle, digs the soldier's grave'. Bacilli and bullets have been as David and Saul, and at the breath of fever whole armies have melted away, even before they have reached the field. The fates of campaigns have been decided by mosquitoes and flies. The death of a soldier from disease merits the reproach of Armstrong:

> Her bravest sons keen for the fight have dy'd
> The death of cowards and of common men—
> Sunk void of wounds and fall'n without renown.

This reproach science has wiped away. Forty years ago we did not know the cause of any of the great infections. Patient study in many lands has unlocked their secrets. Of all the great camp diseases—plague, cholera, malaria, yellow fever, typhoid fever, typhus, and dysentery—we know the mode of transmission, and of all but yellow fever the germs. Man has now control of the most malign of Nature's forces in a way never dreamt of by our fathers. A study of her laws, an observation of her facts—often of very simple facts—has put us in possession of life-saving powers nothing short of miraculous. The old experimental method, combined with the new chemistry applied to disease, has opened a glorious chapter in man's history. Half a century has done more than a hundred centuries to solve the problem of the first importance in his progress.

Briefly, four things have been determined about the disease we call infectious. First, that there are specific germs, which breed true, often showing varieties, as is so common in nature. Secondly, these disease seeds, artificially grown, may be recognized by biological and chemical characters, and will reproduce the disease when injected into a susceptible animal. Thirdly, in the growth and multiplication of the germs there are changes in the body fluids, associated with the production of what is called immunity, and these changes may be artificially induced by inoculation with the germs or the products of their growth. And lastly, many important diseases are transmitted by insects—ticks, mosquitoes, flies, lice, and fleas.

The question was how to translate this knowledge into practical effect. Well, it has been done, and done in this war as never before in history. A victory had to be won first in the army itself, in insisting upon the importance of sanitary education for all officers, and here again we have to thank Lord Haldane. In a larger army than we have ever before had in the field the incidence of disease has often been lower than in times of peace. In the West there has been no great epidemic—neither dysentery, typhus, nor cholera; and typhoid fever, the soldiers' foe, has so far been a negligible quantity. Think what it was in the German army in 1870–1, fighting over much the same ground and with an army of about the same size as our own, 74,204 cases and 8,904 deaths. Peculiar conditions have caused peculiar maladies, such as trench fever, trench feet, odd types of rheumatism and nephritis; but, on the whole, when the figures come out for the first year of the war we shall find a great victory in the low death-rate from disease. In the East dysentery and forms of typhoid fever are troublesome, but the graver camp diseases such as cholera and typhus have not prevailed, and are not, I think, likely to do so.

The Treatment of Wounds.

And lastly, in the treatment of wounds science has made great advances. The recognition by Lister of the relation of germs to suppuration, an outcome of Pasteur's work, has done away with sepsis in civil life. High explosives, shell, and shrapnel make wounds that are at once infected by the clothing and dirt, and are almost impossible to sterilize by any means at our command, but with free drainage, promotion of natural lavage from the tissues by Wright's method, and the use of antiseptics when indicated, even the most formidable injuries do well. The terrible laceration of soft parts and bones adds enormously to the difficulty of treatment. The X-ray has proved a boon for which surgery cannot be too grateful to Röntgen and to the scores of diligent workers who have given us a technique of remarkable accuracy. Other electrical means for detecting foreign bodies have also given good results.

Of the germs blown into wounds from the soil and clothing and skin the pus-formers are the most numerous and most important. Two others have proved serious foes in this war, the germ that causes gas gangrene and the tetanus bacillus. I am told that methods of treatment of wounds infected by the former are giving increasingly good results. The soil upon which the fighting has occurred in France and Flanders is rich in the spores of the tetanus bacillus; the disease caused by it was at first very common and terribly fatal among the wounded. For centuries it has been one of the most dreaded of human maladies, and justly so, as it is second to none in fatality and in the painful severity of the symptoms. No single aspect of preventive medicine has been more gratifying in this war than the practical stamping out of the disease by preventive inoculation. In the first six months of this year only thirty-six of those who were inoculated within twenty-four hours of being wounded suffered from tetanus.

Is Science for or against Humanity?

And what shall be our final judgement—for or against science? War is more terrible, more devastating, more brutal in its butchery, and the organization of the forces of nature has enabled man to wage it on a titanic scale. More men will be engaged and more will be killed and wounded in a couple of years than in the wars of the previous century. To humanity in the gross science seems a monster, but on the other side is a great credit balance—the enormous number spared the misery of sickness, the unspeakable tortures saved by anaesthesia, the more prompt care of the wounded, the better surgical technique, the lessened time in convalescence, the whole organization of nursing; the wounded soldier would throw his sword into the scale for science—and he is right.

The War and International Science.

To one who is by temperament and education a Brunonian and free from the 'common Antipathies' and 'National repugnances'[1] one sad sequel of the war will be, for this generation at least, the death of international science. An impassable intellectual gulf yawns between the Allies and Germany, whose ways are not our ways and whose thoughts are not our thoughts. That

[1] Sir Thomas Browne, *Religio Medici*, pt. ii: 'I feel not in myself those common Antipathies that I can discover in others: those National repugnances do not touch me.'

she has made herself a reproach among the nations of the earth is a calamity deplored by all who have fought against Chauvinism in science, and a bitter regret to those of us who have had close affiliations with her, and lifelong friends among her professors, whose devotion to science has made every worker in every subject the world over their debtor. Even the philosophy of Rabbi Ben Ezra is strained in these days of passion—

> Now who shall arbitrate?
> Ten men love what I hate,
> Shun what I follow,
> Slight what I believe,
> Ten who in eyes and ears match mine.

With death war dies, and there is no hatred in the grave. The past is unforgiving, but we all may—

> With uncovered head
> Salute the sacred dead
> Who went, and who return not.

It was a noble motive that prompted the Warden and Fellows of New College to put upon the roll of honour in their hall the name of a German Rhodes scholar, one of her sons, though an enemy, who had fallen in battle for his country, an action resented by certain narrow-minded Philistines in the press. I should like to pay a last tribute of words to Paul Ehrlich, one of the masters of science, who has recently passed away. Many will recall with pleasure his outstanding position at the last International Congress of Medicine. In micro-biology and in the biochemistry of cells he was a creator, and no one of his generation contributed so much to our knowledge of the relations of living matter and chemical compounds. His studies on immunity form a new chapter in pathology. The climax of many years of patient work on the specific affinities of chemical substances for certain cells and for protozoa was reached in the discovery of '606' as a cure for syphilis. The brilliant labours of such a man transcend national limitations, and his name will go down to posterity with those of his countrymen, Virchow and Koch, as one of the creators of modern pathology.

Conclusion.

I am afraid that the subject of my lecture has been what Robert Burton would call glucupicric—bitter-sweet. This old earth has rarely had a worse year than that through which we have just passed. Men's hearts are failing for fear, and for looking after those things which are coming upon it. Though final deliverance from strife will not be in our day, let us not despair. Only just awake, the race is sore let and hindered by passions and practices, strong as animal instincts, which millions of years of struggle have ground into its fibre. I have just finished reading Henry Osborn Taylor's last book, *Deliverance*, in which he sketches the ways in which our ancestors of all times and countries have adapted themselves to the fears and hopes of their nature. From such a story of incessant and successful adjustments one may take a Pisgah-sight of a day when 'nation shall not lift up a sword against nation, neither shall they learn war any more'.

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THE COMING OF AGE OF INTERNAL MEDICINE IN AMERICA

BY WILLIAM OSLER

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THE COMING OF AGE OF INTERNAL MEDICINE IN AMERICA

BY WILLIAM OSLER

SINCE this publication was started, in 1891, Clinical Medicine in America has reached its majority. In bondage to tutors and governors—English, French, and German—the fulness of time has brought the privilege of an heir—independence and a rich heritage.

The training, long and varied, has been in three periods. The colonials brought the traditions of the mother country, and sent their sons "home" to study medicine, either to Edinburgh or London, a few to Leyden and to Italy. How dominant was British influence may be gathered from Evans's "American Bibliography," vol. viii of which, recently issued, brings the literature to 1792. More than half of the medical publications were reprints of English authors. In the last half of the eighteenth century 112 Americans graduated in medicine at Edinburgh, among them William Shippen, John Morgan, Samuel Bard, Adam Kuhn, Benjamin Rush, Caspar Wistar, and Philip Syng Physick. They brought back the best traditions of Europe, in teaching, in practice, and in the scientific outlook. Medical schools were started, hospitals organized, societies founded, and medical literature began to develop. Morgan's hopes and ambitions are well set forth in his famous "*Discourse, 1765, upon the Institution of Medical Schools in America.*" Thoroughly educated men of his stamp had a potent influence in moulding the mind of the profession, and it is seen in the foundation, very early, of medical libraries at the Pennsylvania Hospital, College of Physicians, Philadelphia, and the New York Hospital. The physician-naturalist flourished, and important contributions to botany were made by Clayton, Bartram, Kuhn, Mitchell, Wistar and others, as one may read in Howard Kelly's delightful sketch of "*American Medical Botanists*" (1914). The outstanding figure of the period is Benjamin Rush, philanthropist and philosopher as well as physician. The Cullen of America, he made valuable contributions to clinical medicine, and was, in addition, an ardent social reformer. Boerhaave, Haller, Cullen, and Hunter were the leaders of medical thought; and the personal and professional relations were chiefly with London and Edinburgh.

For the first half of the nineteenth century French medicine held sway. Bichat, Corvisart, Laennec, and Magendie made Paris the centre of medical study, and after about 1820 the intellectual home of American students. Here and there independent students like Elisha North, John C. Warren, and Nathan Smith wrote valuable monographs on clinical medicine; and Daniel Drake's unique contributions were native, of the soil. The long list of teachers of medicine from the third to the seventh decade were of French mental descent—the Jacksons, Bigelows, and Warrens, H. I. Bowditch, Alonzo Clark, I. T. Metcalf, W. W. Gerhard, Pennock, Meridith Clymer, William Pepper (*primus*), W. P. Johnston, and Alfred Stillé. Many of these men had come under the personal influence of Louis, and of Andral and Chomel, clinicians of the Morgagni-Laennec type.

The sixth to the eighth decades saw the rise of German influence—Virchow and his pupils, the Vienna school, and Ludwig; and, after 1880, Koch and the new pathology. Pasteur and Charcot in France, Lister and the physiologists in England, were great contributing factors, but the centres of attraction for students in the last half of the century, certainly after 1860, had moved from Paris and London to Berlin and Vienna.

The coming-of-age party of clinical medicine in America was held in June, 1886, in Washington, with the inauguration of the Association of American Physicians. Special societies had already been successful, and the idea was in the air, so to speak. The suggestion came, I believe, from Dr. James E. Graham, of Toronto, to Dr. James Tyson. Pepper was actively sympathetic, and took a leading part in the organization. From the start it proved a great success. Francis Delafield, the first president, struck the true note when he said: "We want an association in which there will be no medical politics and no medical ethics; an association in which no one will care who are the officers, and who are not; in which he will not ask from which part of the country a man came, but whether he has done good work, and will do more; whether he has something to say worth hearing, and can say it." The leading clinicians and pathologists of the country were present. One man whom we had all hoped to have with us, the Nestor of clinical medicine in the country, Austin Flint, had recently died, and some of the seniors did not care to join at the meeting. Meridith Clymer, an old pupil of Andral and Chomel, was an interesting link with the past. Looking over the list, it is sad to see that only twenty-five of the original seventy-five members survive. The meeting was made memorable by two papers of the first rank, that of Reginald Fitz on *"Inflammation of the Vermiform Appendix,"* a landmark in our knowledge, and the study of F. W. Draper on *"Pancreatic Hemorrhage."* The association set a standard, promoted good-fellowship, encouraged research among the younger men, and has led to the formation of many societies dealing with various aspects of medicine and pathology. Among these may be mentioned the interurban clinical clubs, which have been most helpful in keeping the younger men in touch with each other and their scientific colleagues.

Quite as, or even more, important in the evolution of medicine in America during the past twenty-five years has been the revolution in medical education. A layman, President Eliot of Harvard, and William Pepper roused the profession, the founding of the Johns Hopkins Medical School set the example, time and a thousand contributing energies have done the rest. It has been a slow, uphill business, and much work remains to be done. The schools have been reorganized, the universities have recognized their duties, the public has been partially educated, and the hospitals have been put in their true relationship with the medical schools. The laboratories of anatomy, physiology, and pathology have been made university units, and everywhere there is progress towards placing on the same basis the departments of medicine, surgery, etc. The work of Abraham Flexner and President Pritchett, of the Rockefeller Foundation, has stirred the Pool of Bethesda as never before in its history.

Twenty-five years ago there was not a single medical clinic worth the name in the United States. A most pernicious system prevailed—bad for the teacher, worse for the pupils. At the University of Pennsylvania, Pepper held a Saturday clinic and gave two didactic lectures weekly. I gave one clinic and, with Bruen and Fussell and Jack Mitchell, held physical diagnosis classes, which were good enough in their way, but the students had no daily personal contact with patients. There was abundant material, and between the University Hospital, Blockley, and the Infirmary for Nervous Diseases, where the present Editor of the CLINICS was my assistant, I was for five years very nearly a "whole-time" man. There was no clinical laboratory, only an improvised room under the amphitheatre, which was very active the year George Dock was in charge.

The greatest single change has been the reorganization of the practical subjects on university lines, making surgery and midwifery and the other branches as much *departments* as chemistry or botany. The Johns Hopkins had a unique opportunity, as for the first time a big hospital was made part of the medical school of a University. Now it is everywhere recognized that a clinic must be run as is any other scientific subject, with a head, a staff, a budget, and laboratories. At last it has been acknowledged that the medical student has rights in wards and laboratories and outpatient rooms, as well as in the amphitheatre, and that he is part of the working machinery of an up-to-date clinic. Year by year there has been the gradual adoption of this plan in the medical schools all over the country.

The burning question to be settled by this generation relates to the whole-time clinical teacher. It has been forced on the profession by men who know nothing of clinical medicine, and there has been a "mess of pottage" side to the business in the shape of big Rockefeller cheques at which my gorge rises. To have a group of cloistered clinicians away completely from the broad current of professional life would be bad for teacher and worse for student. The primary work of a professor of medicine in a medical school is in the wards, teaching his pupils how to deal with patients and their diseases. His business is to turn out men who know how to handle the sick. His business, also, is to bring into play all the resources of the laboratories in the investigation of disease, for which purpose he must have about him active young men who will stay for years at the clinic, largely for the sake of the experience. His business, further, is to get into close touch with the profession and the public, and with both to play the missionary; and this he can only do if engaged part of his time in consulting practice. There always have been of choice whole-time clinicians. So devoted was Desault to his work that he slept at the hospital. More often they have men of the Samuel Gee type, splendid in wards or laboratories, but ill-fitted by temperament to control large classes, or for the hurly-burly of the professional life. By all means let us have them in the special hospitals attached to institutes of research, as in the Rockefeller; but spare the medical schools an experiment, which may be successful now and then, but which—from my point of view—can not but lower in type and tone the work of the clinical professoriate.

An extraordinary change has come over the character of the work in internal medicine. In place of observation and the record of clinical facts, or rather supplementing this essential side, the results of research, experimental and chemical, fill the journals, and have necessitated the establishment of many new ones. The old methods with improved technic have given us the new knowledge on malaria, dysentery, pellagra, hookworm disease. Bacteriology has revolutionized clinical medicine and public health, and the experimental methods have enabled us to stamp out yellow fever and have thrown new light on pneumonia, poliomyelitis, cerebrospinal fever, and typhus. Physiological methods have given us a new cardiac pathology, and instruments of precision are more and more in use by the general practitioner for purposes of diagnosis. Researches upon internal secretion and metabolism are the order of the day, and the most advanced methods of organic analysis supplement the clinical study of cases. Special laboratories exist for studies in metabolism, and institutes for research have been established, some of them with princely incomes; Cuba, Porto Rico, the Isthmus, and the Philippines have made America a centre for the study of tropical diseases. The Public Health Service has become an important department for scientific research. No nation has shown such progress in a quarter of a century.

Minerva Medica is a fickle goddess. Within a century and a half her sceptre has been seen in England, France and Germany. It looks as if she might cross the Atlantic and take up her abode in the land of Morgan and Rush, Gerhard and Flint, Holmes and Mitchell, Pepper and Fitz. Centuries ago she handed the torch of science to her darlings, the Greeks, and by that light we still work. Never has it burned brighter than in these dark days, and never so bright in the United States as in the brief quarter of a century, the completion of which is celebrated by this number of the INTERNATIONAL CLINICS.

INTENSIVE WORK IN SCIENCE AT THE PUBLIC SCHOOLS IN RELATION TO THE MEDICAL CURRICULUM

BY

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By Sir William Osler, Bart., M.D., F.R.S.

Regius Professor of Medicine, Oxford.

FORTY and more years' experience with the finished article as turned out from your shops should give assurance of a knowledge on my part of your methods of work and endeavours. General impressions are rarely accurate, but it may be worth noting that a composite picture of the thousands of students who have left impressions on my mental films is one to be looked at with pleasure; and not without a feeling of gratitude to schoolmasters who have passed on so many men well fitted to study medicine. I do not say well prepared, but 99 per cent. have possessed the essential factor in a successful education, interest, a living interest in the subject. I am taking advantage of the honour you have conferred to urge that by a more intensive method of the study of the sciences,

[1] Presidential address delivered to the Association of Public School Science Masters on January 4th, 1916.

boys designed for the medical profession may leave your hands prepared to begin their special studies.

In a presidential address, and to this audience, a preliminary reminiscent note may be pardoned. As a boy I had the common experience of fifty years ago—teachers whose sole object was to spoon-feed classes, not with the classics, but with syntax and prosody, forcing our empty wits, as Milton says, to compose "Theams Verses and Orations," wrung from poor striplings like blood from the nose, with the result that we loathed Xenophon and his ten thousand, Homer was an abomination, while Livy and Cicero were names and tasks. Ten years with really able Trinity College, Dublin, and Oxford teachers left me with no more real knowledge of Greek and Latin than of Chinese, and without the free use of the languages as keys to great literatures. Imagine the delight of a boy of an inquisitive nature to meet a man[2] who cared nothing about words, but who knew about things—who knew the stars in their courses, and could tell us their names, whose delight was in the woods in springtime, who told us about the frog-spawn and the caddis worms, and who read to us in the evenings Gilbert White and Kingsley's "Glaucus," who showed us with the micro-

[2] Rev. W. A. Johnson, Founder and Warden of Trinity College School Canada.

scope the marvels in a drop of dirty pond water, and who on Saturday excursions up the river could talk of the Trilobites and the Orthoceratites, and explain the formation of the earth's crust. No more dry husks for me after such a diet, and early in my college life I kicked over the traces and exchanged the classics with "divers" as represented by Pearson, Browne, and Hooker, for Hunter, Lyell, and Huxley. From the study of nature to the study of man was an easy step. My experience was that of thousands, yet, as I remember, we were athirst for good literature. What a delight it would have been to have had Chapman's "Odyssey" read to us, or Plato's "Phædo," on a Sunday evening, or the "Vera Historia." What a tragedy to climb Parnassus in a fog! How I have cursed the memory of Protagoras since finding that he introduced grammar into the curriculum, and forged the fetters which chained generations of schoolboys in the cold formalism of words. How different now that Montaigne and Milton and Locke and Petty have come to their own, and are recognised as men of sense in the matter of the training of youth.

I wonder how many of you have a first-hand knowledge of these great masters in your Israel. For a man who, as Montaigne says, has only nibbled upon the outer crust of knowledge in his nonage, and has only retained a general and formless image, it smacks of impertinence to offer idle whimsies to a group of experts. I have a mental reflex when I meet a young man engaged in teaching, and almost involuntarily out come the questions: Have you read Milton's "Tractate"? Do you know Locke's "Thoughts"? Have you ever tried a boy on Montaigne's classical diet? What do you think of Petty's "Ergastula Literaria"? I know what he thinks of me at the close of a few minutes' conversation! But seriously, who does not envy the happy issue of the noble experiment in education made upon the person of the great essayist, whose influence may be seen in the contributions of Milton and Locke? I was glad to read a few months ago the strong tribute paid by Sir Henry Morris (*Lancet,* September 18th, 1915) to these two great English reformers.

May I for a moment in passing say a word or two about the fourth, Sir William Petty, whose *"Advice . . . to Mr. Samuel Hartlib for the advancement of some particular parts of learning"* touches us very closely to-day. It is interesting that it should have been addressed to the man—himself a great educational reformer—at whose request Milton published his "Tractate." When written, the country was in the midst of civil turmoil, with a larger proportion of the population fighting than at any period in its history until the present. The Universities were deserted, education neglected, and upon the old soil thus upturned Petty scattered the seed—to fall among thorns. Only in our day we have seen his three far-seeing propositions realised. Many of our schools are *ergastula literaria,* literary workshops, "where," as he says, "children may be taught to do something towards their living as well as to read and write"; and he was keen that the children of the better classes be taught some "genteel manufacture in their minority," and a delightful list is given. His *Gymnasium mechanicum,* or College of Tradesmen, is represented by our technical schools. Petty's fertile mechanical genius foresaw the enormous advantage of such institutions in stimulating trades and inventions. "What experiments," he says, "and stuffs would all these shops and operations afford for active and philosophical heads." And what a wonderful design is his third institution—a *Nosocomium academicum,* "a hospital to cure the infirmities both of Physicians and patients," a great scientific school for the study of disease and its cure." Neither Montaigne nor Milton nor Locke had the wide national outlook on education displayed by Petty, who alone almost of his generation realised that the problems of natural philosophy, as it was then called, must be attacked in a systematic and co-operative study by a group of men "as careful to advance the arts as the Jesuits are to propagate their religion." One cannot but regret that the Professor of Anatomy at Oxford, and the Vice-Principal of Brasenose College, should have been diverted to a turbulent and disheartening career in Ireland, and to-day the identity of the founder of English political economy and of public health statistics is merged in the author of the Down Survey, and the Beginner—to use Fuller's word—of a great family [3] (Lansdowne).

To come now to the subject-matter of my address—the earlier and more intensive study of science at school to save time at the university.

For fifteen years the slowly evolving sprightly race of boy should dwell in a Garden of Eden, such as that depicted by the poet—no sense of any ills to come, no care beyond the day, buxom health, wild wit, the sunshine of the breast, the lively cheer—

> The thoughtless day, the easy night,
> The spirits pure, the slumbers light.

During this blissful period a boy is an irresponsible yet responsive creature, a mental and moral chameleon taking the colour of his environment, very difficult to understand, often

[3] Petty's "Advice" appeared in 1648 (4to, Lond.), and is also in vol. vi. of the "Harleian Miscellany." I hope to see this remarkable contribution to educational methods reprinted.

never understood by parent or teacher—yet, tied about his neck is a *clavis symphonia* with which anyone may unlock his heart and control his life. Rather an ideal sketch you may think, and doubtless Plato's description fits better with your experience—"and of all animals the boy is the most unmanageable, in so much as he has had the fountains of reason in himself not yet regulated; he is the most insidious, sharp-witted, and insubordinate of animals." What concerns us to-day is that about the fifteenth year there comes a change in this mysterious being—physical, mental, and moral. Consciousness that he is a man and has man's duties is forced upon him, and repeating the tragedy of the Garden, he awakens to the knowledge of good and evil. It is fitting to mark this change with a change in his education. Plato did it. Following two three-year periods devoted to general and humane studies came the maturer pursuits fitting the young citizen for service in the State. My plea is to follow this plan, as for one profession at least it is most desirable.

At fifteen a boy should have had sufficient general education—the three R's, a fair knowledge of the history and literature of his country, and in the public schools enough classics to begin a technical training and to pass the ordinary entrance examination. Now comes the fateful period in which the bent of the boy's mind is determined. A difficulty exists in only a small proportion; a large majority have already selected careers, and the work of the sixteenth and seventeenth years should be determined by this choice, whether professional, commercial, academic, or the Services. The classical, modern, and scientific departments of the schools now meet these demands.

The profession of which I can speak is in a serious quandary. With the rapid development of science the subjects of study have become so multiplied that the curriculum is overburdened, and the five years is found to be insufficient. Men come up later, remain longer, and the twenty-fifth or twenty-seventh year is reached before the qualification to practise is obtained. A measure of relief to this heavy burden—and it is one not likely to lighten during the next decade—is in your hands. Devote the sixteenth and seventeenth years to the preliminary sciences—physics, chemistry, and biology—and send us at eighteen men fit to proceed at once with physiological chemistry, physiology, and anatomy.

To do this three things are needed: teachers, laboratories, and a systematic organisation of the courses.

I put the *personnel* first, as the man is more important than his workshop. Your society indicates the position which the science master has reached in our public schools, not without long years of struggle. The glamour of the classics lingers, but the shock which the nation has had in this great war will make us realise in the future that to keep in the van we must be in the van intellectually in all that relates to man's control of nature. Science "Heads" at Winchester, Eton, and Harrow would give the death-blow to the old-time Anglican tradition so well expressed in a Christmas sermon by the late Dean Gaisford, that classical learning "not only elevates above the vulgar herd, but leads not infrequently to positions of considerable emolument." There is an initial difficulty apt to block good men, the fear of overburdened teaching, since it is not always possible for a school to pay an adequate staff; but the past twenty years have seen the whole situation changed. The posts have become more and more attractive and better paid, so that a definite career is now offered to able young men. Many original contributions to science made by the members have given a proper *caché* to the association, and, I may say, have added enormously to its intellectual status. Men feel proud to have as colleagues distinguished workers. Let us not forget that Priestley got his F.R.S. while a master at the Warrington Academy. The exhibits by members at this meeting indicate a fertility of invention in the highest degree creditable.

Brains, not bricks, should be the school motto in the matter of laboratories. A young Faraday in a shed is worth a dozen scientific showmen in costly buildings with lavish outfits. The accommodation, I am told, is at present ample in the larger schools. I have, indeed, seen laboratories which the most up-to-date college would envy. In the smaller schools it has not always been easy to get either the men, the space, or the equipment for teaching all the branches, and if an attempt is made to give earlier and more intensive science teaching there will have to be improvement all round.

The real crux is not with men or with buildings, but so to organise the teaching of the school as to have a continuous science course through two years. What is done now occasionally by the individual, I should like to see done by all the science men coming up to the universities or to the medical schools. A few men take the preliminary scientific subjects on entering Cambridge. Though possible, this at Oxford is rarely done; indeed, the examination is not at a suitable time! For some years now I have watched the results of the chemistry "prelims" at Oxford, and have consulted with many examiners, and I am sorry to say that the opinion usually expressed has been that in this subject the teaching in the schools is not yet up to college standards.

Here is where my appeal comes to the school authorities. Give us the boys of the sixteenth and seventeenth years for well-organised thorough courses in biology, chemistry, physics, and the associated mathematics. You have the teachers and the "plant." Think what could be done with a class of bright boys in two full years, who had *nothing else to do*. No, I would let them have two other subjects, French and German, taught *à la Montaigne*, by making the boys use elementary French and German text-books. With reading clubs, Selborne clubs, and historical clubs, conducted by the boys themselves in the laboratories, the literary side of their education would be continued, and a sympathetic teacher would not be above putting a little English polish on, say, a short essay on Lavoisier. Judiciously mixed, chemistry through two years, biology through two, and physics in one—how I envy the teachers, how I envy the taught! A full year would be gained, as the two spent at the school in science would be the equivalent of the one now spent upon the preliminary subjects after entering the medical school. It would indeed be possible to allow those who came up to a certain standard to cut off the fifth year. By shortening vacations, and rearranging methods of instruction, we could return to a four-year curriculum. Practically that is what it is now, as a majority of men spend the first year in preliminary sciences, to teach which is really no business of the medical schools. With this arrangement the average man could qualify at twenty-two years of age, spend a year in hospital or at post-graduate study, and start in "life" at twenty-three. We are now losing valuable time and wasting much needed money. What a present to make to our young men—two full years! It is worth while; and it can be done, and should be done.

My colleague, Prof. Arthur Thomson, has suggested that during the present emergency special arrangements should be made to pass on the boys at an earlier age, with their chemistry and physics well in hand. The plan I urge would make a radical change in the constitution of some schools. Not that science is not taught and well taught, but it should be given its proper place, as the dominant partner in the educational family, not a Cinderella left in the kitchen. From an intellectual standpoint the advantages are obvious. The mental exercise of the physical and mathematical sciences, combined with the technical training in the use of apparatus, gives a type of education singularly stimulating to boys. How many of our great inventors have lamented colourless careers at school! Things, not words, appeal to most boys. What an evolution of mind and hand is wrought by a year in a well-conducted physical laboratory. The fascination of making and fitting the apparatus, the wonders of electricity, and the marvellous laws of heat and light—into this new and delightful world a boy of sixteen may pass safely for a thorough training. Only it must not be a mere dabbling, to which the physical laboratory too often lends itself, but a serious day by day, week by week, gradual progress. The senior boys could keep their knowledge of the subject fresh by acting as demonstrators in the junior classes. Many lads show an extraordinary aptitude for physics; there is always a boy Pascal in a big school, and no subject is so suited to arouse a fervid devotion to science. It would do the nation great good to have each generation, at the sixteenth or seventeenth year, pass automatically through a laboratory of physics.

I have spoken of the doubts expressed whether chemistry in the public schools can be taught at a college level. Of course it cannot as a subsidiary subject, to which only a few hours a week are devoted, but in a course extending over two years, as a major subject, with laboratory work four or five mornings a week, surely a youth in his sixteenth and seventeenth years should be able to put in the foundation stones, and in individual cases it is done already. As a mental discipline chemistry almost rivals physics; indeed, the new physical chemistry is a blend which appeals with magic potency to all science students.

But no subject attracts the young mind so strongly as biology, in its varied aspects. Elementary teaching is now admirably arranged, and in a two-year curriculum it should be an easy matter to cover much more ground than in the preliminaries demanded for medicine. Field classes in botany, gardens, museum work, should all be utilised. I would like to see at every school that excellent plan adopted by the late Sir Jonathan Hutchinson at his village museum, Haslemere —nature lectures on Sunday afternoons, with exhibition of the flowering plants of the season, with any other specimens of interest. The biology class gives an opportunity of a clear statement of the facts of sex, always so hard to discuss with boys.

There are objections, of course, to extensive and intensive teaching of science in schools. It is the business of the college, not of the school, to prepare boys for technical studies; but if it is the business of the school to teach science at all, why not teach it thoroughly? The general influence of the school may be trusted to counteract the evil possible in a too early concentration upon special subjects. Nature is never special, and a knowledge of her laws may form a sound Grecian foundation upon which to build the superstructure of a life as useful to the State, and as satisfying to the inner needs of a man, as if the groundwork were classics and literature. The two, indeed, cannot be separated. What naturalist is uninfluenced by Aristotle, what physician worthy of the name, whether he knows it or not, is without the spirit of Hippocrates. It has been well said that instruction is the least part of education. Upon the life, not the lips, of the master is the character of the boy moulded; and doubtless the great master of masters had this in mind when he said: "It may be, in short, that the possession of all the sciences, if unaccompanied by knowledge of the best, will more often than not injure the possessor." (Plato, "Alcibiades," ii.)

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CREATORS, TRANSMUTERS, AND TRANSMITTERS

AS ILLUSTRATED BY

SHAKESPEARE, BACON, AND BURTON

Remarks made at the opening of the Bodley Shakespeare Exhibition, April 24, 1916,

BY

WILLIAM OSLER

At the command of Prospero, the authors of the one and a half millions of books and manuscripts that rest in and beneath these historic buildings would arrange themselves in three groups—creators, transmuters, and transmitters. The first would not crowd the benches of this school; for the second it would be easy to find accommodation in the city; while the third would swarm black over Port Meadow and 'the soft, low-lying Cumnor hills'. So restricted is the intellectual capital of the race that it goes easily on the seven-foot shelf of President Eliot's (of Harvard) library. The vast majority of all books are dead, and not one in ten thousand has survived its author. Like the race of leaves the race of books is. The Bodleian is a huge mausoleum. Books follow a law of nature. Thousands of germs are needed for the transmission of an individual of any species. In the case of the salmon only one in a thousand is fertilized and of these not one in a thousand reaches maturity. So it is with books—a thousand or more are needed to secure the transmission of a single one of our very limited stock of ideas. Were all the eggs of all the salmon to reach maturity the sea could not contain this one species, while the world itself could not contain the books that would be written did even one in a thousand transmit a fertile idea. It is enough, as some one has said, if 'every book supplies its time with a good word'.

In the days when Sir Thomas Bodley concluded to set up his staff at the Library door at Oxford, there lived in this country the last of the great transmitters, Robert Burton; the first of modern transmuters, Francis Bacon; and the greatest of the world's creators, William Shakespeare.

Emerson's remark that 'every book is a quotation' is true in a special sense of the encyclopaedias and dictionaries that fust unused on our shelves. From the huge tomes into which, at the behest of St. Louis, Vincent of Beauvais in the thirteenth century boiled down all knowledge—the earliest edition we have in Bodley weighs above one cwt.[1]—to the last issue of the *Encyclopaedia Britannica*, writers have striven to transmit the stores of human knowledge. Such 'systems' have their day and then cease to be. The individual fares better than the encyclopaedia, but not often. The *Discoveries* of Ben Jonson, a timbered mosaic, so skilfully designed that even the glue is invisible, is dead. No one now reads the *Sylvae Nuptialis* of Joannes Nevizano, a mere string of quotations; few have even heard of the *Zootomia* or *Moral Anatomy of the Living by the Dead*, by Richard Whitlock—though he was a Fellow of All Souls; or of scores of the sixteenth- and seventeenth-century patchworks. Only the golden compilation of Robert Burton lives, and lives by the law so well expressed in the lines:

> Sappho survives because we sing her songs,
> And Eschylus because we read his plays.

The silent, sedentary, solitary student (as he terms himself) in the most flourishing college of Europe, *augustissimo Collegio*, with Saturn lord of his geniture, to relieve a *gravidum cor*, swept all known literature into a cento. No book was ever so belied by its title as the *Anatomy of Melancholy*. In reality the anatomy of man in all possible relations it is easy to read the secret of its salvation. The panorama of human life is sketched in broad, firm outlines by a man of keen humour and kindly satire. Though page after page is laden with what Milton calls 'horse loads of citation', the golden links are of Burton's own fashioning. Even the dry bones of bibliography come to life as he pours out a torrent of praise upon the 'world of books that offers itself in all subjects, arts and sciences to the sweet content and capacity of the reader'. Except Shakespeare, no writer has realized more keenly that all thoughts, all passions, all delights, and whatever stirs this mortal frame, minister to the one great moving impulse of humanity. It is not a little surprising that from a student of Christ Church, an old bachelor, and the Vicar of St. Thomas the Martyr, should have come the most elaborate treatise ever written upon love. There is no such collection of stories in all literature, no such tributes to the power of beauty, no such pictures of its artificial allurements, no such representation of its power of abasement. The thoughts and words of more dead writers are transmitted to modern readers by Burton than by any other seventeenth-century author. That the *Anatomy* is not in the cemetery of dead books is due to the saving salt of human sympathy scattered through its pages. Burton comes within the net of the Baconians, but it was much discussed by the late Mr. George Parker, of the Bodleian, and Mr. M. L. Horr [1] of Denver whether it was not more likely that he wrote the plays of Shakespeare.

[1] '*Who wrote Shakespeare?*' by '*Multum in Parvo*' (M. L. Horr), from the Denver (Colorado) *Tribune-Republican*, 1885. 4 pp. (In Bodley.)

The melting-pot of the transmuters has changed the world. They have been the alchemists at whose touch the base metal of common knowledge has been turned to gold. Among them Francis Bacon takes a high place, not so much for his inductive philosophy, really a new creation, as for the convincing demonstration that the relief of man's estate was possible only through a knowledge of the laws of nature. A great transformer of the mind, he realized, as no one before had done, that 'within the reach of the grasp of man lay the unexplored kingdom of knowledge if he will be but humble enough, and patient enough, and truthful enough to occupy it'. With a Pisgah-sight of Palestine, he lacked the qualities of a Joshua to enter himself upon campaigns of conquest; but he was one of the world's seers with a vision of the possibility of man's empire over nature. The singularly human admixture of greatness and littleness was in his works as well as in his life.

History repeats itself. Greek philosophy, lost in the wandering mazes of restless speculation, was saved by a steady methodical research into nature by Hippocrates and by Aristotle. While Bacon was philosophizing like a Lord Chancellor, two English physicians had gone back to the Greeks. 'Searching out nature by way of experiment' ('tis Harvey's phrase), William Gilbert laid the foundation of modern physical science, and William Harvey made the greatest advance in physiology since Aristotle. Recking not his own rede Bacon failed to see that these works of his contemporaries were destined to fulfil the very object of his philosophy—the one to give man dominion over the macrocosm, the world at large; the other to give him control of the microcosm, his own body. A more striking instance of mind blindness is not to be found in the history of science. Darkly wise and rudely great, Bacon is a difficult being to understand. Except the *Essays*, his books make hard reading. In the *Historia Naturalis*, a work of the compiler class, one would think that a consideration of Life and Death would so far fire the imagination as to save an author from the sin of dullness. Try to read it. A more nicely tasteless, more correctly dull treatise was never written on so fruitful a theme. There is good sense about medicine and nature, but with the exception of the contrast between youth and old age, which has a fine epigrammatic quality, the work is as dry as shoe-leather, and the dryness is all his own, as other authors are rarely quoted. Only a mollusc without a trace of red marrow or red blood could have penned a book without a page to stir the feelings and not a sentence with a burr to stick in the memory. Bacon students should study the lengthy consideration given in it to the spirits, and then turn to Schmidt's *Lexicon* to see how very different in this respect are the motions of Shakespeare's spirit. The truth is Bacon had in a singular degree what an old Carthusian (Peter Garnefelt) called 'the gift of infrigidation'.

What a contrast when a Creator deals with Life and Death! The thoughts of the race are crystallized for ever. From Galen to Laurentius, physicians have haggled over the divisions of the ages of man, but with a grand disregard of their teaching. Shakespeare so settles the question that the stages are stereotyped in our minds. We can only think of certain aspects in terms of his description. The vicissitudes of every phase are depicted. The shuddering apprehension of death we can only express in his words.

The transmuters have given to man his world dominion. The raw ore of Leucippus and Democritus has been refined to radium by Crookes, Ramsay, and the Curies; the foundations of Krupp are laid in the *De Re Metallica* of Agricola; the defenders of Verdun use the expanded formulae of

Archimedes and Apollonius; Lamarck and Darwin, Wallace and Mendel are only Anaximander, Empedocles, and Lucretius writ large; Poppy, Mandragora, and other drowsy syrups had been in use for centuries to make persons insensible to pain, but the great transmutation did not take place until October 16, 1846, when Morton demonstrated at the Massachusetts Hospital the practicability of aether anaesthesia; Pasteur, Koch, and Lister are Varro, Fracastorius, and Spallanzani in nineteenth-century garb. Only by the labours of transmuters has progress been made possible, and their works will fill the shelves of the concentrated *Bibliotheca Prima* of the future.

Whether the benches of this school would seat the members of our third group, the creators, would depend very much on the judgement of Prospero. Thus to Harvey claiming admission, he might say, 'You simply took the idea of a movement of the blood which had been current knowledge since Solomon, and by experiment demonstrated a motion in a circle and not by ebb and flow'. And this is true. Without Aristotle, Galen, and Fabricius there would have been no Harvey. Transforming their raw ores by methods all his own, he made the *De Motu Cordis*, 1628, a new creation in the world of science. Not by the material, not by the method of its manufacture, but by the value of the finished product is the author's position to be judged. In Science the best transmuters have been the fruitful creators. The same law holds in Art and in Literature. The Alchemy of Shakespeare made him a great creator. 'Self-school'd, self-scann'd, self-honour'd, self-secure,' in heaven-sent moments he turned the common thoughts of life into gold. From Carlyle and Emerson, the teachers who stirred our hearts, the youth of my day had a final judgement upon Shakespeare. After the two noble knights of literature [1] have spoken, it will be safer for

[1] Sir Walter Raleigh and Sir Sidney Lee.

a layman to express his feelings in the words of one of these masters:

> What point of morals, of manners, of economy, of philosophy, of religion, of taste, of the conduct of life, has he not settled? What mystery has he not signified his knowledge of? What office, or function, or district of man's work, has he not remembered? What king has he not taught state? What maiden has not found him finer than her delicacy? What lover has he not outloved? What sage has he not outseen? What gentleman has he not instructed in the rudeness of his behaviour?—Emerson, ***Shakespeare; or the Poet.***

Five thousand volumes in Bodley testify to a vast dominion unequalled in the history of literature. Once before in the world a poet held all the thoughts of his race. From Plutarch and Lucian we can judge how an educated Greek was really constrained to express himself in Homer's words. Such universality is to-day the prerogative of Shakespeare:

> All pains the immortal spirit must endure,
> All weakness which impairs, all griefs which bow,
> Find their sole speech in that victorious brow.

As a little needful leaven and just to indicate the very present help he may be in these troublous times, let me quote Hotspur—any officer to any wife:

> And, to conclude,
> This evening must I leave you, gentle Kate.
> I know you wise; but yet no further wise
> Than Harry Percy's wife: constant you are,
> But yet a woman: and for secrecy,
> No lady closer; for I well believe
> Thou wilt not utter what thou dost not know;
> And so far will I trust thee, gentle Kate.

The exhibition which Bodley's Librarian and his Assistants have arranged with such care and the many celebrations the world over will have one good effect—a heightened appreciation of the value of Shakespeare in the education of the young. In life's perspective we seniors are apt to resent that the rising generation should work out its own salvation in ways that are not always our ways, and with thoughts that are not always our thoughts. One thing is in our power, to admix in due proportions with their present somewhat rickety bill of fare the more solid nourishment of the English Bible and of Shakespeare.

ILLUSTRATIONS OF THE BOOK-WORM

By SIR WILLIAM OSLER

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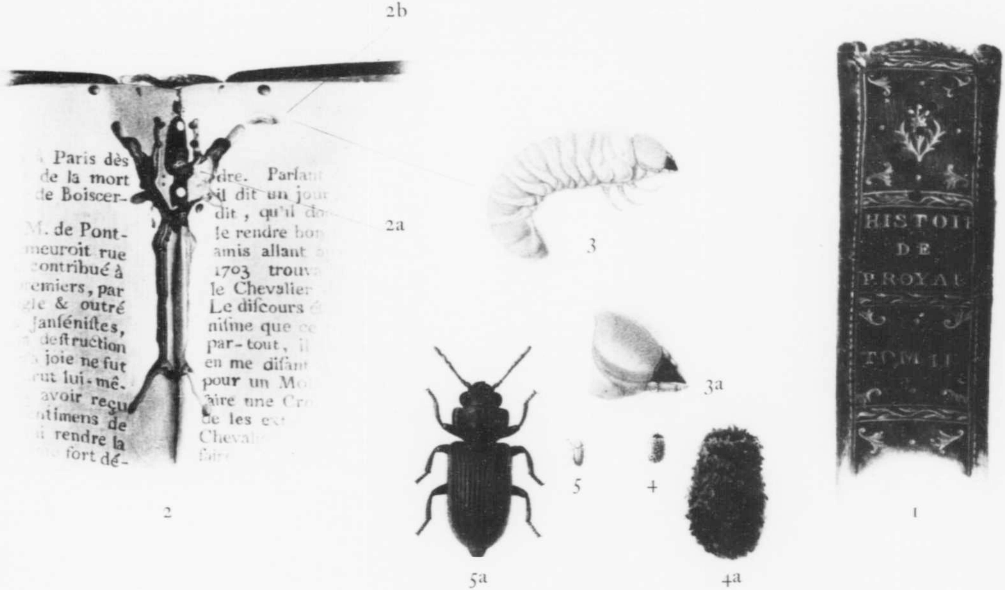

BOOK-WORM.

Anobium hirtum, Illigar.

1. Back of book showing exit holes of the beetles.
2. Book opened showing damage, and (2a) pupa-case in situ, (2b) larva natural size.
3. Larva greatly enlarged. 3a. Head and fore part of same.
4. Pupa case, made of particles of frass cemented together, natural size. 4a. The same greatly enlarged.
5. Beetle in its perfect, or imago, stage, natural size. 5a. The same greatly enlarged.

ILLUSTRATIONS

OF THE

BOOK-WORM

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ILLUSTRATIONS OF THE BOOK-WORM

In *Micrographia*, a 'study of the Minute Bodies made by the Magnifying Glass', London, MDCLXVII, one of the earliest publications issued under the authority of the newly-formed Royal Society, Robert Hooke described in Observation LII the 'small silver-colour'd Book-worm', 'which upon the removal of Books and Papers in the Summer, is often observed very nimbly to scud, and pack away to some lurking cranny'. The third figure of the 33rd scheme pictures a monster so formidable-looking that Blades[1] may be forgiven the suggestion that Hooke 'evolved both engraving and description from his inner consciousness'. Comparing, however, this earliest known drawing with one in Houlbert's monograph, *Les Insectes Ennemis des Livres*, 1903, we find that the distinguished author of the *Micrographia* knew what he was about, as alike in text and figure he has given what Houlbert calls 'une belle et exacte description' of the *Lepisma saccharina*, a formidable enemy of books, 'one of the teeth of time', as Hooke calls it. It is a fine bold figure, well executed, and the text is remarkable for a digression upon the different refrangibilities of light of the scales of the *Lepisma*, which cause the shining appearance, and explain the name 'silver fish' given by children to this insect.

In *Beschreibung von allerley Insecten in Deutschland*, 1721, anderer Theil, p. 36, ix, '*von dem kleinen Gelben Brodt-Käfer*', Joh. Leonhard Frisch gives the first account of the common *Anobium paniceum*; and Tafel viii, fig. i, illustrates roughly the larva and pupa. Though not directly referred to as a book-worm, Frisch knew that it attacked manuscripts and books.

As Prediger's *Buchbinder und Futteralmacher*, 4 vols., 1742 and 1772 (and an earlier unknown edition), is not in the British Museum or in Bodley, I cannot say whether or not the book-worm (which is referred to) is figured. The *Gentleman's Magazine* for 1754 has a brief reference to the work.

The Göttingen prize essays in answer to the questions of the Royal Society of Sciences as to the varieties of insects' injuries to books, &c., *Drey Preisschriften zu Beantwordung, &c.*, Hannover, 1775, have no illustrations.

During the first half of the nineteenth century only a few observations of importance were made upon book-worms. The widespread prevalence of insect

[1] *Enemies of Books*, 1896.

pests in the United States aroused the attention of trained entomologists, and the studies of H. A. Hagen, Riley, and others enlarged our knowledge of the varieties of insects which preyed upon books. How rare are good illustrations may be judged from those in Blades's *Enemies of Books*, 1896, and in Ed. Rouveyre's *Connaissances nécessaires à un bibliophile*, 5me éd., tom. 8, 1889. Scattered contributions to the number of about eighty are recorded for the nineteenth century in the bibliography given by Houlbert. In 1900, at the 'Congrès international des bibliothécaires' held at Paris, it was decided to offer prizes for the best memoirs upon the insects which attacked books. One of these Marie-Pellechet prizes, the memoir of M. Houlbert, just referred to, gives for the first time a systematic grouping and study of the insect enemies of books. It is surprising to find so large a number as sixty-seven species described, of which about one-half are Coleoptera or beetles. Apart from the Termites, which are rare in Europe, the larvae of Coleoptera are the most harmful, and of these the Anobiides are the common and dangerous forms. Houlbert states that in France nine times out of ten the *Anobium paniceum*, known in America as the *Sitodrepa panicea*, is the culprit. In the *Cambridge Natural History: Insects*, Part II, Sharp gives a good account of the Anobiides, and the best figures I have seen of the transformations of *Anobium paniceum*. In tome iii, pl. 53, of Jacquelin du Val's *Genera des Coléoptères d'Europe Anobium pertinax* is figured, the only coloured illustration I have seen of a book-worm.

In October 1915 I received from a Paris bookseller, M. Lucien Gougy, three volumes of the *Histoire abrégie de la dernière persécution de Port-Royal*. Edition Royale, MDCCL,' no place of printing indicated. On a card inside the cover, with ornamented border, is printed 'Resid. Tolos. S.J.', which indicates the provenance of the volumes from the south of France. The backs of two of the volumes were wormed, vol. i with two holes, vol. ii with ten, and this volume when opened showed at the back close to the binding a single large tunnel, an inch and a half in length, with laterals above and below. The borings had a fresh look and there were many granular castings. Near to the top of the main tunnel my eye caught a globular nest or casing (seen in figure 2 *a*, midway between the holes through the back), and from the upper open end of this a brownish black head bobbed in and out. With a lens part of the body could be seen, and with gentle manipulation the little worm was extracted. In figure 2 *b* it can be seen on the page of natural size, at the top of the upper right-hand tunnel. It had a yellowish white glistening body covered with fine soft hairs. The enlarged larva and mandibles are shown at figure 3 *a*, while figs. 5 and 5 *a* show the adult beetle of natural size and magnified, and figs. 4 and 4 *a* the pupa case. Only once before, in the University Library, Utrecht, had I seen a living book-worm. The picture of the opened book was so striking that Professor Poulton, to whom I showed it, urged me to have a sketch made by the well-known artist Mr. Horace Knight, of the British Museum. Mr. Knight writes, September 4, 1916, 'Herewith the drawing of the book-worm which more than a year ago you asked me to make. It has been waiting in hopes the larva would pupate, but it has not even commenced to make a case, and Dr. Graham thinks it may go another year. . . . There are no eggs of this species in the British Museum and no drawing of any value.' Mr. Knight's beautiful sketches are so superior to anything in the literature that Mr. Madan has kindly consented to have the plate reproduced in the *Bodleian Quarterly Record.*

The specimen is *Anobium hirtum*, not a native of England, but met with occasionally in the centre and south of France. Houlbert says there are very few observations upon it. In the southern states of America it is more common, and the best account is to be found by E. A. Schwarz (*Insect Life*, vol. vii, p. 396, Washington, 1895) in a paper entitled 'An imported Library Pest'. Large numbers were found in the State Library, Bâton Rouge, La., and the Library of St. Charles College.

Insect book-worms are rare in Oxford, even in the most secluded libraries. Mr. Maltby, the well-known bookbinder, has the largest collection I have seen, made during the past twenty-five years, all of *Anobium domesticum*, except one unknown Lepidopteran larva. There are a few in Mr. Madan's possession. Though many of the old books in Oxford libraries are badly wormed, recent ravages are rare. One of the least used collections is that of Bishop Allestree, housed so quaintly above the cloisters at Christ Church. There have been books badly damaged, but at a recent visit I could find no worms in the books, but one shelf had plenty of borers whose sawdust covered the tops of the books below. It may be mentioned that the *Anobium* is the genus of the 'death-watch' beetles which make a clicking sound in wood, so that there is some basis for the statement of Christian Mentzel, an old seventeenth-century worthy, that he heard a book-worm crow like a cock. Bodley is singularly free from the ravages of book-worms—confirming the remark of Charles Nodier, 'La bibliothèque des savants laborieux n'est jamais attaquée des vers'.

WILLIAM OSLER.

THE ANTI-VENEREAL CAMPAIGN.

BEING

THE ANNUAL ORATION

OF THE

MEDICAL SOCIETY OF LONDON,

1917.

BY

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

Reprinted from the 'Transactions of the Medical Society of London,' vol. xl, 1917.

LONDON:

HARRISON AND SONS, ST. MARTIN'S LANE, W.C.

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THE ANNUAL ORATION.

THE ANTI-VENEREAL CAMPAIGN.

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

MR. PRESIDENT AND GENTLEMEN.—With the flotsam and jetsam of the sale-room there came to my library the other day a book for the times with the title 'A Discourse of Constancy ..... written in Latin by Justus Lipsius. Containing Comfortable Consolations, for all that are afflicted in Body and Mind. London. 1654.' To have known of the 'Discourse' through two admirable articles by Basil Anderton, of Newcastle,* gave an added welcome to Humphrey Moseley's 12mo. "in the original state."

In the dialogue the two friends discuss the miseries of the age, which had made the Low Countries almost as desolate as they are to-day, and the great Louvain Professor a homeless wanderer. To the despairing Lipsius his friend urged that "equal calamities and far greater had already fallen on the race," and that after all it was the lot of man, his destiny, and that cities and people owe their ruin "by Commission and Providence." As a tonic to their constancy they rehearse through many chapters the wonderful slaughters, the strange cruelties, the plagues and famines, and rapines; and the conclusion reached was that Good comes out of Evil, and that the righteous are never forsaken. Having accepted this comfortable consolation, hard for us to read anywhere except on the title-page of the book, our neo-Stoical friends went to dinner!

THE CONQUEST OF THE GREAT INFECTIONS.

The past three years have seen the slaughter of man by man on a scale heretofore unknown, except in the lively imagination of the

* "A Stoic in his Garden" and "Justus Lipsius," 'The Library,' 1915 and 1916.

Chronicler of the Kings of Israel. On the illustrated title-page of the little book, Fate and Necessity beam from the sky, dispelling the clouds and mist, and the light of Providence shines on the figure of Constantia. To us in these dark days comes a consolation denied to Lipsius and his friend. They did not realise, as we do, that it is Apollo, not Mars, who slays most in war, that Nature in the form of disease is more fatal to man than man with his weapons. The needless deaths of Peace far exceed those of the most disastrous wars. More people died of plague in two years in India than have been killed on both sides since the great war began. In 1915, while nine of our soldiers abroad died every hour to save their country 12 babies died at home in the same time, to the scandal of their country.

The knowledge of Nature's laws has enabled men to devise really magnificent ways of wholesale butchery; yet with a delicious inconsistency the same knowledge has taught him the science of her ceaseless warfare through disease, and has enabled him to win the greatest victory in the history of humanity. Even in war time man displays just as much hostility to a hostile Nature as he does to the enemy in the field. Bitter experience has shown him that disease is more fatal than powder and shot. The new knowledge has enabled him for the first time to reverse the ratio between the bacilli and bullets. Full details are not to hand for the Allied Forces, but we know that the destructive pestilences have played a minor, not as heretofore the major, *rôle*. And it has been the same in the German armies, in which the deaths from disease have been about 1 to 15 killed and died of wounds.

The story of the conquest of the great infections is the brightest single chapter in the history of science. The humanitarian aspect appeals to our better feelings, and hopes for the betterment of the race have been centred about health and homes and habits. There is a fly in the amber, of course, and the vision is blurred (narrowed, indeed, to darkness!) as one looked in two directions—towards cancer and towards venereal disease. In choosing a subject for my address, I could not let the opportunity slip of lending the weight of this ancient and honourable Society to anything I might say upon the great awakening that has taken place with regard to syphilis and gonorrhœa. Among infections they stand alone. Against all others man wages a keen warfare. They present the remarkable and subtle combination of Man and Nature in an incessant and successful propaganda against the health of the nation. The report by Dr. R. W. Johnstone to the Local Government Board, 1913, and the report of the Royal Commission embrace every aspect of the question.

Statistical Data.

I propose to touch upon only two points—the importance of the enemy and the possibility of a successful campaign. I had the inestimable advantage of early professional association with a hero-worshipper. Dr. Palmer Howard, my teacher, and for ten years at Montreal my revered colleague, was a man of keen intellectual attachment. Wide awake when the dawn appeared, he saw with remarkable clearness the immense possibilities of preventive medicine under the guidance of such men as Chadwick, Budd, Simon, Farr, Ward Richardson, Buchanan, and Russell. When not talking of Bright and Addison, Stokes and Graves, he was lauding these men, their ways, and their works. Important literary events were the arrival of Dr. Farr's Report and the Report of the Medical Officer of the Local Government Board, as they furnished ammunition for the year, and it was my privilege, if not always my pleasure, to dig out statistics of the various diseases or to abstract some special article. This, you may think somewhat irrelevant, statement is preliminary to an excursion I am about to ask you to make with me, not over unpathed waters, but through the familiar pages of the Registrar-General's Report—the just-issued volume for the year 1915. Custom has not made stale the awe experienced in the contemplation of its long rows of figures, the mystery of the position of the dots, and of such new expressions as standardised rates. And let me add a warning. No author of my acquaintance has been so uniformly unhappy as myself in dealing with statistics. And I have tried so hard! But there is scarcely a percentage in my text-book that has not been challenged, and corrected, from various sources more than once. Like Lucian, then, in introducing his 'Vera historia,' it may be well to solicit at the outset my hearers' incredulity.

The first thing to arrest attention in Sir Bernard Mallet's big Blue-book is the absence of all reference to venereal disease in the "Review of the Vital Statistics for the Year 1915," by Dr. T. H. C. Stevenson. Of 18 causes of death specially discussed, all but three belong to the infections, of which tuberculosis, pneumonia, and cancer* head the list—not a word about syphilis! For the report of 1912 Dr. Stevenson prepared a special discussion for the Royal Commission on Venereal Disease, and the difficulties of the whole subject, from the statistical standpoint, were exposed. The truth is, syphilis has been, and remains, the despair of the statistician. Trustworthy data are not forthcoming. Even in death a stigma is associated with it, and the returns are everywhere but under the special caption of the disease itself. Among the 11 causes of infant mortality during the first year syphilis is not mentioned, though on p. 22 it is twice alluded to casually—the only place in which the word occurs in the 46 pages of the review! This is no reflection on Dr. Stevenson, who works with material furnished by the profession.

Where, then, do venereal diseases appear? At p. 142 (International List No. 37) syphilis is stated to have been responsible for 1,885 deaths at all ages, and other venereal disease for 61. Not a very heavy bill, and of the 1,885 deaths, 1,162 were under a year, 1,277 under five years. Of the ten best killers among the infections (exclusive of the motley group of diarrhœal diseases of children) syphilis comes last. In order of potency they are (I give the round numbers), tuberculosis, 54,000; pneumonias, 49,000; cancer, 40,000; measles, 16,000; influenza, 10,000; whooping-cough, 8,000; diphtheria, 6,000; scarlet fever, 2,400; cerebrospinal fever 2,000.

Reduction of Typhoid Fever.

But, Mr. President, I cannot pass these dry figures without a digression. To find syphilis among the ten great infections may cause surprise, but this is nothing to the astonishment at the absence of what has been in so-called civilised countries the very David among the infections, typhoid fever—a paltry 1,400 deaths, a rate of 35 per million. For 40 years physicians everywhere have consulted these reports for the statistics of this disease as the sanitary index of the most sanitary country in the world. Where and how was this great victory won? Where do you suppose? In a Government office—of all places! At the Local Government Board—of all places! And by a group of Government officials—of all men! By Simon, and his successors. Staff work,

* I put cancer with the infections to use its mortality rates.

team-work, organised administration, have solved one of the greatest of the problems of public health.

To realise the magnitude of the victory one must have lived and moved and worked year by year in typhoid-stricken countries—helpless and hopeless without proper sanitary laws, or without the power to enforce them. To have succeeded within the memory of some who hear me in reducing the mortality of typhoid fever from between 700 and 800 per million living to the low figure 35 per million is one of the decisive battles of humanity. Conditions in this country have become so healthy that even with hundreds of thousands of recruits at the most susceptible age concentrated in camps the death-rate from typhoid disease has been the lowest in our history—and there is the added triumph of an enteric-free army in France. Inoculation has done much; but the conquest of enteric fever in this country was won by honest sanitation, carefully directed from a centre by experts, and by Government experts.

Mr. President, here, if ever, we may say with Simonides, "The State is a man's teacher," and for the benefit of the timid Ionian individualist we may add Plutarch's comment—that this lesson is only learned through many a bitter struggle and experience. The immediate purpose of this digression will appear later in my address. Let us now return to the Report.

Gonorrhœa and Race Conservation.

Content at this stage, the superficial reader will have a very erroneous idea of the position of venereal disease in the nation's life; but before going deeper into its pages let me recall a few pathological and clinical details. Among the infections gonorrhœa and syphilis stand out as the great race poisons. No other germs act in precisely the same way. The gonococcus is not a great destroyer of life; the figures given for 1915 convey the truth, only some 61 deaths. This tallies with clinical experience, as the fatal complications are very rare. But the gonococcus is the greatest known preventer of life—in fact, one of its cruel properties is to sterilise a very considerable proportion of its hosts. To realise the ravages of gonorrhœa, do not consult the Blue-books or the text-books, but study the reports of the gynæcological clinics and hospitals for diseases of women. As high as 25 per cent. of the major operations may be for gonorrhœa complications, which are among the commonest sources of chronic ill-health. Conservative estimates place the percentage of sterility in women due to gonorrhœa at 50. A large majority of these are innocent victims of infection, often innocent infection, by husbands who thought themselves free from all traces of what they regarded as a harmless indiscretion of youth, and who could have been cured under a proper system of control treatment. Then the complicating epididymitis in the male is a common cause of sterility. One recalls the dictum of Noegerrath—the founder of our modern knowledge of gonorrhœa in the female—90 per cent. sterile women have husbands who have had gonorrhœa.

From the standpoint of race conservation gonorrhœa is a disease of the very first rank, and costs the country annually thousands of lives. With 30 to 40 per cent. of all the cases of congenital blindness, with the chronic pelvic mischief in women, and with the unhappiness of sterile marriages—with these and many minor ailments scored up against it, we may say that, while not a killer, as a misery producer Neisser's coccus is king among the germs.

Syphilis.

The spirochæte of syphilis is easily the most notable among germs. A protozoon—it is the only protozoon, indeed, it is the only germ of world-wide dominion, irrespective of race or clime. From its well worked out biology, just two points suffice for our present purpose. The first, in some ways the most important single feature in its history, is the frequency of the transmission from parent to child. Congenital tuberculosis—how rare! Congenital pneumonia—unknown!—in fact, a killing transmission in the great infections is very rare. In syphilis it stands out less as a biological peculiarity than as a fact of supreme importance in the national health. The spirochæte may kill the child *in utero*, a few days after birth, or within the first two years of life, or the blighted survivor may be subject to innumerable maladies.

Stillbirths.

The stillborn are at last to be numbered. Until now they have remained the "hidden untimely births," to use the language of Job. Sir Arthur Newsholme estimates them at close upon 100,000 *

* 'Report on Child Mortality,' 1916, p. 8.

What percentage of these deaths are spirochætal we do not know. This we do know, that syphilis is perhaps the most common cause of abortion, and that in examinations which have been made in large maternity hospitals more than 25 per cent. of the stillborn have been found infected. In this stage of big figures we can afford to be liberal, so let us reject the 80, or even the 50, per cent. of some estimates, and let us put the "untimely hidden births" due to syphilis at 25 per cent. and tally them at, say, 20,000 for the year 1915.

Have we any data to justify these figures? I have looked through a great deal of literature, and was not a little pleased to find from my old hospital by far the most satisfactory information. Let me state that the obstetrical department of the Johns Hopkins Hospital was begun in a very quiet way. We put a good man in charge, Dr. Whitridge Williams, who has had first-class assistants, whole-time men, and a method of teaching which has enabled him to get a great deal of work out of his students. The result has been the output of valuable knowledge, and the collection of a body of experience which bears directly upon the question before us. Of the first 10,000 cases in the clinic there were 705 fœtal deaths—*i.e.*, from the seventh month on—7·05 per cent. In all cases the placenta was examined as well as the fœtus. "By far and away the most common etiological factor in producing death in the fœtus is syphilis," responsible for 26·4 per cent. in the series. This, too, is a low estimate, as at least 53 of the 127 macerated fœtuses were probably syphilitic, though this could not be determined microscopically. I purposely refrain from quoting the statistics, also of 10,000 cases, of the Sloan Maternity, New York, from which the syphilitic are excluded. The small but very thoroughly worked out details of 500 cases by Dr. Siemens, of Yale Medical School, give 26 per cent. An investigation is in progress in London for the Local Governmeut Board, and I am allowed to quote the figures to date, which give only 44 positive cases in 300—a much lower percentage than I have found elsewhere. A 20 per cent. estimate would, I think, be reasonable.

Infantile Mortality.

In 1915, of 800,000 children born, 90,000 died within the first year, the lowest number yet recorded. Add this heavy loss to the intra-uterine deaths, and it makes stock-raising for the human animal a very poor business? I have no time to discuss (but I may offer congratulations on) the efforts to lower this early death-rate by Mr. Broadbent, of Huddersfield, and by his colleagues in the great child-saving work they are doing for the nation. The reports on the physical welfare of mothers and children by Dr. E. W. Hope and Dr. Janet Campbell, just issued by the Carnegie United Kingdom Trust, will prove a boon and a blessing to sanitary workers.

Of what did these 90,000 children die! First let us note that about one-fifth of these died within the first week, and a fourth within the first month. Ten causes are mentioned: whooping-cough; other common infections; diarrhœa and enteritis; premature birth; congenital defects; atrophy, debility and marasmus; developmental and wasting diseases; tuberculous diseases; convulsions; bronchitis and pneumonia; and then other causes. Again, the interest in this list centres in what is not there! Shades of Fracastorius! Syphilis is not even mentioned! When I was a pathologist and physician to an infants' home, we did not have—nor did we need—Schaudinn or Wassermann or Noguchi to tell us of what 95 per cent. of infants died during the first month. Jonathan Hutchinson and Parrot, and Diday and Fournier had told us that. The Registrar-General cannot go behind his returns, but it is worthy of comment that in Dr. Stevenson's discussion on the causes of infant mortality syphilis is only mentioned twice (p. xxii), and that casually. When we turn to the total deaths from syphilis then we do get light, as among the 1,885 deaths 1,162 were under one year, 1,277 under five years, but these figures are far below the mark. Careful work is in progress to determine the number of deaths within the first year from syphilis, and we shall not be far wrong in placing the figure at between 15,000 and 20,000. Dr. Helen Y. Campbell, in charge of the Bradford Infants' Clinic, reports for 1915 34·30 per cent. with the clinical features of syphilis among the 207 deaths in 3,010 infants under one year.

Widespread Manifestations of the Spirochæte.

The second point in the biology of the spirochæte is a peculiarity it shares with many other parasites of resting dormant in the body for years. As a rule such germs, even while retaining their virulence, do little or no damage. Not so the spirochæte, whose capacity to work evil is not to be measured by years. Since Schaudinn's great discovery there is a sharper point to Sigmund's oft-repeated aphorism, "Syphilis is the worm that never dieth." *Venus impura* is a hard mistress. Venus of the long arm she should be called, as 10, 20, 30, even 40 years from the date of infection the book bills are rendered, and she wrings the uttermost farthing out of her poor victims. One plain outcome of all recent work is that the untreated or the half-treated syphilitic is a bad life. No insurance company to-day will take a man who has a Wassermann reaction. So widespread are the manifestations of the spirochæte in the body that there is truth in the paradox I was in the habit of telling my students. Study one disease, study syphilis thoroughly, and you take a knowledge of all others on the way—general medicine, nearly all surgery, and certainly all the specialities.

But I see an incredulous look on some faces, and I hear the whispered comment—'tis heard often enough! "Where is all this syphilis! It does not come my way." Yes it does. The syphilis we see but do not recognise everywhere awaits diagnosis, so protean are its manifestations. My colleague at the Johns Hopkins Hospital, Lewellys Barker, in a recent paper enumerates 19.* A good test of the importance of a disease is to take the 37 volumes of the two series of the Index Catalogue of the Surgeon-General's Library, Washington, in which is indexed practically all medical literature between 1880 and 1917. In vol. xvii of the second series issued in 1912 are 207 double-columned pages of reference, against 117 pages in vol. xiv of the first series in 1893. No other single disease except tuberculosis has so much space devoted to it.

Syphilis illustrates the truth of the axiom that "Men do not die of the diseases that afflict them." Look up and down the columns on pp. 138–167 of the Report, and except in the figures I have already given there is no reference to syphilis, and if from the 1,885 deaths you take out 1,277 before the fifth year, there is left the apparently comforting assurance of only 608 deaths among adults for the year 1915. Nothing could be more misleading.

The two-century-old conviction that syphilis was responsible for a great many internal disorders (Morgagni, 1761, and Lancisi, 1728) did not really bear fruit until the seventh and eighth decades of the last century. Fournier started the ball rolling; but it was the discussion on Erb's paper, "Syphilis and Tabes," at the 1881 London Congress that roused the profession. To the distinguished

* 'Medical News,' February 26th, 1916.

Heidelberg clinician, still more to the great syphilographer, Fournier, and to that model physician in mind and method, William R. Gowers, we owe the demonstration of the important part played by syphilis in the etiology of the chronic diseases of the nervous system. I remember the discussion as if it were yesterday, and I have re-read it with no little astonishment. And yet, as the actual demonstration of to-day was lacking, the clearest eyes saw but through a glass darkly, and we must sympathise with an opposition which was able to bring so large a body of negative evidence against the new view. The evening after the discussion an interesting incident happened at Dr. Bristowe's house. Bouchard, Erb, and one or two others talked over the subject. Bristowe, who was a waverer, emphasised the point that many physicians had locomotor ataxia who certainly had not had syphilis. Turning to me he said: "Now our mutual friend X. has surely not had it—he would have told me!" I felt sorry to have to say that I had seen our mutual friend on the continent under treatment with secondary symptoms!

The improved technique by which the spirochæte is demonstrated in the tissues and the serum reactions have opened a new chapter in our knowledge of the prevalence of the disease. The profession has read it with amazement, the sanitary authorities with bewilderment, but best of all the public is actually reading the chapter in the open.

Examination of Registrar-General's Mortality Returns.

Let us see now what the Registrar-General can tell us about the book-bills of the Cyprian. Germs show singular preferences for different parts of the body—the tubercle bacillus for the lungs and lymph glands, the *Plasmodium malariæ* for the blood, the lepra bacillus for the skin, and the *Spirochæta pallida* for the nervous system and the blood-vessels. Of the 562,000 deaths in 1915 about 58,000 were due to diseases of the nervous system. Two of these need not detain us. Locomotor ataxia and general paralysis of the insane *are* syphilis and account for 735 and 2,263 deaths respectively. Now that is as much as we can say positively about the lists on pp. 146 and 148 of the Report, but let us take the other diseases in order.

A certain number of cases of meningitis are syphilitic, but they cannot be picked out from Class C—returned as "Other forms," numbering more than one-half of the total deaths from this disease.

We may leave this out altogether. After locomotor ataxia comes "Other diseases of the spinal cord," 2,846 deaths, a larger proportion of them in the fourth to the sixth decades. Any neurologist would say that a reasonable estimate would take at least one-half of these —say, 1,500. By far the largest single cause is cerebral hæmorrhage—apoplexy—25,423, a majority of the deaths occurring after 50, beyond which age it is the privilege of any man to rupture a blood-vessel in his brain without suspicion; 3,713 of these deaths were between the ages of 25 and 50, of which 3,000 could be claimed as due to syphilis. "Softening of the brain" should long ago have gone into the limbo of unused terms with "rising of the lights," but there are 1,472 returns under that caption; who could deny us 500 of these? The "Paralyses without specified cause," 2,983 cases, is a hopeless section, but as more than two-thirds were hemiplegia we could be given at least 500. That a certain proportion of other forms of mental alienation, 1,100 deaths, were cases of G.P.I. is very probable. Judging from the studies of Leonard Finlay* and of Fraser and Watson,† epilepsy, spastic diplegias, and mental deficiency are common results of congenital syphilis. The extraordinary amount of latent neuro-syphilis in the community is well brought out by the studies of Southard and his colleagues at the Boston Psychopathic Hospital. From epilepsy, infantile convulsions, and "other diseases of the nervous system," which mount up to about 15,000, we could claim a couple of thousand at least. This gives us a total from this section of about 10,000 deaths in which syphilis is a probable cause of death.

The spirochæte attacks the vascular system in preference to all other parts, and many of the deaths noted as apoplexy and meningitis, etc., are really from blood-vessel lesions. Aneurysm, the first important internal disease to be attributed to syphilis, and the aortitis on which it depends are usually spirochætal. Between the 25th and the 55th years the cases are always spirochætal: in the young they may be embolic and in the aged atheromatous. Of the 1,141 deaths we could put down 1,000 to syphilis. There is a terrible bill opposite organic disease of the heart, 56,000 deaths. About 17,000 of these are between the ages of 30 and 55, and a majority of these are in men. Unfortuately, valvular disease and the myocardial cases are not differentiated from the others, nor the

* 'Glasgow Med. Jour.,' 1914.

† 'Journal of Mental Science,' 1913.

aortic from the mitral. For reasons to be referred to later we shall be safe in taking one third of the cases between 30 and 55—say, 5,000 at least—and we may take an equal number from the 10,000 dead of diseases of the arteries, atheroma, and aneurysm. A low estimate would put the cardio-vascular deaths due to syphilis at above 10,000.

It is unnecessary to bring in the comparatively small number contributed by other organs, the liver, lungs, larynx, kidneys. We have enough to put the grand total of the ravages of the *Spirochæta pallida* above 60,000, and to move syphilis from the tenth place in the Registrar-General's Report to which it belongs—*at the top, an easy first among the infections.* Many years ago in the 'Life and Death of Mr. Badman,' I came across Bunyan's phrase the "Captain of the Men of Death," which "caught on" in the literature. In his day it may have been true of consumption; it is so no longer; the headship in temperate climates belongs undoubtedly to syphilis.

Post-mortem EVIDENCE.

It was not without reason, some of you may now think, that I entreated my hearers' incredulity. There is a hazy uncertainty about these figures, I admit, but we shall find they are understated, not overstated. So impressed have clinicians and pathologists been with the absence of clear-cut evidence that in all parts of the world investigations are in progress dealing with the incidence of syphilis in ordinary hospital work. I cannot begin to quote all the papers, but I may refer to a few just to make you feel less incredulous about the character of my claims.

Dr. Warthin,* one of the best known of American pathologists, whose technique is only equalled by his patience and thoroughness, investigated the tissues in a series of consecutive *post-mortems* with the most scrupulous care to determine the existence of the spirochæte. One-third of the autopsies in adults showed its presence somewhere in the organs. Of these 41 cases only 11 were known to have had syphilis, 5 had active lesions in the nervous system, and 25 had shown no clinical changes suggestive of syphilis. In 36 there were syphilitic lesions in the heart (spirochætes demonstrated), 32 in the aorta, 31 in the testicles, 4 in the liver, and 6 in the adrenals. He concludes that interstitial myocarditis, aortitis, and fibrous orchitis

* 'American Journal of the Medical Sciences,' 1916.

form a triad distinctively spirochætal. The material from which this study was made represents an average intake of a hospital supplied largely from the country and from smaller towns of the State of Michigan. It would be interesting to repeat in one of the large London hospitals a similar study in 500 bodies, though the prolonged and tedious character of the work makes it almost impossible unless a special staff (after the war) could be appointed. It is the type of work that carries conviction, as the parasites are demonstrated in the lesions.

The Wassermann Reaction.

The other method of inquiry does not carry the same weight. Not that the Wassermann reaction is not a satisfactory test of the presence of syphilis, but the technique is delicate and beset with difficulties that may vitiate the results. I will only refer, then, to studies made under the control of men I know, and with as great care as possible to perfection of the technique. C. H. Browning's paper* gives many details from English and Scotch sources.

My native country has a Conservation Commission which deals with everything from babies to beavers. I do not know the circumstances under which the Commission called for a report on the prevalence of venereal diseases, but they asked the members of the staff of the new Toronto General Hospital to undertake the work, and their report just issued (January 17th, 1917) deals with all aspects of the problem. The point of interest here is that from 12 to 14 per cent. of patients admitted to the hospital show serological reactions characteristic of syphilis. In 60 per cent. of those persons the disease was not suspected. That the observations were made by Dr. Detweiler in the laboratory of Professor J. J. Mackenzie is a sufficient guarantee of the character of technique carried out.

The Brigham Hospital, Boston, is a new research hospital on the most advanced lines. Of 4,000 patients examined by Walker and Haller,† 600 had been infected—15 per cent. Here again the latent cases far outnumber the active. In Baltimore Dr. George Walker, a well-known specialist, examined 1,080 patients, 10 per cent. of whom gave the reaction. Of 327 prostitutes, 67 per cent. were infected.‡ Dr. John H. Musser, jun., reports that the examination

* 'Brit. Med. Jour.,' 1914, vol. i.

† 'Journal of American Medical Association,' 1916, 1.

‡ *Ibid.*, vol. lxxvi, 1738.

of cases at the University Hospital, Philadelphia, gave 14 per cent. with the specific reactions for syphilis.

I know there are those who look askance at the results of the Wassermann reaction, which has not, and does not claim, mathematical accuracy, and it is a test in which much depends on the personal skill and honesty of the pathologist. These figures, from sources well known to me personally, may be trusted as far as one can such slippery articles. Modern research everywhere leads to three conclusions: (1) that there is an immense body of latent syphilis in the community; (2) that a very large number of persons have not been thoroughly treated; and (3) that to the enormous groups of cerebro-spinal and cardio-vascular deaths syphilis is an all-important contributor.

Growth of Campaign against Venereal Diseases.

The discovery of the spirochæte in 1905 gave an enormous impetus to the study of syphilis, while the improved treatment announced by Ehrlich in 1910 aroused hopes that at last—with the cause known and the cure assured—we had in our hands weapons for an effective fight. The public and its incorporated activities, the State, had persistently ignored its existence. Centuries of silence had made venereal disease taboo. Press and pulpit alike ignored the unsavoury subject. I doubt if the word syphilis occurs in the index of 'The Times' until 1910, when a brief announcement of Ehrlich's discovery was made. Venereal diseases are rarely mentioned until the recent Commission, though, of course, a great deal of discussion took place upon the Contagious Diseases Acts. History repeats itself. Imperial Rome is said to have been one huge brothel, in which sexual diseases were rife, though whether syphilis was one of them we do not know. The bibliophile Jacob (Paul Lecroix, who is also Pierre Dufour of the great work on prostitution) calls attention* to the hesitancy with which the Latin writers, medical and lay, refer to the *morbus indecens*, or, indeed, to any sexual disorder. To the rapid increase of venereal disease in them he attributes the appointment of State physicians by Nero.†

* 'Recherches Historiques sur les Maladies de Venus,' Bruxelles, 1883.

† The question of the existence of syphilis in Græco-Roman times has been re-opened with the proof of the presence of the disease in Europe before the discovery of America. I have asked Mr. Warde Fowler, the well-known authority on Roman social life, what he thinks of the bibliophile Jacob's

The beginning of the twentieth century saw us in a condition of hopeless apathy. Within a decade what a changed attitude in profession and public. You, Mr. President, started the former by the issue of your six-volume 'System of Syphilis,' which has proved such a useful armoury. Dr. Johnstone report was an "eye-opener." The Royal Commission appointed in 1913 gave practical expression to a realisation of the importance of the problem by the public. Best of all, Lord Sydenham's report has not been sterile, as is so often the case with Royal Commissions. The rapidity with which it fertilised the House of Commons is unparalleled in the history of even that prolific lady. An outcome, too, of the work of the Commission was the founding in 1914 of the National Council for Combating Venereal Diseases, the primary function of which is educational. Under the wise guidance of Sir Thomas Barlow the Council has provided accurate and enlightened information to the public, and has been a rallying centre for the various professional

statement. His reply is worth quoting:—"In my judgment the question depends on the evidence of Celsus entirely; all the rest which Jacob adduces is vague and indirect, and apt to give way when you probe it. For example, he makes a great point of slave doctors kept in big establishments, who would keep unpleasant diseases secret, and so on. I have looked up the evidence about these, and there is nothing more in it than that in a few very big establishments it was convenient to have a doctor on the spot, as in a big ship. The economy of those big households or farms was self-sufficing, in this as in other ways. And it was far from universal even in large farms, for Varro expressly says that farmers preferred to use the doctors of the neighbourhood. Again, he quotes St. Augustine for the Syrian luxury that came to Rome in the second century B.C., and jumps to the conclusion that all kinds of evil diseases came with it. That may have been so, but it does not come out of Augustine's words; and I am pretty sure that if Augustine had wanted to say so he would have said it without any scruple. But, on the other hand, supposing that the passage quoted from Celsus distinctly points to syphilis or something like it, the fact that there is no mention of such things in Roman literature would not be enough to damage Celsus' evidence. What survives of Roman literature is mostly clean and in good tone, and one would not expect to find any such allusion to it. The absence of any allusion in certain poems of Catullus, and in the great passage about love at the end of the fourth book of Lucretius, might suggest that one should be careful about interpreting Celsus, but would by no means be decisive. (I have just been over the Lucretius passage, and can find no trace of allusion to a morbus; and L. was very plain-spoken in such matters.) So I think that you must go by Celsus alone. Apart from him, I should say there is no evidence of any weight, positive or negative." The difficulty with Celsus is a matter of interpretation. The lesions described are not necessarily sexual.

bodies interested in the subject. The work of the Eugenic Education Society under Major Darwin has been most helpful.

The outset of the great war has stimulated, not retarded, the plan of campaign. Since that memorable scene which shook the gods in Olympus with inextinguishable laughter Venus and Mars have been inseparable. War means an enormous increase in the number of infections. The last quoted figures for the British Army at home are ('Hansard,' April 23rd): 71,000 cases of gonorrhœa, 21,000 cases of syphilis, and 6,000 cases of soft chancre. In the Canadian Army to March 31st, 1917, there have been 18,335 cases of venereal disease—figures which have stirred public opinion in the Dominions to the boiling point.

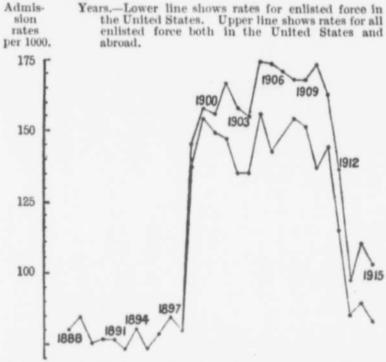
Legislative Action.

Stricter prophylaxis should reduce these figures. I have had from Col. Bradley, U.S.A., and Major Lyster, U.S.A., now stationed in England, the full details of the methods now carried out so successfully in the United States Army.

The annexed chart (p. 306) speaks for itself.

Various stimuli, public and private, have had at last the desired effect. The Government felt that opinion in the country was strong enough to act on the advice of the Commission, and hand over the venereal problem to the public health authorities represented by the Local Government Board. The most sensible single bit of evidence given to the Commission was expressed by the Hon. Miss Brodrick, a trained nurse, that we should deal with the disease "as if it were small-pox or scarlet fever, simply as a disease, quite apart from the moral side." This is what the Government has done. Recognising the existence of the disease as a great menace to public health, legislation has been enacted to fight the enemy on a settled plan at many centres under the control of the Local Government Board. It is a new departure to deal with an individual disease in this way.

What a change a single word may effect! Tuberculosis, the white plague, is really a more hopeful disease to fight than syphilis. Though it has the same strong allies, poverty and drink, there is absent the complicating problem of prostitution. The word "may" instead of "shall" in the Tuberculosis Act gave us an ineffective guerilla warfare of local bodies for a Kitchener and a general staff. The Government made no mistake this time—*shall* is the word, and all over the country the clinics are in course of formation. Nurtured upon the Reports of the Local Government Board, I dwelt with a purpose on the successful campaign which it had waged against typhoid fever. In that great warfare Sir John Simon was chief of staff, and the battle was won by able lieutenants who directed the actual fighting in various parts of the country.



1888-98.—During this decade the Army was stationed throughout the United States principally at small posts. No compulsory physical inspection; no systematic propaganda to reduce venereal disease. The rates represent practically those patients unable to do duty. Cases not treated or those doing duty were usually not recorded.
1898.—Spanish War. Militia called into service.
1898-99.—Great change in Army; marked expansion. Old soldiers disappear; volunteers come in. Young recruits sent to Cuba, Porto Rico, Philippines.
1899-1901.—Philippine Insurrection. Troops in Cuba, Porto Rico, China.
1901-09.—High rates prevail in United States and abroad.
1909-11.—Principles of preventive medicine applied; prophylaxis urged.
1911.—Syphilis increases. Wassermann test used in diagnosis.
1912.—Systematic measures. Fortnightly physical inspections and prophylaxis enforced by G.O., May 31st. Pay stopped, G.O. 31.
1914—15.—Concentration on Mexican border.

Read the story in his writings, and you will wonder how it ever could have been accomplished, against the opposition of Dogberrys inside and outside the House. Had the country listened to Sir John Simon half-a-century ago, when he advocated the "urgent need of control of the public health by a responsible Minister of State," our arrears in infant mortality and housing would not now be so heavy. Still, let us be grateful to him and his successors for all the good work that has been done.

Establishment of Venereal Clinics.

No more hopeful legislation has ever been enacted than the establishment of these venereal clinics, with which the country will be equipped, though not fully, for the battle. But let the people and their representatives realise that they are dealing with the subtlest foe of humanity and the greatest sanitary problem which confronts civilisation. A general staff, controlling the campaign, will work from the Local Government Board (or before long, let us hope, from a Ministry of Health),* with laboratory, statistical, and social service departments, a publicity bureau, and a library. The centres will be units working with a single object, and the doctors, nurses, and social workers will be members of a great national army.

Already the Commission—for it is its work—has done what the profession has not been able to do in these long years—opened the doors of the general hospitals to these victims. The governors and trustees have lined up at last with the Good Samaritan. There are many institutions in which an up-to-date scientific clinic with laboratories will be a great boon. The profession welcomes the scheme from the educational side, as there will be within easy reach opportunities for the study of all aspects of both disorders, and, from the practical side, they will be able to bring their patients freely for special treatment, for special consultation, and for the laboratory tests which are so essential. There will, I hope, be at each centre lectures and demonstrations as have been organised in Liverpool. A sympathetic and loyal feeling on the part of the practitioners in each district is really essential to the success of the work.

Between the clinical and the laboratory side there will be enough at each clinic to occupy a large part of the time of a male and female doctor, who will, I trust, become the skilled advisers of the profession and of the public in each district. It should be our business to make these positions sufficiently attractive to catch the very best, and I am sure the hospital authorities will welcome them warmly as members on the staff. In large cities they might well be whole-time positions, though I should prefer to allow their colleagues and the public to have the benefit of their ever-increasing

* The Waldorf Astor Report just issued, 'The Health of the People : a New National Policy,' should give a great stimulus to the unification of the many departments at present dealing with public health.

experience. A great missionary field will be opened for women doctors, who should do the work among their own sex at the clinics.

Education of the Public.

Nowadays, in the hospitals the individual is studied and cared for, not solely his or her disease. Social workers of the right sort, with the right spirit, the helpful sympathetic spirit which—

> "Gently scans your brother man,
> Still gentlier sister woman,"

will do much to make the clinics known and appreciated. The National Council could very well supervise this work, which should be done by carefully selected volunteers. The clinic should be the centre in each district of an active educational propaganda, which should be stimulated and planned by the general staff, and not left to the timid discretion of the local authorities. By meetings, literature, placards—in every legitimate way—a knowledge of the dangers of venereal disease should be distributed, and the importance of early and thorough treatment insisted upon. The public lavatories, the toilet-rooms of restaurants, railway stations, hotels, and factories should be utilised in a crusade against advertising venereal quacks. The stage should be used actively, and such a play as Brieux's "Damaged Goods," while strong meat for the *young*, enforces on young men the lesson of the terrible risks better than the chapters in Proverbs or than any number of leaflets.

In every possible way the sympathetic co-operation of the public is to be sought. Get people to realise that it is a great communicable disease, two-thirds of the victims of which are innocent, and much will be done to break down the present barriers of ignorance and false sentiment. For any legislation to be successful the people must be prepared. The problem bristles with difficulties, but the primary duty is to gain the confidence of the public and respect their feelings, so far as they are consistent with the welfare of the State.

Unqualified Treatment.—Notification.—Compulsory Treatment.

We are committed, then, to a campaign of education, and an elaborate scheme of treatment. Two circumstances make it probable that these measures—and a good beginning, let us grant—will not suffice in themselves to reach the enemy.

So deep is the stigma associated with the disease that patients avoid hospitals—even their family doctors—preferring quacks and others who promise a speedy cure. Legislation is in progress to prevent unauthorised treatment of the disease. The active sympathy should be sought of the 5,000 men calling themselves herbalists, referred to by Mr. Hayes Fisher in the House ('Hansard,' April 23rd, 1917). I am sure the profession has no wish to interfere seriously with a calling which ministers to a thirst for "simples" so Gargantuan. These men have families, and could be interested in public health; many of them are good botanists and of above the average intelligence. They know that syphilis and gonorrhœa are quite beyond the reach of herbs, and that even guaiacum—the holy wood—no longer avails.

To be successful in any fight the primary essential is to know where your enemy is placed. The Commission did not feel able to recommend confidential notification, nor does the new Act enforce it. Perhaps they were wise, and knew their business better than some of us who advocate it. Realising as fully as anyone the strong arguments against notification, the gravity of the situation outweighs with me all private considerations, and I feel sure that within a year we shall be ready for the change. It works well, we are told, in Scandinavian countries, and it will be interesting to have the results from those Australian dominions in which it has been introduced.

Another point really more serious is also associated with notification. Both syphilis and gonorrhœa require protracted treatment. It is the partially or badly treated cases that come to us 10 to 20 years later with aneurysm or nervous breakdown. The primary symptoms are often so slight that it is impossible to get patients to continue a course of medication lasting a year or even more. Here is where the clinics will be on trial, and we shall watch their experience anxiously. I see reports from a Boston hospital at which 28 per cent. of the patients did not return, and to a New York venereal clinic 29 per cent. of the syphilitics came but once. To be successful in this fight we must have control of the patients—the treatment must be compulsory. It is so in the Army, from which the men with syphilis and gonorrhœa are not to be allowed to return to private life until a reasonable guarantee is given in each case of cure. If the House of Commons in any way represents outside opinion, the public is a long way from appreciating the appalling risks they run. Though on the street to-day, the spirochæte may be in your home to-morrow. The very reasonable proposals of Capt. Guest, Mr. Rawlinson, and Sir H. Greenwood ('Hansard,' April 30th), that sanitary and curative measures should be adopted in the case of persons, men and women, convicted of certain definite offences, was met by cries of ruthlessness and Prussianism. The probation officers and workers of the London Diocesan Police-court Mission know what they are talking about when they urge compulsory detention and treatment. Practised with Mars, it is no sex inequality to do the same with Venus, but the Government is committed, for a time at least, to a policy of persuasion, feeling that notification and compulsory treatment are too far in advance of public opinion. Mr. John Burns ('Hansard,' April 30th) thinks that the Local Government Board has the power to deal with the question of notification. I doubt if it could enforce the treatment of syphilis any more than it does in the case of tuberculosis.

The Outlook.

To many the venereal situation looks dark and hopeless. It is not. For the first time in history the outlook is bright, despite the fact of an inevitable increase of cases during and after the war. Three things have happened to justify this hope.

The public is at least awake to the necessity of an educational campaign, in which the appalling dangers of the disease shall be brought home plainly. Other means than those heretofore must be brought to bear in a full and free enlightenment upon the subject. Such literature as Corbett-Smith's 'Problem of the Nations' and the various publications of the National Council are having an enormous influence. That the preaching of chastity appears a ghastly failure, in the face of the record of 800,000 fresh cases annually in this Christian kingdom (Melville White's estimate), is no reason why the earnest appeal for personal purity should not take the first place in the educational campaign. Where the Apostles had to confess defeat, their successors need not feel discouraged, and, had they not laboured so hard for so long, the percentage of the poxed in the community might have been doubled. The reproach is not upon Christianity, but upon earthen vessels too frail to hold it. Venereal disease has been called a bi-sexual problem. Patrol beside St. Martin's Church at this hour and you would be inclined to deny it; but remember, for the aggressive harlotage that still disgraces our streets, man is primarily responsible. The blame, but not always the burden, is upon him. The pity of it is that the strong offence's cross is borne, not always by the offender, how much soever he may sorrow, but by innocent women and children, who form more than one-half of the victims.

That the State has at last intervened is another ground for hope. In the matter of health you may trust the people. Once get democracy to realise that it is badly diseased, and it displays a Job-like regard for its skin. Has not Tammany, a very synonym for corruption, given New York City the most progressive, up-to-date system of sanitation in the world? You will have gathered, Mr. President, that I am a strong advocate of strong central control in these matters. My inspiration does not come from Hegel or his bastard modern disciples, but from the fountain-head, the great teacher who tried in vain to bring the Athenians back to "thoughts of order, to disinterestedness in their functions, to that self-concentration of soul in one's own part, that loyal concession of their proper parts to others on which such order depends."* Plato tells us "States are as the men are; they grow out of human characters." How chastened has been the strong Ionian element in British life! The war has brought to the individual a Dorian realisation of duty never before witnessed. All that a man hath, and all that he holds dearest, are drawn into a new ideal of service to the State. It will not be so hard after this schooling to accept an ever-increasing control of the disease by a Ministry of Health, with notification and compulsory treatment.

Most hopeful of all is the changed heart of the people. At last the sinner is to receive Christian treatment. Above the mantelpiece of his library hung what the founder of my old school, the Rev. W. A. Johnson (Trinity College School, near Toronto), used to call the Magna Charta of humanity. In the centre of the most dramatic scene in the Gospels stood the woman taken in adultery. About her thronged the Scribes and Pharisees, with eyes turned from her to the Christ, stooping as he wrote with his finger on the ground the watch-words of the New Dispensation—"He that is

* Pater, 'Plato and Platonism,' 1893, p. 216.

without sin among you, let him first cast a stone at her." I should like to see a copy of this picture in every one of the new clinics in testimony that we have at last reached the full meaning of the priceless message, "Neither do I condemn thee; go, sin no more."

Fighting in this spirit, the soldiers of our "New Model" will put up an irresistible barrage against the most formidable enemy of the race—an enemy entrenched behind the strongest of human passions, and the deepest of social prejudices.

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The Library School in the College

BY

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

REGIUS PROFESSOR OF MEDICINE, OXFORD; A CURATOR OF THE BODLEIAN, AND PRESIDENT OF THE BIBLIOGRAPHICAL SOCIETY

[*Reprinted from* THE LIBRARY ASSOCIATION RECORD, *Aug.-Sept.*, 1917]

ABERDEEN: THE UNIVERSITY PRESS

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"The library movement to-day is rich in possibilities both for town and country. It is always difficult to measure the influence of institutions on the well-being of the community. But it is certain that the love of literature adds greatly to the happiness of each generation, and also that the diffusion of knowledge and the direction of thought which a well-organized library system can promote deeply influence the future progress of the community. Thinking ultimately is that which moves and develops society, and we shall not have a real democracy until we have a well-educated people. With every stimulus to thought which good books bring, and with every development in the organized bodies of working men and women students, the well-being of the workers themselves is being surely and steadily secured. As the leisure of the workers increases, the opportunity for study becomes greater; and, while the more recreative literature should not be neglected, the first call should rather be to provide the best materials of study for those who are becoming the leaders of thought among their fellows."—Prof. Adams' "Report on Library Provision and Policy to the Carnegie United Kingdom Trust, 1915".

THE LIBRARY SCHOOL IN THE COLLEGE.[1]

BY SIR WILLIAM OSLER, BT., M.D., F.R.S., REGIUS PROFESSOR OF MEDICINE, OXFORD, A CURATOR OF THE BODLEIAN, AND PRESIDENT OF THE BIBLIOGRAPHICAL SOCIETY.

AT the outset of a difficult journey what a comfort to meet with one who knows the road and its perils, the land and its delights, one to whom you may turn in every difficulty, feeling sure of encouragement, a never-failing friend whose presence is a perpetual benediction. Working as you will do in that final triumph of organization and equipment, the National Library building, recall for a moment or two the beginnings of the modern library movement in those far-off days of the fourteenth century, and invoke the blessing of Richard de Bury upon our labours. "If thy presence go not with us carry us not up hence." From the start let him be your closest companion, and his "Philobiblon" the guide of your professional life, in the hope that some measure of his gracious spirit may be your portion. The hard hazard of the times wrecked the noble scheme of the great Bishop to found a library at Oxford, but his book remains the ideal library companion, and his memory is enshrined in the hearts of all true book-lovers.[2] His practical wisdom was wonderfully shown in the plan of his lending library for the scholars and masters of the University, both

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[1] An Address at the opening of the Summer School of Library Service, Aberystwyth, 31 July, 1917.

[2] The "Philobiblon" is to be had in the King's Classics Library, price 1s. 6d. Chatto & Windus.

regulars and seculars, for their advantage and use in study. One of his golden rules I should like to see enforced in every library—when a man asked the loan of any book the keepers were first carefully to consider whether they had the book in duplicate.

Before taking up the subject of my address, let me offer in a semi-official way the greetings and best wishes of the Library Association for a successful meeting. It is particularly gratifying to know that more than fifty students are in attendance, coming from all parts of the kingdom. As this is an introductory lecture a few preliminary statements are in order, and without any technical knowledge I thought it wise to consult the Director of the National Library, Mr. John Ballinger, from whose notes I have culled them.

I.

Within the last few years the work has been so organized that we may speak of a science of librarianship. The old rule-of-thumb order which each custodian of a collection of books adopted, as his own knowledge or ignorance suggested, is giving place to carefully thought-out methods of arrangement designed to make the books of greater service, and more easily accessible. The librarians of to-day, and it will be true still more of the librarians of to-morrow, are not fiery dragons interposed between the people and the books. They are useful public servants, who manage libraries in the interest of the public. The old notion of the right person to have charge of books is going, but by no means gone; the sooner it goes the better for everybody. Many think still that a great reader, or a writer of books, will make an excellent librarian. This is pure fallacy.

For the first hundred years of its existence, the British Museum was worked by men chosen for their success or partial failure as literary men. Then came a stirring time. Mr. Anthony Panizzi, an Italian refugee, was appointed to a minor post in the Museum in the year 1831, and displayed from the first such a grip of the science of administration that six years later he was appointed Keeper of Printed Books, over the head of Carey, the distinguished translator of Dante.

Already the state of affairs at the Museum was uncomfortable. The eminent, easy-going literary men, and others selected for all sorts of reasons other than administrative ability, were in a state of ferment. Panizzi had a bad time, but he stood his ground, and prevailed. Posts were given to young men, mainly from the Universities, chosen by examination, and so trained that the work of the Museum was gradually done by experts. The real greatness of the library began with Panizzi. When he was appointed Keeper the printed books numbered about 165,000, after one hundred years of existence. Think of what has happened since! In about seventy further years the collection of printed books exceeds two millions. Not only the British Museum but your craft at large owes much to Panizzi. He was a librarian in the best sense of the word, and received his reward in promotion to the Principal Librarianship, which he filled for nearly twenty years—much loved and much hated. Often described as tyrannical, he certainly was masterful, but he was most liked by the best men among his subordinates—and they included at least three who succeeded to the chief office, and also Dr. Garnett, who went into the Museum on the selection of Panizzi.

Between the years 1855, roughly, and the present, there has grown up in Britain and America libraries of a type altogether different from anything existing before—the libraries of the people, public libraries, sometimes mis-called free libraries, brought into existence by the will of the people, maintained by funds derived from the rates. These libraries are firmly established as a factor in promoting education and culture, besides serving many other useful purposes. They are in many places highly organized contributors to the general welfare, but their potential place in the scheme of things intellectual has not been grasped as yet in Britain. Perhaps it is because too much has been done for the people, who have not in this matter worked out their own salvation. Mr. Carnegie and his Trust have spent on library buildings in the United Kingdom more than two millions sterling. In America the function of the public library is better understood than it is here. Why is this?

Britain was first in the field with this, as with so many other movements. Somehow we seem to have been content to jog along, leaving things to chance, or to the small number of eager understanding people who have concerned themselves with the movement.

Associations of people interested in the work have been formed, one in this country, the other in America, and working together they have done a vast amount for the improvement of library administration, though only the fringes, as it were, have been dealt with.

America has gone further than we in the matter of technical training. Library schools have been in operation for many years, and their graduates in large numbers have found employment. In this country the Library Association has laboured with praiseworthy zeal to set up standards of proficiency, to establish classes for instruction, and to test by means of examinations the qualifications of candidates.

What encouragement have they received from those who have in their hands the government of libraries? Not many years ago our schools were officered by teachers very slenderly equipped, and the impression still prevails that no particular qualifications are required for the organization and administration of a library.

Let us consider for a few minutes how the matter stands, taking the prospectus of this Summer School as a basis. Eight branches of study are there indicated as necessary for librarians, who should possess, in addition, a good education and a healthy constitution.

Let us glance for a moment at the subjects. What librarian or assistant can hope to deal with books without a good knowledge of literary history, not merely of his own but of other countries? There is a story of a man who styled himself "Chief Librarian" (his staff was a boy of 16), who was asked at the library counter by the Editor of one of the local newspapers whether there was a copy of the "Morte D'Arthur" available. To the pressman's profound astonishment the "Chief Librarian" replied that the library did not keep French books. "Oh! thank you," said the pressman, "good day." There are many similar stories.

But this one happens to be true. And it has never been told until now. It may serve to show the importance of some knowledge of literature even to a "Chief Librarian" with one junior for his staff.

Bibliography, next in order, is sub-divided by the Library Association into Historical Bibliography, Practical Bibliography, and Book Selection. How many people would be able to pass even an elementary test in either of the first two sub-divisions, or even to define them. Many cataloguers (of sorts) describe themselves as bibliographers, thereby displaying their ignorance of terms, and of the whole subject.

Bibliography deals with the history of printing, the evolution of the printed book from the manuscripts, paper, bookbinding, book illustration, authors, publishers, booksellers, the collation and description of books, the various methods of book production ; while book selection is concerned with the type of books suitable to the needs of the people who are to use the library. To do this efficiently requires wide knowledge of books of reference—bibliographies—practical experience, and sound judgment. For a clear statement of the many problems relating to the subject, the little work of the late Prof. John Ferguson, "Some Aspects of Bibliography," 1900, will be found most helpful.

Next in order is Classification, the application of which to collections of books is comparatively recent, and the outcome of modern experience. By it the library is made an organized instrument of service, like a well-trained and disciplined army. For just as hundreds of thousands or even millions of men without proper organization form a mere mob, so a library without classification is nothing more than a mob of books. Catalogues lessen the confusion, but every catalogue is out of date as soon as it appears, and the reader becomes dependent upon his own and the librarians' memory for the latest books on his subject. With classification, however, this difficulty disappears. The books are sorted to their proper place as they come in. If one wishes to study "Cancer," for example, or "Poultry-keeping," or any other subject, a properly classified library would be of infinitely greater help than any catalogue, and more expeditious, because all the books wanted would lie next each other on the shelves.

Classification is making its way in the libraries of this old country—slowly, but it must come, and those who are to take part in the administration of libraries as their life-work will do well to recognize this fact, and equip themselves. In America, where the scrapping of obsolete methods is more general, and more promptly adopted, no library of any size ignores classification. What is more, the libraries which in past years adopted methods which no longer hold front rank, are changing over to better systems. Even small libraries should be classified, they will grow, and if started on right lines valuable time and labour will be saved.

The Library of Congress started reorganization some years ago, a heroic thing to undertake with such large collections, and the re-classification has occupied a special staff for over seventeen years. It is now approaching completion, and incidentally has produced the soundest and most practical scheme of classification yet given to the world, known as the Library of Congress Classification. Most of the American libraries are using it. On this side the National Library of Wales is the only library to adopt it up to the present.

Following the subjects in the order of the Syllabus of the Library Association we come to Cataloguing, an important branch of the work, but not, as many people suppose, the most important. The widely prevalent idea that library work is made up of cataloguing and that beyond compiling catalogues the staff is mainly engaged in reading and writing books is very wide of the truth. Valuable as is a catalogue it can be of little use unless the books have first been arranged in an order which will enable them to be found when called for, and returned to their places when done with. The classifier in fact must precede the cataloguer, or the labour will be wasted.

One could discourse for a month, or longer, on catalogues without exhausting the subject. Every man and woman of average ability thinks he or she can make a catalogue—and they may be right. But the question is as to the value of the catalogue when it is made. There must be rules, as for all other things worth the doing. The British Museum rules, drawn up by Panizzi, were far in advance of anything existing at the time. These in turn have been added to, amended, and otherwise revised, until the Anglo-American code of rules came into being a few years ago. Even this code is not final. But it is adequate for most purposes, and if generally followed would result in a much better type of catalogue.

About one point in cataloguing much has been written (and in the United States some action has been taken), and it calls urgently for attention. It is absurd that valuable time, which might be given to other pressing work, is daily devoted by hundreds of librarians to cataloguing the same books. All this unnecessary labour could be saved by the adoption of a system of co-operative cataloguing. If one library would undertake to catalogue and print cards for all books as they appear, then the others could be supplied with printed cards for such books as they add, with an immense saving of time and money. Each library would add to the cards the shelf numbers of the books, and the printed cards could at once be inserted in the card catalogue.

There are six libraries in the United Kingdom entitled to a copy of every book issued. Three are connected with Universities, Oxford, Cambridge, and Dublin, one is the Library of the Faculty of Advocates at Edinburgh, and two, the British Museum and the National Library of Wales, are public libraries maintained by State funds. One of the two last named might very well be called upon to take up this important work, the expenses being met by an increased grant from the public funds. This question has an important bearing upon our scheme of studies. By performing the functions of a practising school, a system of co-operative cataloguing would give splendid opportunities for the training of cataloguers. There would be many advantages resulting from such a scheme. It would take too much time to enumerate them all. One, however, is worth mentioning. It would enable the public to obtain reliable information from a full catalogue entry, on a *printed* card, easy to read, free from slips in copying; all entries would be in full, because the cards for subject entries and cross-references would all be the same, with the addition of the subject at the head of the card.

This method has been in operation in the United States for several years. The cards are prepared, printed, and distributed at cost price, plus 10 per cent, by the Library of Congress. One card costs two cents, further cards of the same book are supplied at about one half cent each card. Five cards of the same book cost about twopence. Why should this country continue to waste valuable time, when by co-operation so much time and expense can be saved?

At this point we take leave of the Syllabus of the Library Association, and come to two branches of a librarian's equipment which have been rather neglected in this country. On the Continent the Archivist is an important personage. He is going to be important here. We welcome therefore the addition of Archives as a subject for study in this Summer School, and congratulate the authorities upon securing one of the most expert of living Archivists as the Instructor. The name of Mr. Hubert Hall is known to all of you. I am glad to hear that the entries for his course of instruction are satisfactory. It is a great opportunity of getting an insight into the methods of record preservation and classification. The course of instruction in bookbinding will be a useful auxiliary to the study of Archives, as in addition to bookbinding in its usual forms, instruction and demonstrations will be given in cleaning, repairing, and preserving documents, rare books and valuable manuscripts.

II.

It is not a little strange, it is indeed a singular anomaly, that our universities, whose chief function is to train men to influence others, do little or nothing directly for the education of those great teachers of the nation, the masters of the elementary schools, and the purveyors of knowledge called librarians. Not 5 per cent of these teachers in England and Wales are college-bred. Perhaps when salaries are raised to a living level, and the training colleges for teachers are made part and parcel of the college system, we may reach the realization of the dreams of Erasmus and Colet.[1] But the question to-day for us is the personal one—the training of librarians, for which purpose this Summer School has been opened.

A collection of books is, as Carlyle says, a university, and a custodian of books is necessarily a teacher. Post-graduate education is largely in the hands of libraries. Take in illustration my own experience of the past ten days. In a complicated and unusual type of war-shock case, about which I asked my own books in vain, the answer was easily found in the Royal Society of Medicine Library. About a Cambridge University medical diploma, 1683, I bothered my teachers at Bodley, at Cambridge, and at the British Museum. An early, possibly unknown, edition of the "Malade Imaginaire" led me far afield beyond the Taylorian Institution. The British Museum and Bodley are themselves Universities as great as Oxford and Cambridge. The London Library possibly helps the education of more people than London University.

Vocational training is not the chief business of a college which should offer the broad foundations of a liberal education, partly through the personality of the teacher and the moulding association of comrades, and partly by the influence on growing minds of the great minds of the past of whose thoughts the book is the transmitter. The two processes are supplemental, and it is the function of the college to see that the human and literary sides of the training are developed equally. Deep versed in books, the student may become a shallow-pated pedant unless there has been that testing of the facts of life that comes only to those whose delight is with the sons of men. How true it is that instruction may be the least part of education, and the ideal of the college must ever be the Academy and the Lyceum where the masters and the pupils form happy bands in which all are teachers and all are taught.

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[1] "Erasmus also thought boys carried from School, as from their first Vessel, that Savour or Tincture of Good and Evil that prevailed in all their following Course of Life and gave them the Right or Wrong Bent and Turn, to be wise and useful in their Generation or to be a Sort of Rakes and Reprobates for ever." —"Life of John Colet," by Samuel Knight, 1724, p. 178.

In many ways with proper direction and example, youth is its own best teacher, and the mutual clash of bright minds may be of more value than any syllabus. How well in "In Memoriam" does Tennyson describe those precious extra academic hours in which

> We glanced from theme to theme,
> Discussed the books to love or hate,
> Or touched the changes of the state,
> Or threaded some Socratic dream.

The problem before us may be stated simply, and the solution is not, I believe, difficult. The library is everywhere becoming one of the great factors in our educational system, and the director is perforce a teacher of wide and critical influence. How shall he be trained so as best to utilize his opportunities for the public good? No man in the community requires a more comprehensive and thorough education. All knowledge is his province. A common tap for the waters of wisdom, he should not perhaps know everything, but he should know where everything may be found. The parson, the doctor, the lawyer, the engineer, the farmer, the worker in every craft should be able to go to him with full assurance that he will be able to help. The Apocalyptic literature, the recent theories of immunity, the law of war claims, submarine engineering, the chemistry of dyes, the metallurgy of nickel steel, the story of aviation, the laws of trajectories should be as familiar to him as the "best sellers" among the novels or the most popular of the war poets. He is the badly salaried intellect of the community, and if fortunate enough to be able to suffer fools gladly he leads a life of surprising usefulness. And let us not forget other important qualifications—an ability to manage a business as complicated as a department shop, and a knowledge of men and a gift of manners that will enable him to drive his Committee or Council without strain on bit or rein. As Mr. Tedder remarked in a recent address, "The Librarian in Relation to Books," "The model librarian must be two-sided—at once a man of business, and a man of learning and reflection". With the missionary spirit and an absorbing interest in his work the librarian may be one of the happiest of men. But, oh the difference, should he be a grouchy old churl, whose chief aim is to stand sentry over the shelves, and keep the public at bay. A more deservedly unhappy man does not exist than the librarian who regards the reader as an intruder. One of the best stories in that best of literary hoaxes, "The Old Librarian's Almanack" (Elm Tree Press, Woodstock, Vermont, 1909) is of Timothy Mason who "in charge of a Publick Library, was one day reading diligently when a Member of the Library entered, and presenting the Subscription Ticket begged the librarian to fetch him a certain Book. Master Timothy, being incens'd at this Interruption of his Reading, and Chancing at that Moment to see the Constable passing the Library, did put out his Head from the Window and Bawl loudly for the Constable to come in. When the latter had enter'd he gave the Member into the custody of the Officer, preferring against him a charge of Disturbance of the Peace." Through the creation of the fancy of Edmund Lester Pearson, Jared Bean, the old librarian, displays as much quaint wisdom as if he really had been Curator of the Connecticut Society of Antiquaries in the middle of the eighteenth century. The days are long past in which people tolerate rudeness in their keepers of books. Nor, however attractive, is the recluse student-librarian of the Magliabechi type any longer possible (see D'Israeli, "Curiosities of Literature"). He must be a man of the world and a man of affairs with a cordial, sympathetic manner, native or assumed. It is said that Bodley owes the gift of one of its most magnificent collections to the genial reception by Dr. Bandinel of Francis Douce, when visiting the library with D'Israeli in 1830. A frigid afternoon with a dyspeptic curator lost to a library I am interested in a priceless collection of Americana.

There are more than eight hundred public, i.e. rate-supported, libraries in the United Kingdom and probably another two hundred belonging to colleges, institutions, and societies. It would not be far wrong to put the personnel at more than three thousand, certainly a large and important constituency, worthy of careful cultivation by all interested in education.

We may expect a rapid extension of library work within the next ten years. In addition to the big collections there are in this country more than 100 small local libraries chiefly in South Wales and Monmouthshire, and these will grow on the lines laid down by the founder of public libraries, that remarkable man, Dr. Thomas Bray (1656-1730). The Bibliotheca Parochialis, as he termed it, is receiving the attention of the Carnegie United Kingdom Trust, and I commend to your attention this section of Professor Adams' Report (pp. 15-17). From his concluding remarks you may realize how important the movement is in this direction :—

"In these experimental areas there would be : (1) A central library, from which the books are distributed at regular intervals, and from which also there should be supervision of the whole area. (2) Village libraries, usually placed in the school, with the schoolmaster as librarian. This local library should consist of (*a*) a permanent collection of certain important reference books and standard works; (*b*) a circulating library which would be exchanged each three months, or at such times as may be arranged. Such library facilities would bring a new power and influence into the hands of the teacher in the rural community, and, with the education authorities sympathetic to the movement, there may swiftly be spread through the whole country a public library service the effects of which for good it would be hard to over-estimate."

You may gather, too, from this Report the amounts paid in salaries, not I am afraid very encouraging figures. The fact is that a liberal profession is miserably underpaid. I wish the Carnegie Trust had made well-salaried brains as strong a condition of grants as well-mortared bricks. A direct effect of this parsimony is seen in the scarcity of the college-bred on the staffs of the libraries. An attractive occupation is neglected by the very people best fitted by education to undertake it. In the past twenty years professional certificates have been issued by the Library Association to about 650 candidates, not half a dozen of whom are college graduates. One hundred years ago the medical profession was trained very largely on the apprenticeship plan—four years with a general practitioner and then for a year the student "walked the Hospital". This is very much the method in your profession to-day. The technique is picked up in the daily round and then a certain number of the better students follow the classes of the Library Association, or come, as you have done, to a Summer School. The condition confronting us is that between two and three thousand persons, actively engaged on all-important work, are in backwaters, and not in the broad stream of educational life. This is bad for them, bad for the libraries, and worse for the public. Nor can the colleges afford to neglect the cultivation of so important a field of influence. I have already admitted that the main business of the college is not vocational but cultural, not final but initiative—the liberal education in the old sense, from which we cannot afford to depart. We have departed from high standards, as even at Oxford and Cambridge men may enter at once upon special studies, and take the college degree in subjects which are purely vocational—a grievous mistake, I believe, so far as the three so-called learned professions are concerned. Technical training with a view to immediate utility should follow in the special schools of the University, medical, theological, legal, etc. It is a farce to say that a man is getting a liberal education who enters at once upon the study of chemistry, physics, and biology, or who takes up theological work the term after matriculation. Possibly with historical and literary accessories and with modern languages a technological training may be made a liberal one, in which the student will get a wide outlook, and the all-essential Platonic conviction of education as a life-long process.

III.

I should like to see added to the schools of at least one University in each division of the Kingdom a *School of the Book*, in all its relations, historical, technical, and commercial —every aspect of bibliography, every detail of typography, every possible side of bibliopoly. And the Press should be included, as the daily paper is nothing but a glorified broadside. The opportunities exist: as the great library furnishes a laboratory, the college with the library staff supervise the courses, and a University Press subserves the typographical side of the training.

Prof. Adams says: "It is very desirable that the higher training in librarianship should be associated with University institutions, and that the best single centre for such work is in London, though it is also worthy of the consideration of the Trustees whether higher courses in librarianship could be arranged in other important centres, such as Manchester or Liverpool, Glasgow or Edinburgh, Cardiff and Dublin" ("Report," p. 23). A school started in Wales should be in connexion with the National Library, which is its natural home. A London school in association with the British Museum and the University would minister to the needs not only of England but in special studies could become a great centre for all parts of the Empire. A Scotch and an Irish school would have their own distinctive features. Certainly in no better way could the Carnegie Trustees further the higher interests of the profession than by subsidizing such schools in grants for teachers and in scholarships for pupils. The Library Association and the London School of Economics, which at present supervise the work, would welcome the extension of plans to which they have devoted much time and money.

A library school was first started in connexion with Columbia College, New York, by Dewey, a great name in your ranks, and in the thirty years that have passed scores of schools have been established, some with only short courses as the present one, others are training classes in big libraries, but many are schools in the true sense of the term—a post-graduate course extending over two years which leads to a special degree. Henry R. Evans, in a "Report on Library Instruction in American Universities, Colleges, and Normal Schools, 1914," states that ninety-one colleges have courses more or less adequate and complete. The development of the work in some of these schools is remarkable. The catalogue of one before me shows nineteen teachers, eleven of whom are members of the college staff. The school offers to freshmen and to others a course on the use of the library, and of the ordinary reference books. Even a preparatory college curriculum is laid down for those who wish to devote themselves to library work—modern languages, Latin, mediæval history, etc. Special students with large experience are admitted to advanced standing, and any senior student may elect to take any course for which he is prepared. The curriculum is very much the same as that laid down by the Association. In the vacation members of the school are expected to do work in public libraries, and during the course visits are made to binderies, bookshops, and printing houses.

Can the market be forced in this country? Is it worth while to establish such schools when positions are not open which make it worth while to encourage good students. There are thirty-nine public libraries in Wales and Monmouthshire, with a personnel of about 114. In addition there are 113 workmen's libraries and the libraries of the National Colleges and the denominational schools. Of the 44 in Prof. Adams' Report, in which returns are given in 31, the total expenditure for salaries and wages is under £100. This does not look a very promising market in which to ask a man to invest the intellectual savings of four or five years' work. For a time at least, the Summer School may have to meet the demand. On the other hand, there are plenty of good billets, outside the Principality, and the Celt combines migratory with predatory instincts. A combined effort in each section of the Kingdom, would, I believe, be successful, and the movement would grow. In America the Library School has been a great boon, and has been the means of furnishing highly trained men and women who have, within my knowledge, completely changed the atmosphere of the libraries. I have seen the Surgeon-Generals' Library, the College of Physicians, Philadelphia, the Boston Medical Library, the McGill Medical Library, to mention only those in which I have been personally interested, grow from small beginnings to collections of national importance. The most striking bibliographical contrast in my own collection is the tiny octavo of 32 pages, the first catalogue, 1865, of the Surgeon-Generals' Library, Washington, alongside of the 36 folio volumes of the first and second series just completed. The stimulus of trained specialists has been a potent factor in this development. Even in the technical collections the assistants are chosen from graduates of the Library Schools, and they are usually women. A substantial financial uplift in salaries and the making of graduation from a Library School an essential qualification, would change the status of the profession and ensure the success of a movement for higher education.

Over the portals of a modern University is the "Homo sum" motto of Terence, as from ice cream[1] to aviation there should be nothing foreign to its comprehensive purpose. More than ten years ago I was asked by a friend to draw up a scheme of instruction in which everything relating to every possible side of the book would be represented—authors, makers, users, distributors, and conservators. The conception of the University Library and the University Press as technical laboratories had not yet, he said, touched the academic mind. Nothing came of our consultations. To-day the outlook is more favourable, and I have unearthed the scheme. Without hampering traditions it should be possible here to build up a great school of the book. You have not yet a University Press, but one could easily grow out of the present establishment at the Library, the work from which both in printing and binding is of a very high order. Modified to meet local conditions the scheme of the National School would be as follows:—

I. ORGANIZATION.—Control jointly by a Committee representing the Library, the Press, the University, and the Colleges.

II. STAFF.—(*a*) *Permanent.* The heads of the Library and of the Press, and the assistants in special departments, who would supervise the technical work.

(*b*) Lecturers on library economics, history, bibliography, publishing, binding, etc., chosen partly from the library, partly from the college staffs.

(*c*) Special lecturers from outside, as you have arranged for this Summer School. Publishers, manufacturers,

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[1] In the calendar of a progressive American University I see courses advertised on this Apician subject!

printers, and inventors would be asked to give special lectures.

III. Students.—(*a*) Ordinary undergraduates, who would be given instruction in (i) the use of the library; (ii) the elements of bibliography; (iii) palæography.

(*b*) Special students: (i) in library work; (ii) in newspaper work, printing, publishing, binding, and illustrating.

The school in these departments would offer practical training quite as important as in other technical subjects. For a time at least the courses in library economics may have to be given in a Summer School, but to fit men for the higher library posts we should look forward to an advanced course of two years' post-graduate work.

(*c*) Research students. One of the chief functions of the school would be to train men and women in methods of literary and historical research. Tutorial classes and private instruction should be offered in all departments. The National Library with its unique collections should become the Mecca for Celtic students from all parts of the world for whom skilled assistance should be provided by the best scholars.

IV. The Public.—The classes in bibliography should be open. Anyone desiring special instruction in any matter relating to a book, from the preparation of manuscripts to the designing of a book cover, should be able to find it at the school. In the great working centres of South Wales extension classes would be held for working men dealing with the book as a tool of the mind.

And in connexion with the Press there would be organized a typographical museum in which would be displayed by models, etc., everything relating to the art of printing—a place in which the historical evolution could be studied from the Chinese movable type to the latest linotype machine.

IV.

A School of the Book would prove an active ferment in the departments of literature and history. A few " Professors of books," to use Emerson's phrase, would introduce bibliography into the curriculum in a practical way. Take Milton, for example. The booklet with "Lycidas"—what a story in its few pages, and how it completes the fascination of the poem to know the circumstances under which it was written! Only a few libraries possess the 1638 edition, but in an enterprising seminar, one member would get a photograph of the title page, another would write an essay on these college collections, so common in the seventeenth century, a third would discourse on Milton's life at Christ's College, while a fourth would reconstruct the story of Edward King. The 1645 edition of the Poems, with Milton's famous joke beneath the ugly reproduction of his good-looking youthful face, would take a term, while the Paradise poems and the prose writings considered bio-bibliographically would occupy a session. How delightful to deal with Erasmus in the same way! how helpful to the senior students! how stimulating to the teacher! Think of the virtue that would permeate a classroom if the teacher held up a first edition of the "Praise of Folly," and then threw on the screen Holbein's illustrative pictures. The man cannot be separated from his books—both must be taken together to estimate properly his position and his influence. A term could be spent with Sir Thomas More and his books, and the student would take on the way much of the helpful history of the Reformation. The great advantage of combined biological and bibliographical concentration is seen in the awakening of a vital and enduring interest in which alone is the taste for good literature encouraged. The dry formal lecture rarely touches the heart, but in the conversational method of the seminar, or on the quiet evening at home with a select group and a few good editions of a favourite author the enthusiasm of the teacher becomes contagious. How different would be the attitude of mind of the average student towards the "Essay on the Human Understanding" if the splendid story of Locke's life served as an introduction. The man and the book must go together, sometimes indeed, as is the case with Montaigne, the man is the book, and the book the man! Take the Founder and Father of your art, Conrad Gesner, "felicis memoriae". A study of the bibliography of his writings would carry the student through the whole range of literature and science to the middle of the sixteenth century. Even to handle the "Bibliotheca Universalis" is an inspiration! Wonderful man! with that rare gift of friendship, which mocks at death and the passage of time. To know his books is to love the man, and every true student mourns him to-day as tenderly as did Caius at Cambridge his "mors inopinata"! Some years ago I pasted on the fly-leaf of my copy of the "Bibliotheca" the following account—I know not from whom:—

"Conrad Gesner, who kept open house there for all learned men who came into his neighbourhood. Gesner was not only the best naturalist among the scholars of his day, but of all men of that century he was the pattern man of letters. He was faultless in private life, assiduous in study, diligent in maintaining correspondence and good-will with learned men in all countries, hospitable—though his means were small—to every scholar that came into Zurich. Prompt to serve all, he was an editor of other men's volumes, a writer of prefaces for friends, a suggestor to young writers of books on which they might engage themselves, and a great helper to them in the progress of their work. But still, while finding time for services to other men, he could produce as much out of his own study as though he had no part in the life beyond its walls." [1]

To come to modern times—who will attempt to interpret Shelley without a consideration of his bibliography? A sympathetic lecture on the vicissitudes of "Queen Mab," 1813, would unlock the heart of the young reformer.

The dryness is not in the subject, but in the authors of our bibliographies. Do you wish a model? Read a "Bibliography of Samuel Johnson," by William Prideaux Courtney, which we have recently issued from the Clarendon Press. It is really the literary life of the great lexicographer, and makes a fine supplement to Boswell. And in the department of medicine we too have a model—the Two-letter Bibliography of James Atkinson, a Surgeon of York, who finished

[1] If any reader knows the source of this, please let me know.

the letters A and B, and then time and money failed; but he has left us the only medical bibliography without a dry page.

And there is another side of the work of the School of the Book. The times we live in offer small encouragement to a belief in the accuracy of any human record. We are back in the days of Lucian's "Liar" when the "delight of romancing themselves is only equalled by the earnest attention with which they receive other people's efforts in the same direction". The tongue has always been suspect, but now who will glean truth from the written record? It is not merely the congenital Cretans who are always with us, but the written statements of a cloud of witnesses are hopelessly at variance in regard to the simplest of facts. To make the best of these frail earthen vessels we must train historians and biographers in the critical study of original documents. This is the other great function of the School—to teach scholars how to study and interpret the rich stores of documents in our public and private collections. Of the training of Archivists you will hear from Mr. Hall. When, as we may hope, library schools are organized, opportunities will be offered to students on the same wide and liberal lines as the "École des Chartes" of Paris, whose students have been well named the modern Benedictines. It is not a matter of training men for library work, but as stated on the original foundation of the "École des Chartes," "Le but de l'institution est de former des érudits". While there would be pupils whose object was to make a profession of the care and study of archives, a majority, let us hope, would be learning how to do spade work in the sources of history and literature. What a revelation are the publications of the Record Office and of the Historical Manuscripts Commission! And so many rich veins remain unworked! What a different view we have of Shakespeare's business and dramatic personality since Prof. Wallace's spade work at the Record Office. Pupils of the "École des Chartes" have made Rabelais live again in the ten volumes of "Le Revue des Études Rabelaisiennes". It is astonishing that so many documents of the first importance should have remained unstudied. In my own country, Canada, a revoultion has been effected in our knowledge of its history by the studies of Dr. Doughty and his colleagues, made possible primarily by the housing and classification of an immense bulk of documents. By enlisting the services of special students the material at Ottawa, at the Record Office, London, and in Paris, has been at least partly sifted. The change of Ezekiel has come over the dry bones of Canadian history. No student of federalism to-day can afford to neglect the practical lessons taught in the gradual development of Canadian constitutional history.

A final word from one student to another. Your business is that of purveyors, universal providers of the mental food of the public; and not only are you caterers but you will often be called upon to do the work of cooks and doctors. The majority of mankind, as Burke says, providence has doomed to live on trust, a trust less in you, I fear, than in the ephemeral literature of the day. It is not often that one has a vivid, enduring impression of a newspaper article; but one day in October, 1872, in a Tottenham Court Road tea-shop, I read in "The Times" a statement of Ruskin to the effect that no mind could resist for a year the dulling influence of the daily paper. Doubtless as an exclusive dietary the press and the magazine do lead to mental conditions the counterpart of what we know in the body as the deficiency diseases, scurvy, rickets, etc. The library through you supplies the vitamines which counteract the mental lethargy and anæmia which come from too exclusive use of Northcliffe and other patent foods. You have a great opportunity—see that you rise to it. For most of you, I fear, the college course is not open, but for all of you there is the open door of self-education. The magic personality of the teacher, the stimulus of comrades, you may miss; but in compensation you may get closer to the moulding influences of the great minds of the race. We no longer lay our disposition to the charge of a star—a man is his own star. Strive for mental accuracy and independence, cultivate the critical investigating faculty, keeping at the same time your mouth shut. Get your minds into touch with such magnetizers as Plato and Plutarch and Montaigne. In a profession demanding an amazing measure of equanimity, you cannot afford either to fight or to fret.

Too genuinely interested in your fellow-creatures to be vexed with their vagaries, you will find the highest happiness in life to be an unselfish devotion to their interests. "I am among you as one that serveth," is the motto to-day of the sensible man who wishes to escape from the mental and moral worries of this much-perplexed world, and I give it as a prescription specially suited to the librarian. The outlook for your profession is bright, and you may help to make it brighter here in Wales by encouraging in every way the improvement of the conditions under which you work. One thing I should dearly like to see—an up-to-date *School of the Book* in connexion with the National Library and this College; and if anything I have said here hastens its establishment I will feel in Lucian's words "that I shall have had a share in its building if not in the dedicatory inscription; my finger-tips will at least have touched their wet mortar".

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ESSAI DE BIBLIOGRAPHIE HIPPIQUE

BY

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ESSAI DE BIBLIOGRAPHIE HIPPIQUE.

Donnant la description détailée des ouvrages publiés ou traduits en Latin et en Français sur le Cheval et la Cavalerie, avec de nombreuses biographies d'auteurs hippiques ; par le Général Mennessier de la Lance, ancien Commandant de la 3[e] division de cavalerie. Tome Premier A à K, Paris, 1915 ; Tome Second L à Z et supplément, Paris, 1917, Lucien Dorbon.

NOT naturally dry, bibliography is too often made so by faulty treatment. What more arid than long lists of titles, as dreary as the genealogies of the Old Testament, or as the catalogue of the ships in Homer ! What more fascinating, on the other hand, than the story of the book as part of the life of the man who wrote it—the bio-bibliography ! Such, for example, is the recent bibliography of Samuel Johnson, issued by the Oxford Press, from the pen of that master of the subject, the late William Prideaux Courtnay, which shows us, even better than does Boswell, the working ways of the great lexicographer. To be of value to the full-fed student of to-day a bibliography should be a *Catalogue raisonné*, with judicious remarks and explanations. In our great libraries this is impossible from lack of space, but the plan is followed with great advantage in the special bibliographies, of which the work before us is a model of its kind. Volume II., which has just appeared, completes this important contribution to the literature of the horse—for works in Latin and in French. We may congratulate the veteran general on finishing a task that has occupied his leisure for fifteen years. As it is a bio-bibliography, we turned at once to the author's name, opposite which is only one small report on a Cavalry Conference in 1892, to find that he was born in 1835, made Sub-Lieutenant in 1856, Colonel in 1881, General of Division in 1895, member of the Committee on Cavalry, and put in the reserve, in 1900. Then follows the briefest possible summary of what must have been a life full of action—nine campaigns in Algiers, the war of 1870, and a campaign in Tunis! Forty-six years of active service left him still deeply interested in the Army and, as he says, in the brave animal on whose back he had travelled so many thousands of miles. He decided to occupy his leisure in a study of the literature of the horse and of cavalry, in Latin and French, from the beginning of printing.

The subject-index in each volume gives an idea of the scope of the work: I quote only a few of the more important headings—Sales, Feeding, Archæology, Cavalry, Cavalcades, the History of the various Cavalry Regiments, Equitation, Training, Horse Shows, Breeds and Breeding, Stud-books, Remounts, Hippologie, Hippophagie, Hygiene, Jurisprudence, Veterinary Medicine, Palæontology, Horse-posts, Protection and Compassion, and Iconographie.

A book-lover likes to put a new bibliography to the test, so I took from my shelves the famous *Veterinariæ Medicinæ*, Libri II. of Ruellius ("hippiatre et Médecin français"), 1530, to find an admirable description of this collection of Greek fragments translated by order of Francis I.; and then the *Hippiatrique* (Ἱππιατρικα), in Greek, Basle, 1537, of which there is a much better account than I can find in any of my bibliographies, with a statement of the various other editions in French, Italian, Spanish, and German. The older authors in veterinary medicine are very fully described, and for purposes of bibliographical reference this part of the work will be indispensable. To mention a few of the more important: Comte Basta, 1550-1622; Beaugrand, whose *Mareschal Expert* (1619) held its own in France in scores of editions for 200 years, though, as our author says, a monument of ignorance, barbarism, and superstition; the *Hierozicon* of Samuel Bochart (1663), a learned Protestant minister, who disputed for nine days consecutively at Caen with a Jesuit; Bonacossa (1564); Boulengerus (1598); Camerarius, whose *Symbols and Emblems of Animals* appeared in 1595; Choul, the writer on ancient cavalry (1555); Crescentius, the thirteenth-century author on *Rural Economy*, the various editions of which are traced from 1471; La Broue, writer of the first French work on equitation, 1593; the Duke of Newcastle, 1592-1676, a sketch of whose stirring life is given, and a full account of his great folio, *La Methode Nouvelle* and *Invention Extraordinaire de dresser les Chevaux*, 1657; Ruffo, in charge of the stables for the great Frederick II. (thirteenth century); Lando, whose *Regrets facétieux et plaisantes harangues funèbres sur le mort de divers animaux* (1st ed. 1548) must be good reading; and Solleynel, author of *Le Parfait Mareschal*, 1664. Eleven pages cover the "Traités sur l'Equitation et sur le Commandement de la Cavalerie of Xénophon"—*remarquable par la clarté de l'exposition et par la connaissance approfondie du sujet.*

Translations into the French of English authors are fully given, as the Earl of Pembroke's *Equitation*, and the works of Bracy Clark, Clater, Fleming, Flower, Bishop, Goodwin, Markham, Ryding, and Youatt.

The bibliography of the official regulations, decrees, ordinances, and regulations relating to the cavalry arm and to the breeding of horses should prove most useful.

An interesting section deals with the Carrousels and Cavalcades of the sixteenth and seventeenth centuries, in which the horse played so important a part. The painters and sculptors of the horse are fully described and their chief works cited. Some of the biographies are of special interest, as of Claude Bourgelet (1712-1779), founder of the first veterinary schools, at Lyons, 1762, and later at Alfort; of Decroix (1821-1901), the introducer of hippophagy into France; and of Eugene Gayot, who originated the Anglo-Norman breed of horses.

Eugène Sue, the famous novelist, whose career as a doctor I had forgotten, figures as the author of *Deleytar* (1837), a set of stories, one of which is concerned with the exploits of the celebrated stallion Godolphin—Arabian.

The picture given in these volumes of the life and literature of our French brethren is very stimulating. The importance of the subject of equitation and training, and the various systems are illustrated by the lives and works of Baucher, Aure, and others. In the bibliographical notes the complete story of the French veterinary profession may be read. The impression is left that this branch of our science is on a very high plane on the other side of the Channel. Doubtless the active Government support has contributed not a little to raise its intellectual and social status. The position in science reached by such masters as Bouley and Chauveau cannot be matched outside of France. No veterinary surgeon has as yet been President of the Royal Society, and no Veterinary Professor a President of the Royal College of Surgeons or of the Royal College of Physicians.

Students of the horse in all its relations owe a deep debt of gratitude to General Mennessier de la Lance for this comprehensive and valuable work, so full of accurate and careful scholarship. As a former teacher in a Veterinary College I may be permitted to offer him on behalf of the profession in Great Britain our congratulations on its completion, and our heartfelt wishes that he may be spared to see final victory crown the Army of which he has been so distinguished a member.

William Osler.

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Section of the History of Medicine.

President—Dr. RAYMOND CRAWFURD.

The First Printed Documents relating to Modern Surgical Anæsthesia.[1]

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

THE story of surgical anæsthesia illustrates how long it takes an idea to become effective. The idea of producing insensibility to pain during a cutting operation is of great antiquity—e.g., *vide* chapter ii, 21, in the Book of Genesis. Nor is the word anæsthesia modern, as is sometimes said, and invented by Oliver Wendell Holmes. It occurs, Withington tells me, first in Plato ("Timæus"), and is used by Dioscorides in the modern sense.

The extraordinary controversy which has raged, and re-raged every few years, on the question to whom the world is indebted for the introduction of anæsthesia, illustrates the absence of true historical perspective, and a failure to realize just what priority means in the case of a great discovery.

Why do we not give thè credit to Dioscorides, who described both the general and local forms, or to Pliny, or Apuleius, or to Hiotho, the Chinaman, who seems to be next in order, or to the inventor of the Spongia somnifera, or to Master Mazzeo Montagna, in Boccaccio, or to any one of the score or more of men in the Middle Ages who are known to have operated on patients made insensible by drugs or vapours? Why do we not give the credit to Davy, who had the idea; or to

[1] Remarks made on presenting Morton's original papers to the Royal Society of Medicine, May 15, 1918.

Hickman, who had both idea and practice; or to Esdaile, who operated on hundreds of patients in the hypnotic state; or to Elliotson, who did the same; or to Wells, who, in 1844, operated under nitrous oxide; or Long, who frequently practised ether anæsthesia? Why? Because time out of mind patients had been rendered insensible by potions or vapours, or by other methods, without any one man forcing any one method into general acceptance, or influencing in any way surgical practice.

Before October 16, 1846, surgical anæsthesia did not exist; within a few months it became a world-wide procedure; and the full credit for its introduction must be given to William Thomas Green Morton, who, on the date mentioned, demonstrated at the Massachusetts General Hospital the simplicity and safety of ether anæsthesia. On the priority question, let me quote two appropriate paragraphs: "He becomes the true discoverer who establishes the truth; and the sign of the truth is the general acceptance. Whoever, therefore, resumes the investigation of neglected or repudiated doctrine, elicits its true demonstration, and discovers and explains the nature of the errors which have led to its tacit or declared rejection, may certainly and confidently await the acknowledgements of his right in its discovery" (Owen, "Homologies of the Skeleton," p. 26). "In science the credit goes to the man who convinces the world, not to the man to whom the idea first occurs" (Francis Darwin, *Eugenics Review*, 1914). Morton convinced the world; the credit is his.

Morton's original essays are among the *rarissima*, not existing, so far as I can ascertain, in any of the general or special libraries of this country. I have been looking for them in vain for many years. In a parcel of his father's papers recently received from William J. Morton, of New York, there were duplicates of "Letheon," and "On the Mode of Administration of Sulphuric Ether," which I have great pleasure in presenting to the Library. Also a duplicate copy of the *Boston Medical and Surgical Journal* of November 18, 1846, which contains the first printed account of the new procedure, by Dr. Henry J. Bigelow. In the same journal for December 9, Dr. J. Collins Warren (primus) gives an account of the operation at the Massachusetts General Hospital. These four papers stand out in the literature of surgical anæsthesia as fundamental, and truly epoch-making.

Morton called the drug "Letheon" and applied for Letters Patent to secure his rights—not an unethical procedure in the dental profession of America. This led to the publication of his first pamphlet called "Letheon," the bibliography of which some one should undertake.

The medium through which Dr. Morton communicated the results of experiments on etherization to the public, was a "circular" which he had printed, at his own expense, almost every week. It was at first, as its name imports, a mere letter of advice; but, as it became the receptacle of newspaper articles, and correspondence from every portion of the Union, announcing the success of etherization, it was necessarily enlarged into a large and closely-printed sheet of four pages. Soon this "circular" became a pamphlet, and of this five different editions were published, under Dr. Morton's immediate supervision, embodying a digest of all the authentic information, both from Europe and America, on "Anæsthesia" (Rice, "Trials of a Public Benefactor," 1859, p. 114).

The Index Catalogue, Surgeon-General's Library, only mentions a 14-page pamphlet, 1846, printed by Dutton and Wentworth, Boston. The early form of the circular may be seen on the back page of the *Boston Medical and Surgical Journal*, December 9. In the number for November 18, with Bigelow's paper, there is only an advertisement of Morton's courses of instruction in dentistry. The circular appeared first November 26, and is copied at pages 14 and 15 of the "Letheon" pamphlet, fifth edition. This pamphlet is made up of more than eighty short articles from medical journals and newspapers, and is of special value in giving the popular, first-hand impressions relating to the great discovery. There is very little of Morton's—only the circular already referred to, and, on page 16, the terms for the "Apparatus, a Bottle of the Preparation, Instruction, &c."

In 1847 Morton published a 44-page pamphlet on "The Proper Mode of Administering Sulphuric Ether by Inhalation" (Boston: Dutton and Wentworth), in which the original apparatus (now a treasured relic at the Massachusetts General Hospital), is described. In the early part of April he found that a sponge would serve the same purpose, and was less dangerous. The greater part of the pamphlet is taken up with general directions, the outcome of the author's experience.

The claims of Morton were very fully stated in a pamphlet published in Paris, 1847, with the title, "Mémoire sur la découverte du nouvel emploi de l'éther sulphurique," and in 1850 he published a small work "On the Physiological Effects of Sulphuric Ether and its Superiority to Chloroform," Boston. So far as I can ascertain, this completes his output on the subject of anæsthesia, except a posthumous pamphlet "On the Use of Ether as an Anæsthetic at the Battle of the Wilderness" (*Journal of the American Medical Association*, April 23, 1904).

The third item is No. 16 of vol. xxxv of the *Boston Medical and Surgical Journal* (then, as now, issued weekly) for November 18, which introduces to the profession modern surgical anæsthesia. Henry J. Bigelow, the distinguished surgeon, had been interested in Morton's private dental cases, and read a paper before the American Academy of Sciences, November 3, and at the Boston Society of Medical Improvement, November 9. It was called "Insensibility during Surgical Operation produced by Inhalation," and after referring to the early cases of Warren and of Hayward at the Massachusetts General Hospital, fuller details of the dental cases are given which he had seen with Dr. Morton. No small share of the early confidence inspired in the profession is due to this temperate statement by Dr. Bigelow, who fully realized the enormous value of the discovery.

In the literature of anæsthesia these are the three fundamental contributions. With them should be placed J. Collins Warren's account of the first operation, *Boston Medical and Surgical Journal*, December 9, and vol. xxxv of this publication, which contains some twenty-two papers on the subject, illustrating the rapid spread of the practice.

The opportunity here offers to suggest the arrangement of certain subjects in our libraries on an educational basis. For example, why should not the members of the Section of Anæsthetics of this Society collect and classify their literature on historical lines? Start with the documents that magnetized into life an antique practice—these pamphlets of Morton, Bigelow's paper, Warren's paper, and vol. xxxv of the *Boston Medical and Surgical Journal*. Put these together—all in vellum and lettered in gold—as the blastoderm from which the enormous literature has developed which could be arranged on the shelves in ten or more sections. The Index Catalogue of the Surgeon-General's Library has a good classification, but for my own collection I have used the following:—

(1) The general story, as given in such publications as the Jubilee numbers of the *British Medical Journal* and of the *Boston Medical and Surgical Journal*, and the text-books, in which the history of the subject is well given, as Snow, Foy, &c.

(2) Pre-ether period. On cards references to Gurlt's "Geschichte der Chirurgie," Bd. iii, p. 621, and vol. i of Simpson's works, from which sources most of the text-book and other descriptions are taken; and to Dioscorides, Pliny and Apuleius, to the Spongia somnifera, to Boccaccio and the numerous other early writers. Brief descriptions could be written on the cards. Then in order would follow the works

of Davy, of Beddoes, the tragic story of Hickman, the remarkable documents relating to anæsthesia produced by compression of arteries, veins, and nerves, Bartholinus's use of cold for local anæsthesia, and the section would conclude with the writings of Esdaile and of Elliotson on hypnotism in surgery. What an education, even to glance at this literature in due sequence on the shelves!

(3) The modern period beginning with Morton, Wells and Jackson, the story of the miserable priority claims, the congressional reports, the publications of the Morton Association, the topical literature, showing the introduction of the practice into different countries, the Long literature, &c.

(4) In chronological order the subject of anæsthesia in midwifery, embracing everything from Simpson's original pamphlet to the latest popular magazine article on twilight sleep.

(5) Chloroform and its introduction. The papers of the discoverers, Guthrie, &c., the Simpson pamphlets, his famous "Encyclopædia Britannica" article dealing with the subject of anæsthesia under the word "Chloroform," which led to the sharp Bigelow-Simpson controversy, the Hyderabad Reports, the British Medical Association and other reports and documents.

(6) Local anæsthesia from Dioscorides and Bartholinus to Kohler, Corning, Halsted, Cushing, and others.

(7) Agents other than ether and chloroform, used for inducing anæsthesia, arranged in order of introduction.

(8) Technique, including the various methods of administration, intravenous, intratracheal, and the literature of apparatus.

(9) Physiology.

(10) Pathology.

I speak as an amateur. Doubtless expert members could easily arrange a more comprehensive scheme. To separate in literature the quick from the dead is one of the functions of a well-ordered library, but much that we carelessly regard as dead is magnetized into life when put in its historical relations. The plan here suggested, which could be applied in other directions, sustains that continuity, to the study of which this Section is devoted. You remember the rings of Lucretius —well, there is a *vis et vincula librorum*, binding together books, a force just as potent as the *vis et vincula lapidis*, which supported the rings; and in the literature of anæsthesia this force is derived from the works here presented to the Library.

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TYPHOID SPINE*

BY SIR WILLIAM OSLER, BART., M.D., F.R.S.

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LET me begin at the end by reading a letter received January 3rd, National Hospital, Queen Square, London:

DEAR SIR WILLIAM—Sapper C., typhoid spine, was admitted yesterday. You will be interested to know that he is now walking normally. It was a good case, although he walked after ten minutes' treatment.

Yours sincerely,

L. R. YEALLAND.

Had Sapper C. gone to Lourdes—had he gone to our own Canadian Shrine, St. Anne de Beaupré, what a miracle! Paralyzed for nearly two years! unable to move body or legs; never out of his bed! and yet he walked in ten minutes! Well, it is a miracle all the same, an illustration of the faith that heals—not the same sort of faith, however, that the lame man at Lystra had, the firm persuasion that Paul and Barnabas were able to cure him, for I am afraid from what Dr. Yealland says, and from what we know, Sapper C. was not very anxious to get well.

Now to refresh your memory of the case, which is an important one from many standpoints. I saw the patient in April, 1916, with Dr. Whithall, at the V.A.D. Hospital, Maidenhead. The condition was as follows: Excessive nervousness and apprehension, so that he broke into a profuse sweat, trembled, and was very fearful lest we should attempt to move him. He was well-nourished, no mental disturbance, special senses normal, pupils widely dilated. When stripped a diffuse blush spread over the trunk, and there was an unusually persistent condition of goose skin. He was unable to move the body, any attempt being followed by agonizing pain in the back. The legs looked normal, and there was no wast-

* Clinical Remarks, January 7th, No. 15 Canadian General Hospital, Cleveden, Taplow.

ing, no disturbance of sensation. An attempt to sit up was followed by severe pain in the back; with great difficulty he was turned on the left side, but it was impossible to get him in the sitting posture. The spine was straight, no projection or unusual prominence. Below the mid-dorsal region it was very painful on pressure, and over the lumbar spines the slightest touch caused him to cry out. The examination of the abdomen was negative; nothing could be felt on either side or in the iliac regions on the deepest pressure. The spleen was not palpable. The legs could not be lifted from the bed or drawn up. On making the attempt they went into clonic spasm. The toes could be moved and the ankles flexed. The temperature of the legs was normal, and there were no trophic changes.

Sensation: Normal in hands and face. On the skin of abdomen, in a band about a hand's-breadth in width below the costal margin, there was extreme hyperæsthesia; the slightest touch caused him to cry out; he could not even bear the weight of the bedclothes. It extended to the back, but was not nearly so marked as in front. Below the navel the sensation was normal. On the skin of the legs he felt the pin-prick everywhere, and recognized the difference between heat and cold.

Reflexes: Knee-jerks exaggerated, slight rectus clonus, no ankle clonus; Babinski sign not present. Cremasteric and abdominal reflexes present. Bowels and bladder normal.

In February, 1916, the patient had an attack of typhoid fever, and was treated in the V.A.D. Hospital, Maidenhead. Though prolonged, it was not a severe attack, the temperature never rising above 104° F. The convalescence was slow, and he remained in the hospital all the summer. In October he had another febrile attack which was thought to be influenza. Following this, he began to have pains in the back and stiffness; these symptoms have persisted, and he has never been out of bed, and has become more and more incapacitated.

I asked to have the patient transferred here to the Duchess of Connaught's Hospital, Cleveden, where he was admitted May 7th, 1917. A spinal jacket gave great relief to the pain in the back, and the hyperæsthetic girdle rapidly disappeared. In the eight months the changes have been an improvement in his general condition, manifested in a gain of weight, in less marked basal motor changes, and less apprehension and dread of pain. The area of hyperæsthesia has disappeared. The rigidity and immobility of the back has persisted. We have never been able to get him to sit up.

An attempt to move the legs at once brought on the clonic spasm, and there always was an appearance of unusual effort in attempting to make the movement. Night and morning one of the nurses made him draw the legs up and down, and this of late he has been able to do pretty well, and with less tremor. The reflexes have remained the same, and there has been no anæsthesia, though at times the tactile sensations seemed less acute than at others.

Shortly after admission to Taplow an x-ray picture was taken which showed a very dark shadow in front of the lower dorsal and lumbar vertebræ, practically identical with the shadows shown in Figs. 2 and 6 of Dr. J. B. Carnett's article in *The Annals of Surgery*, 1915. I submitted the picture to a number of experts, some of whom expressed doubts as to the significance of so large and dark a shadow. Major Morgan, when he took charge of the department, very kindly made a special study of the case, and the subsequent x-ray pictures showed a spine normal in every particular.

The case has attracted a great deal of interest, and in the weekly demonstrations I could not always carry conviction to the minds of visitors that the condition was purely functional, and that the patient would ultimately get well. My personal education in the disease is worth noting:—

The first case one sees of a special disease or complication usually fixes itself in the memory. In 1887, I was asked by Dr. Grassett, of Toronto, to see with him a young officer invalided from India with paralysis after typhoid fever. Healthy looking, excessively nervous, unable to walk or to move in bed, the striking feature was a painful stiff back, so that any attempt to turn or move made him scream. There was nothing to be made out on examination except tenderness in the dorsal region. The legs were weak, but there was no paralysis, and the bladder and bowels were unaffected. The pain and stiffness had lasted for more than five months, and he was brought home believed to be permanently disabled. He was so nervous that I regarded the whole condition as functional, ordered a jacket with massage to the legs, urged him to get up and go out and gave a favourable prognosis. The improvement was rapid and progressive, and he got quite well. This was my introduction to the condition which Gibney, of New York, first described in 1887 as typhoid spine. In 1890, at a meeting of the Association of American Physicians, Dr. Loomis called our attention to Gibney's observations. In Series I of our "Studies in Typhoid Fever", *John Hopkins Hospital Reports*, vol. iv, p. 73, I wrote a paper with the title, "On the Neurosis following Enteric Fever, known as the Typhoid Spine" (the first communication on the subject to follow Gibney's), in which I reported two cases, and, in opposition to Dr. Gibney, took the view that it was a functional disturbance, analogous to "railway spine" or "hysterical spine". I was much impressed with the rapidity with which the cases recovered—far too rapidly in Case II for a spondylitis. In Series II of the "Typhoid Studies", *John Hopkins Hospital Reports*, vol. v, p. 315, I reported three additional cases, two very mild, all negative on examination, which improved rapidly with the Paquelin cautery. In Series III of the "Typhoid Studies," *John Hopkins Hospital Reports*, vol. viii, p. 485, I reported a mild case of "tender spine". To this time I had seen nothing to make me change my view of the functional character of the trouble. Meanwhile we had seen many cases of the bone lesions following the disease, and it always seemed a strong point in favour of my view that the typhoid spine never presented any swelling, and never went on to suppuration. In 1902 I had to change my mind. I saw a patient of Dr. Reinhardt, in the fourth week of convalescence, with stiff, painful back, weak legs, excessive nervousness, but in addition a well-marked painful swelling just above the right sacro-iliac articulation. Convalescence was slow, but no suppuration followed. Several other cases were seen, and with the help of Dr. T. McCrae I reached the belief that Gibney's original view was correct for some cases. Careful *x*-ray examinations showed spinal changes, and in a patient at the Clinique in July, 1904, Dr. Baetjer demonstrated a definite deposit of bone filling the space between the second and third lumbar vertebrae. In 1906 Dr. McCrae reported this case and another with bone changes in the spine,* and in the "System of Medicine" we edited together he gave an excellent analysis of the condition, and grouped the cases into three categories. First, those in which the hysterical features predominate. Secondly, cases with periostitis, or perispondylitis, with fever, pain, rigidity, and evidence of nerve root involvement. And thirdly, a group of cases with definite objective changes in the spine, as shown by the *x*-ray pictures, as well as by examination.

I confess freely to have taken too one-sided a view of the condition, but it was not without a strong basis of support. Such a prompt recovery, such as followed in several of the reported cases, seemed quite inconsistent with the existence of a spondylitis. In showing a case at the Johns Hopkins Medical Society, 1901, the

* *Amer. Journ. Med. Science*, 1906, ii, p. 140.

following features were dwelt upon as indicating the functional character of the condition: First a state of neurasthenia with vasomotor changes, and in not a few cases the definite stigmata of hysteria. Secondly, stiffness of the back, persisting for weeks and months, is associated with pain, sometimes of an agonizing character, on movement. Thirdly, pain on pressure over certain spinal processes. Fourthly, a negative local examination, with the absence of fever. And lastly, in many cases, prompt recovery, with the use of the Paquelin cautery, and measures directed to the neurotic condition.

This case of Sapper C. is a strong confirmation of this view. You saw him last Monday after the spinal jacket was removed—still very neurotic, the spine absolutely rigid; we could not induce him to sit up; he could just lift his legs off the bed with the same type of general clonic tremor. I know that some of you felt hopeless about him, and he had got hopeless about himself, but new surroundings, a new mind, and very skilfully applied methods did in ten minutes what we have failed to do in a year—put him on his feet. I saw him on the 3rd looking well, walking well, and very happy to be on his legs again.

The literature of typhoid spine to 1905 is fully analyzed by Karl Fluss, *Centralblatt f.d. Grenzgebiete der Medizin und Chirurgie*, Bd. viii, and by Elkin and Halpenny in vol. i of the *British Journal of Surgery*, 1914. More than 100 cases have been reported, a large proportion in males. The onset is usually during convalescence, but has been weeks after, and has followed a sudden jar or twist or a blow. Constitutional disturbances are present in all cases. Fever is usually absent, but a range of 100° to 100·5° F. is not uncommon. Paroxysms of fever have been described, and there may be marked leucocytosis. A change in the mental condition has been noted in the majority of instances. The patients are excitable, apprehensive, self-centred, with the features of neurasthenia, and very often positive hysteria. In Sapper C.'s case this has been a striking phenomenon throughout. He was like a shell-shock subject, and at the first examination had an emotional storm with profuse sweating, goose skin, and then a vasomotor hyperæmia spread over the entire trunk. I have not seen a case without neurotic manifestations in some degree, even when signs of local disease were present.

Perhaps the most interesting case on record is the study by Dr. Leonard Ely, of New York, of his own attack (*Medical Record*, September 20th, 1902). One hesitates to suggest the existence of hysteria in a professional brother, but one may say, at any rate, that the condition simulated it, and he confesses to have been "considered hysterical by his nurses". The professional baseball pitcher, whose protracted case is reported by Carnett; the cases of Lovett and Withington and Taylor's case had hysterical features combined with organic changes.

Of the local features, pain in the back, particularly on movement, is the most constant, and it may be of extraordinary severity, so that the patient screams on the slightest movement. It comes on in paroxysms, and is aggravated by the slightest jar or at any attempt to move. Patients have had to be chloroformed when they use the bed pan, and the threat of suicide has been recorded in several instances. The pain may be of a definite nerve-root character, extending round one or both sides, or it may pass down one or both legs.

Tenderness on pressure is present over the spinal processes of varying numbers, sometimes limited in the lower dorsal and lumbar regions. Rigidity of the back is a constant feature; the patients are unable to stoop, and have a difficulty in raising themselves to the sitting posture. One patient came into the hospital supported by two friends almost bowed double, and it was only with the greatest difficulty that the back was straightened.

If, as some orthopædic surgeons hold, a rigid back indicates organic disease, all of these patients had it, and no case I have seen has been more marked than in Sapper C. Clonic contraction of the muscles has been present in a number of instances. It may be nothing more than the fine tremor on attempting moving of the legs; but there is one type of muscular contraction in these cases that is of great importance, as to my mind it is an unerring stigma of hysteria. I refer to the rhythmic contraction of the abdominal muscles, noted by Ely in his own case, and present in two of Carnett's cases. In a patient admitted in October, 1902, with pain in the back and the ordinary features of typhoid spine, the abdominal muscles were contracting at the rate of 75 to the minute, which gave a very remarkable appearance to the flanks, which were moved in and out like a pulsation.

Inability to use the legs is present in severe cases, but there is no actual paralysis, no wasting, and the features are quite unlike post-typhoid paraplegia from myelitis or from neuritis. Reflexes are increased, but not changed in type. Disturbances of sensation in the form of hyperæsthesia are common, particularly in the back. Anæsthesia may be present, and it is interesting that Dr. Yealland, in Sapper C.'s case, found a stocking anæsthesia, which certainly was not present on any occasion on which I or others examined him.

The last and important point is the evidence which exists in some cases for disease of the spine. This is of two forms: Kyphosis has been present, and of a type that could only occur from positive disease of the bone. Swelling of the soft parts on either side of the spine has been described and was present, as I have stated, in the patient seen by Dr. Reinhardt, the only one of the ten or twelve cases I have seen in which on physical examination changes were present. Of ordinary scoliosis and of associated atrophy of the lumbar muscles one cannot be so certain, as they are common enough in hysteria.

The *x*-ray picture has been studied now in a large number of cases. Osteoporosis, absorption of the intervertebral discs, and local bone proliferation have been described. It is extraordinary how few satisfactory skiagrams of the condition exist. I have looked in vain for one through the special journals, and some that have been published elsewhere are in the highest degree unsatisfactory. It is not fair to criticize a print without the plate, but Figs. 2 and 6, illustrating Dr. Carnett's paper, have had an extraordinary resemblance to the first plate taken of Sapper C., but subsequent study showed them to be artefacts, and the spine and adjacent bones show no trace of disease.

Upon one remarkable feature all writers dwell. Unlike ordinary typhoid periostitis the spondylitis rarely (if ever) goes on to suppuration. When present the lesion must differ essentially from that which we see in the long bones and the ribs. Typhoid bacilli have been frequently found in the bone marrow of the vertebræ, and there is no inherent reason why similar inflammatory changes should not be produced as in other bones. We know, indeed, from the presence of the kyphosis and from the *x*-ray picture that such changes do occur. Why they are not seen more often is, I believe, that they are not always present, and that we must recognize functional variety, which has its counterpart in certain forms of hysterical and railway spine.

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Observations

ON

THE SEVERE ANAEMIAS OF PREGNANCY AND THE POST-PARTUM STATE.

BY

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THOSE of us whose professional careers coincide with its modern study will remember how important was the part played by these conditions in severe anaemia. Channing (1842), Lebert (1853), and Gusserow (1871) dealt with this aspect of the subject. Many of Biermer's original cases were in pregnant women, and a large proportion of the cases forming the basis of the monographs of Müller (1877) and of Eichhorst (1878) were in this class. After 1885 the literature shows a striking reduction in the references, and Ehrlich and Lazarus, in Nothnagel's *System*, suggested that local influences in the cantons were responsible for the frequency of this association in the cases reported by the Swiss clinicians. So experienced a teacher as Ahlfeld, they state, had never met with a case. Considering how much has been written by British physicians on the various forms the literature on the anaemia of pregnancy and the post-partum state is very scanty—only one of nineteen in the *Index Catalogue* of the Surgeon-General's Library, both series. In Allbutt and Rolleston's *System* French makes only a passing remark on the association. With few exceptions the textbooks in obstetrics have very little to say, and the gloomy prognosis is an echo of the unfortunate experiences of the older writers. Among recent works Edgar's has the best section. That cases are rare in this country is shown by the absence of reference in the writings of so experienced workers as Byrom Bramwell and William Hunter. In the United States Channing's really remarkable study seems to have aroused an interest in the subject, and five American papers are quoted in Vol. I of the *Index Catalogue* before the appearance of Cusserow's in 1871. In Cabot's[1] series of 1,200 cases of progressive pernicious anaemia, in 35 the disease began during pregnancy or shortly after parturition, 18 during the former. This proportion—about one in thirty-five—is probably the average for the United States. Davis,[2] in reporting a case, gives a very good summary of the older American literature; and Findley,[3] who deals with the subject more recently, concludes that "in all well established cases the disease has proved fatal." In the discussion on this paper Richard Norris stated that there had only been one case among three thousand women at the Preston Retreat. Of the first twenty-three cases of "progressive pernicious" anaemia of which I have notes, all but one seen in Montreal, five were *post partum*. I saw two in Philadelphia, and there were a few at my Johns Hopkins clinic, but I have not the figures. The theses of Decroix,[4] Husson,[5] and Robert[6] indicate that the association is not very common in France. The recent German and Swiss literature is given in Naegli's well known monograph on the blood. Possibly the existing conditions of underfeeding, etc., have led to an increase of cases during pregnancy, and the intense wave of streptococcus infection may have increased the cases of acute septic anaemia *post partum*.

The cases may be divided into four groups:

I. Anaemia from Post-partum Haemorrhage.

(*a*) The bleeding may be profuse and rapidly fatal. The physician sees fatal haemorrhage in aneurysm, in typhoid fever, in peptic ulcer, and in ruptured oesophageal varix, none of which conditions present the tragedy of the *post-partum* case. Only once has it been my misfortune to witness this peculiarly pathetic accident. Peace and quiet reign in the lying-in chamber and happiness in the household, for all has gone well, and the young mother is just beginning to realize the joy that "a child is born into the world." The doctor may have left, feeling safe and satisfied. The attention of the nurse is attracted by a sudden restlessness of her patient, whose face shows a beginning pallor, and she finds the dressings soaked with blood. Very soon the symptoms are those of acute anaemia—a rapid, jerky pulse, extreme restlessness, yawning, sweating, sighing respiration, increasing pallor, and with muscular twitchings, convulsions, or a sudden collapse all is over. This was what I saw one afternoon, called hurriedly to the house of a neighbour—a strong, healthy young woman *in articulo mortis*, after a normal delivery, as bloodless as if the carotids had been cut. No wonder that novelists have made such a tragedy the climax of a story. Hitchins, in *The Fruitful Vine*,[7] makes Dolores die in this way; and it is possible that Walter Savage Landor had in mind this type of death in his beautiful little poem in *Pericles and Aspasia*:

Artemidora! God's invisible,
While thou art lying faint along the couch,
Have tied the sandal to thy veinèd feet;
And stand beside thee, ready to convey
Thy weary steps where other rivers flow

* * * * *

Fate's shears were over her dark hair unseen
While thus Elpenor spoke.

(*b*) *The Anaemia Following Repeated Small Haemorrhages.*—This not infrequently follows abortion, more rarely the repeated bleeding after a delivery at term. The following is a good illustrative case:

Mrs. B., aged 45; admitted October 8th, 1918, having had an abortion in the fourth month of her seventh pregnancy, one month previously. She had been losing blood intermittingly, not any large amount, but every few days a clot or two would come away. There had been slight irregular fever, and a progressive anaemia. At times there was a slight purulent discharge. She was curetted, and with douches the discharges soon ceased. She looked profoundly anaemic, and with a sallow brown tint of the skin. The blood count was: Red blood corpuscles 2,106,000 per c.mm.; leucocytes 12,800. Ten days later the red blood count was 1,800,000 and the leucocytes 12,000. On the 21st thrombosis of the left femoral vein with swelling of the leg. The blood films showed the red cells irregular in shape and size, many normoblasts, and numerous platelets. In the open air with plenty of good food, iron and arsenic, she improved rapidly, and left the infirmary on December 3rd with a nearly normal blood count.

As in many cases, the anaemia here was due to a combination of repeated small haemorrhages and a mild sepsis. The general appearance was that of an ordinary Addisonian anaemia, for which any casual observer would have mistaken the case. In III and IV of my Montreal series the profound anaemia followed many small haemorrhages after abortion.

II. The Severe Anaemia of Pregnancy.

The blood of the pregnant woman shows in the early months a diminution of red corpuscles, a low haemoglobin, and a slight leucocytosis (as is well shown in the composite chart in W. L. Thompson's[8] study from Williams's clinic), to be followed by a rise to or near normal in the ninth month. A slight pallor in the early months is common, and is often associated with the morning vomiting or dyspepsia. That this so-called chloro-anaemia of pregnancy might pass on to a grave and fatal form was recognized by Channing and Lebert, but it was the full report by Gusserow[9] of five fatal cases that roused the attention of the profession to the seriousness of severe anaemia in pregnancy. The following is a typical case:

On April 13th, 1917, I saw with Dr. Arthur F. Stabb and her husband Mrs. A., the wife of an army surgeon, a primipara of good previous health, though she had had a "tendency to anaemia." The pregnancy, which began in September, 1916, was uneventful until March, when anaemia began and increased rapidly, so that by April 1st she had dyspnoea and swelling of the feet. On April 3rd albumin appeared in the urine in large amounts. On April 10th the blood count was: Red blood corpuscles 864,000 per c.mm.; leucocytes 13,360; haemoglobin 20; colour index 1.12. The lymphocytes were increased 30 per cent., and the normoblasts were 6 per 100 leucocytes. There was the usual extreme irregularity in size and shape of the red cells. Labour began on the 9th, and on the 11th she was delivered of a stillborn child of normal appearance for the seventh month. There was very little haemorrhage, and she stood the strain very well. When seen on the 13th she was well nourished, but with all the objective features of profound anaemia. There were no internal haemorrhages. The case was regarded as a typical example of the so-called toxic or haemolytic anaemia of pregnancy, and, based on an unusually fortunate experience, I ventured to give a favourable prognosis. The recovery was rapid and uninterrupted, as the blood counts show: April 18th, red blood corpuscles 1,036,000; April 26th, 2,368,000; May 3rd, 2,592,000; June 17th, 3,250,000; and December 4th, a practically normal count. The leucocytes rose on April 18th to 45,000 per c.mm., and fell to 3,360 on May 3rd. On April 26th the normoblasts rose to 16 per 100 leucocytes, after which date they disappeared.

III. Post-partum Anaemia.

In this, the common form, after a normal delivery without excessive loss of blood, the patient begins to get pale, and within a few weeks the blood count may fall below 2,000,000 per c.mm., and the anaemia may progress and prove fatal in from eight to twelve weeks. How serious this type may be is seen from the high mortality in the series of Channing and of the Zurich clinicians. On the other hand, the experience elsewhere has been more favourable. Dr. Palmer Howard, one of the earliest and most careful students of the subject, insisted that the large percentage of recoveries in the *post-partum* cases, and the absence of recurrence distinguished this form from the true Addisonian anaemia, though clinically the cases appear to be identical. The five *post-partum* cases in my first series all recovered. One was alive more than thirty years after and had passed through two subsequent pregnancies without trouble. The following case gives a good picture of the disease:

Amelia T., aged 35; admitted February 2nd, 1888. In the October previous she had been delivered of her fourth child; no complications. She had begun to nurse the baby, but gradually got pale and weak and had frequent fainting fits and much shortness of breath. On admission the anaemia was so extreme that she could not sit up in bed without feeling faint. The red blood corpuscles were 1,170,000 per c.mm., with extreme irregularity in form and size and many nucleated red cells. The haemoglobin was 15 to 18 per cent. With rest in bed, good food, iron and arsenic, she improved rapidly and left the hospital with a normal blood count.

Not infrequently in severe anaemia there is a continuous fever, which may lead to error in diagnosis, even suggesting typhoid fever, a point to which Cabot refers. The fever may be more irregular, and even associated with chills, which in the following case led to the diagnosis of malaria.

L. T., primipara, aged 24, seen with Dr. Jenkins, October 6th, 1898. Though a difficult labour there were no complications, and for ten days everything was normal. Then she began to get pale and grew rapidly worse, and in the sixth week after confinement, when I saw her, the red blood cell count was 1,200,000 per c.mm., leucocytes 15,000, haemoglobin 15 per cent. Every fourth or fifth day the patient had a chill in which the temperature rose to 103-104°, after which she sweated profusely.

There was no discharge, no evidence of sepsis, other than the fever and the chills. The spleen enlarged, and as she lived in a region in which parturition was recognized as one of the factors determining recurrence of malaria this had been suggested in explanation of the chills. The blood was negative during a chill and after. The red cell count fell to 800,000 per c.mm. and her condition for weeks was critical, but she gradually improved, and four months later she had a nearly normal blood count.

IV. The Acute Anaemia of Post-partum Sepsis.

In certain types of sepsis there is rapid blood destruction. In acute endocarditis the anaemia with a large spleen may completely mask the clinical picture, as in cases which I reported a few years ago in the *Interstate Medical Journal* (1913). In no condition do we see such rapid haemolysis as in *post-partum* sepsis—a form of anaemia not sufficiently recognized or studied.

In 1882 I saw with Dr. Alloway, on the seventh day after delivery, a young woman in a state of profound anaemia. The blood loss had not been severe, but for some days there had been an unusually foul though slight discharge. The red blood cells were just 1,000,000 per c.mm., the leucocytes 20,000. I never saw the objective features of anaemia more pronounced, and her chief complaint was the painful throbbing of the abdominal aorta, which pulsated with extraordinary violence. She died on the twelfth day. There was "diphtheritic" endometritis, septic thrombi in the pelvic veins; no endocarditis.

Such extremely rapid cases are not common, but Cabot[10] refers to one with identical features, in which the acute sepsis was not suspected. The red blood count was 800,000 per c.mm. "Diphtheritic" endometritis was found at the *post-mortem* examination, without which, as Cabot remarks, the case would have gone into the category of puerperal pernicious anaemia. While every patient with puerperal fever has some grade of anaemia, only in a few does the blood loss dominate the picture. In many of the best textbooks on obstetrics—for example, Edgar (1903)—the condition is not referred to. An excellent account is given by Lea,[11] who states that the loss of red cells may be at the rate of from 200,000 to 1,000,000 per c.mm. a week, and that the count may fall to 300,000 per c.mm. Three cases of puerperal sepsis recently in the Radcliffe Infirmary illustrate the condition very well.

Mrs. C., aged 24, admitted under Colonel Collier August 31st, 1918, had a miscarriage late in her second pregnancy. Fragments of retained placenta were removed. She had the typical sallow, pale yellow (not the brown-yellow) tint of skin, and the usual features of moderate anaemia. The red blood cells were 2,700,000 per c.mm., leucocytes 8,600, haemoglobin 46. She improved rapidly, and left the infirmary on September 21st, 1918.

Mrs. M., aged 49, admitted August 8th, 1918, under Colonel Brooks. Since the delivery of her eleventh child, July 16th, she had had severe sepsis with high irregular fever and a progressive anaemia. The blood cultures were negative. The blood count was: Red blood cells 1,580,000 per c.mm., leucocytes 13,400, haemoglobin 16 per cent., colour index 48.

Nothing special in the differential count other than a high percentage of lymphocytes. The irregularity in size and shape of the red cells was extreme, and there were many normoblasts. She died on September 8th in a state of profound anaemia.*

Mrs. W., aged 31, primipara, admitted under Colonel Collier, November 30th, 1918, having been delivered a week before. No complications. Acute sepsis developed with high fever and a very offensive discharge. When admitted the patient was very anaemic, with a sallow, sub-icteroid tint and all the symptoms of a severe infection. Streptococci were isolated from the blood, and she was given antistreptococcic serum on December 1st and 3rd. The red blood count was 2,250,000 per c.mm., leucocytes 9,600, haemoglobin 40. The differential count showed nothing special; normoblasts were present in moderate numbers. The anaemia progressed rapidly, the fever remained high, and she died on December 7th.

With an increased frequency of streptococcus infections and an unusual virulence of at least some strains in respiratory affections, it would be interesting to learn if puerperal fever has been more prevalent throughout the country. So far as I know, the *post-partum* sepsis cases have not shown a special tendency to haemorrhage, as have so many of the streptococcic infections of the past six months.

Remarks.

To the nature of the haemolytic agent in the pregnancy and *post-partum* cases there is as yet no clue, any more than we have to the cause of that most baffling of all blood diseases, Addison's anaemia. The progress and the blood picture suggest the haemolytic type, which can be produced experimentally and which is caused by the poisons of the *Bothriocephalus*. In the profoundly changed metabolism of pregnancy and in the intensely katabolic metabolism of the *post-partum* states we assume the production of haemolytic agents—toxins—but, as French remarks, "the use of the word toxin almost connotes ignorance." Though progressive and often pernicious, the anaemia is caused by an agent which differs in one all-important particular from that which causes the anaemia of Addison. When recovery takes place it is permanent, and the woman may escape in subsequent pregnancies. The second patient in my series (whom I knew well) had an attack of extreme gravity, recovered, bore two children subsequently, and was alive thirty years after the attack. Recovery from the Addisonian form may last ten, fifteen,

* There may have been septic endocarditis in this case, as a few days before death there was a soft diastolic murmur along the left sternal border. The dancing, vibrating pulsation of the peripheral arteries was extreme and the pistol-shot sound unusually loud. In connexion with the production of this in the arteries, about which so much has been written recently, the following note, dictated September 2nd, 1918, is of interest: "A loud systolic bruit is heard over the abdominal aorta without pressure; but neither heart sound. Over the femoral, without the slightest pressure, two sounds are heard, quality and intensity about equal, and almost as loud as the sounds heard over the heart itself. With pressure both increase in intensity, then a loud systolic murmur develops, and on pressure to obliteration, a loud single pistol shot remains."

or even seventeen (McPhedran) years, but such instances are exceptional, and in the cases of reported permanent recovery there is always the question of mistaken diagnosis.

The blood picture may be of value in estimating the outlook. Signs of active regeneration may be present, as in Mrs. A.'s case, indicated by blood crises and a large proportion of red cells with signs of recent formation, and the basophilic granulation described by Boggs and Morris and by Milne, the mitochondria (Sappington) and the reticulation described by Robertson and Bock.[12] The number may rise from 1 per cent., the normal, to 20 or 25 per cent. with marked bone-marrow stimulation. A high colour index is the rule in the pregnancy and *post-partum* cases. The blood condition is uncertain, however, as well shown in two exceptionally well studied cases in Meyer's clinic, reported by Jungermann,[13] in which the contrast was striking, the one with low colour index and features of an aplastic anaemia, the other the characteristic Addisonian picture. Both were pregnancy cases, and both had normal deliveries and recovered completely. The absence of platelets is a feature of the common idiopathic anaemia, contrasting, in this respect, with the post-haemorrhagic and septic forms. In the hands of skilful students the criteria offered by the blood examination should, as a rule, be of great value in the prognosis.

My individual experience is exceptional and much more hopeful than indicated in the literature, and particularly in works on obstetrics. The seven cases seen in Montreal and Philadelphia recovered. I have not at hand our large material from the Johns Hopkins Hospital; but I do not remember a fatal pregnancy or *post-partum* case. The later appear to be the more fatal, and the cases reported by Elder and Mathews[14] show that a fatal termination may follow in spite of the most careful treatment.

Acute haemorrhage *post partum* may be rapidly fatal from reduction in blood volume; very large amounts may be lost extending over several days, and yet recovery takes place.

The report of Robertson and Bock, just mentioned, contains much information of value in estimating the blood loss in haemorrhage and the means of treatment. From what is recorded, and from personal experience, I should say the danger of a grave anaemia progressive in character is not great after a fairly profuse haemorrhage. Once the bleeding stops, recovery is progressive and often surprisingly rapid. On the other hand, repeated small losses of blood after abortion or a normal delivery may be followed by an anaemia out of all proportion to the quantity of blood lost. The starting point, indeed, of a few cases of Addison's anaemia appears to be repeated epistaxis or bleeding piles.

The treatment of the cases is that of the severer forms —fresh air, rest, food, iron, and arsenic (in which I still have faith); and if the blood count is very low, 20 per cent. of corpuscles and haemoglobin, transfusion may be employed.

The newer technique has many advantages, but the results do not, in Addison's anaemia at any rate, appear to be more favourable than those we had with the old Aveling or Roussel apparatus.

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THE OLD HUMANITIES AND THE NEW SCIENCE

An Address before the Classical Association, Oxford, May 16th, 1919

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THE OLD HUMANITIES AND THE NEW SCIENCE [1]

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I

EARLY in the sixteenth century a literary joke sent inextinguishable laughter through the learned circles of Europe. The *Epistolae Obscurorum Virorum* is great literature, to which I refer for two reasons—its standard is an exact gauge of my scholarship, and had *Magister Nostrandus Ortuinus Gratius* of Cologne, to whom most of the letters are addressed, been asked to join that wicked Erfurt Circle, he could not have been more surprised than I was to receive a gracious invitation to preside over this gathering of British scholars. I felt to have been sailing under false colours to have ever, by pen or tongue, suggested the possession of even the traditional small Latin and less Greek. Relieved by the assurance that in alternate years the qualification of your President was an interest in education and literature, I gladly accepted, not, however, without such anticipatory qualms as afflict an amateur at the thought of addressing a body of experts. Not an educated man in the Oxford sense, yet faint memories of the classics linger—the result of ten years of such study as lads of my generation pursued, memories best expressed in Tom Hood's lines:

> The weary tasks I used to con!
> The hopeless leaves I wept upon!
> Most fruitless leaves to me!

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[1] An address delivered in the Divinity School at a meeting of the Classical Association, Oxford, May 16th, 1919.

In a life of teaching and practice, a mere picker-up of learning's crumbs is made to realize the value of the humanities in science not less than in general culture.

To have a Professor of Medicine in this Chair gives to the Oxford meeting an appropriate renaissance—shall we say mediaeval?—flavour, and one may be pardoned the regret that the meeting is not being held in May 1519, to have had the pleasure of listening to an address from a real Oxford scholar-physician, an early teacher of Greek in this University, and the founder of the Royal College of Physicians, whose *Rudimenta Grammatices* and *de Emendata Structura Latini Sermonis* upheld for a generation, on the continent at least, the reputation of English scholarship. These noble walls, themselves an audience—indeed, most appreciative of audiences—have storied memories of Linacre's voice, and the basis of the keen judgment of Erasmus may have been formed by intercourse with him in this very school. In those happy days, to know Hippocrates and Galen was to know disease and to be qualified to practise; and my profession looks back in grateful admiration to such great medical humanists as Linacre and Caius and Rabelais. Nor can I claim to speak for pure science, some salt of which remains from early association, and from a lifelong attempt to correlate with art a science which makes medicine, I was going to say the only—but it is more civil to say the most—progressive of the learned professions.

To have lived right through an epoch, matched only by two in the story of the race, to have shared in its long struggle, to have witnessed its final victory (and in my own case, to be left I trust with wit enough to realize its significance)—to have done this has been a wonderful privilege. To have outgrown age-old theories of man and of nature, to have seen west separated from east in the tangled skein of human thought, to have lived in a world re-making—these are among the thrills and triumphs of the Victorian of my generation. To a childhood and youth came echoes of the controversy that Aristarchus began, Copernicus continued, and Darwin ended, that put the microcosm into line with the macrocosm, and for the golden age of Eden substituted the *tellus dura* of Lucretius. Think of the Cimmerian darkness out of which our generation has, at any rate, blazed a path! Picture the mental state of a community which could produce *Omphalos—an attempt to untie the geological knot!*[1] I heard warm clerical discussions on its main thesis, that the fossils were put into the earth's strata to test men's faith in the Mosaic account of the creation, and our Professor of Natural Theology lectured seriously upon it! The intellectual unrest of those days wrapped many in that "dyvine cloude of unknowynge," by which happy phrase Brother Herp designates mediaeval mysticism; and not a bad thing for a young man to live through, as sufficient infection usually remains to enable him to understand, if not to sympathize, with mental states alien or even hostile.

An Age of Force followed the final subjugation of Nature. The dynamo replaced the steam-engine, radiant energy revealed the hidden secrets of matter, to the conquest of the earth was added the control of the air and the mastery of the deep. Nor was it only an age of Force. Never before had man done so much for his brother, the victory over the powers of Nature meant also glorious victories of peace; pestilences were checked, the cry of the poor became articulate, and to help the life of the submerged half became a sacred duty of the other. How full we were of the pride of life! In 1910 at Edinburgh I ended an address on *Man's Redemption of Man* with the well-known lines of Shelley beginning "Happiness and Science dawn though late upon the

[1] By the distinguished naturalist Philip Henry Gosse.

earth." And now! having survived the greatest war in history, and a great victory, with the wreckage of mediaeval autonomy to clear up, our fears are lest we may fail to control the fretful forces of Caliban, and our hopes are to rebuild Jerusalem in this green and pleasant land.

Never before in its long evolution has the race realized its full capacity. Our fathers have told us, and we ourselves have known, of glorious sacrifices; but the past four years have exhausted in every direction the possibilities of human effort. And, as usual, among the nations the chief burden has fallen on that weary Titan, the Motherland,

> Bearing on shoulders immense,
> Atlantean, the load
> Well nigh not to be borne
> Of the too vast orb of her fate.

Not alone did she furnish the sinews of war, but she developed a spirit that made defeat impossible.

No wonder war has advocates, to plead the heroic clash of ideals, the purging of a nation's dross in the fire of suffering and sacrifice, and the welding in one great purpose of a scattered people. Even Montaigne, sanest of men, called it "the greatest and most magnificent of human actions"; and the glamours of its pride, pomp, and circumstance still captivate. But there are other sides which we should face without shrinking. Why dwell on the horrors such as we doctors and nurses have had to see? Enough to say that war blasts the soul, and in this great conflict the finer sense of humanity has been shocked to paralysis by the helplessness of our civilization and the futility of our religion to stem a wave of primitive barbarism. Black as are the written and unwritten pages of history, the concentrated and prolonged martyrdom surpasses anything man has yet had to endure. What a shock to the proud and mealy-mouthed Victorian who had begun to trust that Love was creation's final law, forgetting that Egypt and Babylon are our contemporaries and of yesterday in comparison with the hundreds of thousands of years since the Cave-dwellers left their records on walls and bones. In the mystic shadow of the Golden Bough, and swayed by the emotions of our savage ancestors, we stand aghast at the revelation of the depth and ferocity of primal passions which reveal the unchangeableness of human nature.

When the wild beast of Plato's dream becomes a waking reality, and a herd-emotion of hate sweeps a nation off its feet, the desolation that follows is wider than that in France and Belgium, wider even than the desolation of grief, and something worse—the hardened heart, the lie in the soul,—so graphically described in Book II of the *Republic,*—that forces us to do accursed things, and even to defend them! I refer to it because, as professors, we have been accused of sinning against the light. Of course we have. Over us, too, the wave swept, but I protest against the selection of us for special blame. The other day, in an address on "The Comradeship of Letters" at Turin, President Wilson is reported to have said: "It is one of the great griefs of this war that the Universities of the Central Empires used the thoughts of science to destroy mankind; it is the duty of the Universities of these States to redeem science from this disgrace and to show that the pulse of humanity beats in the classroom, and that there are sought out not the secrets of death but the secrets of life." A pious and worthy wish! but once in war a nation mobilizes every energy, and to say that science has been prostituted in discovering means of butchery is to misunderstand the situation. Slaughter, wholesale and unrestricted, is what is sought, and to accomplish this the discoveries of the sainted Faraday and of the gentle Dalton are utilized to the full, and to their several nations scientific men render this service freely, if not gladly. That the mental attitude engendered by science is apt to lead to a gross materialism is a vulgar error. Scientific men, in mufti or in uniform, are not more brutal than their fellows, and the utilization of their discoveries in warfare should not be a greater reproach to them than is our joyous acceptance of their success.

What a change of heart after the appalling experience of the first gassing in 1915! Nothing more piteously horrible than the sufferings of the victims has ever been seen in warfare.[1] Surely we could not sink to such barbarity! Is thy servant a dog! But martial expediency soon compelled the Allies to enlist the resources of chemistry; the instruction of our enemies was soon bettered, and before the Armistice there were developments in technique and destructive force that would have delighted Nisroch, who first invented aerial "machinations to plague the sons of men." A group of medical men representing the chief Universities and medical bodies of the United Kingdom was innocent enough to suggest that such an unclean weapon—the use of lethal gases, "condemning its victims to death by long-drawn-out torture," and with infinite possibilities for its further development—should be for ever abolished. "Steeped in folly by theories and prepossessions," failure to read the "lessons of war which should have sufficed to convince a beetle"—such were among the newspaper comments; and in other ways we were given to understand that our interference in such matters was most untimely. All the same, it is gratifying to see that the suggestion has been adopted at the Peace Congress.

With what a howl of righteous indignation the

[1] I am sorry to have seen Sargent's picture "Gassed" in this year's Academy. It haunts the mind like a nightmare.

slaughter of our innocent women and children by the bombing of open towns was received. It was a dirty and bloody business, worthy of the Oxydracians by means of Levin-bolts and Thunders and more horrible, more frightful, more diabolical, maiming, breaking, tearing and slaying more folk and confounding men's senses and throwing down more walls than would a hundred thunderblots (Rabelais, Book IV, ch. lxi).

Against reprisals there was at first a strong feeling. Early in 1916 I wrote to the *Times*: "The cry for reprisals illustrates the exquisitely hellish state of mind into which war plunges even sensible men. Not a pacifist, but a 'last ditcher,' yet I refuse to believe that as a nation, how bitter soever the provocation, we shall stain our hands in the blood of the innocent. In this matter let us be free from bloodguiltiness, and let not the undying reproach of humanity rest on us as on the Germans." Two years changed me into an ordinary barbarian. A detailed tally of civilians killed by our airmen has not, I believe, been published, but the total figures quoted are not far behind the German.

Could a poll have been taken a week before the Armistice as to the moral justification of the bombing of Berlin—for which we were ready—how we should have howled at the proposer of any doubt. And many Jonahs were displeased that a city greater than Nineveh, with more than the three score and ten thousand who knew not the right hand from the left, had been spared. We may deplore the necessity and lament, as did a certain great personage:

> . . . yet public reason just—
> Honour and empire with revenge enlarged
> . . . compels me now
> To do what else, though damned, I should abhor.

All the same, we considered ourselves "Christians of the best edition, all picked and culled," and the churches remained open, prayers rose to Jehovah, many of Whose priests—even His bishops!—were in khaki, and quit themselves like men—yes, and scores died the death of heroes! Into such hells of inconsistency does war plunge the best of us!

Learning—new or old—seems a vain thing to save a nation, but possibly as a set-off, science as represented by cellulose and sulphuric acid, may yet prove the best bulwark of civilization! In his *History of the Origin of Medicine* (1778, p. 30) Lettsom maintains that the invention of firearms has done more to prevent the destruction of the human species than any other discovery; he says: "Invention and discernment of mind have made it possible to reverse the ancient maxim that strength has always prevailed over wisdom." Science alone may prevent a repetition of the story of Egypt, of Babylonia, of Greece, and of Rome. The suggestion seems brazen effrontery when we have not even given the world the equivalent of the Pax Romana! Ah! what a picture of self-satisfied happiness in Plutarch! One envies that placid life in the midst of the only great peace the world has known, spanning a period of more than 200 years. And he could say, "No tumults, no civil sedition, no tyrannies, no pestilences nor calamities depopulating Greece, no epidemic disease needing powerful and choice drugs and medicines"; though as a Delphic priest there is a pathetic lament that the Pythian priestess has now only commonplace questions to deal with.[1] Surely those cultivated men of his circle must have felt that their house could never be removed. Has Science reached such control over Nature that she will enable our civilization to escape the law of the Ephesian, written on all known records—*panta rei*? Perhaps so, now that material civilization is world-

[1] Why the Pythian priestess, etc. (Plutarch's *Morals*, vol. iii, p. 100, Goodwin's edition).

wide; cataclysmic forces, powerful enough in centres of origin, may weaken as they pass out in circles. Let this be our hope in the present crisis. At any rate, in the free democracies in which Demos with safety says "L'État c'est moi," it has yet to be determined whether Science, as the embodiment of a mechanical force, can rule without invoking ruin. Two things are clear: there must be a very different civilization or there will be no civilization at all; and the other is that neither the old religion combined with the old learning, nor both with the new science, suffice to save a nation bent on self-destruction. The suicide of Germany, the outstanding fact of the war, followed an outburst of national megalomania. For she had religion—it may shock some of you to hear! I mean the people, not the writers or the thinkers, but the people for whom Luther lived and Huss died. Of the two devotional ceremonies which stand supreme in my memory, one was a service in the Dom, Berlin, in which "not the great nor well bespoke, but the mere uncounted folk" sang Luther's great hymn *Ein' feste Burg ist unser Gott.*"[1] With the Humanities Germany never broke, and the proportion of students in her Schools and Universities who studied Greek and Latin has been higher than any other country. You know better than I the innumerable classical studies of her scholars. In classical learning relating to science and medicine she simply had the field, for one scholar in other countries she had a dozen, and the monopoly of journals relating to the history of these subjects. And she had science, and led the world in the application of the products of the laboratory to the uses of everyday life—in commerce, in the Arts, and in war. Withal, like Jeshurun, she waxed fat; and did

[1] And the other, how different! The crowded Blue Mosque of Cairo, and the crowded streets with the thousands of kneeling Moslems awaiting the cry of the Muezzin from the tower.

ever such pride go before such destruction! What a tragedy that the successors of Virchow and Traube and Helmholtz and Billroth should have made her a byword among the nations! "Lilies that fester smell far worse than weeds!"

II

So much preliminary to the business before us, to meet changed conditions as practical men, with the reinforcement born of hope or with the strong resolution of despair.

For what does this Association stand? What are these classical interests that you represent? Take a familiar simile. By a very simple trick, you remember, did Empedocles give Menippus in the moon-halt—the first stage of his memorable trip—such long and clear vision that he saw the tribes of men like a nest of ants, a seething mass going to and fro at their different tasks. Of the function of the classical members in this myrmecic community there can be no question. Neither warriors, nor slaves, nor neuters, you live in a well-protected social environment, heretofore free from enemies, and have been well taken care of. I hate to speak of you as larvae, but as such, you perform a duty of the greatest import in this trophidium stage of your existence. Let me explain. From earliest days much attention has been paid by naturalists to the incredible affection—"incredible *στοργή*," Swammerdam calls it—which ants display in feeding, licking, and attending the larvae. Disturb a nest, and the chief care is to take them to a place of safety. This attention is what our symphilic community—to use a biological term—bestows on you. So intensely altruistic, apparently, is this behaviour, that for the very word "*στοργή*," which expresses the tenderest of all feelings, there is a difficulty in finding an equivalent ; indeed, Gilbert White used it almost as an English word. The truth is really very different. It has been shown that the nursing function—or instinct—is really trophallactic. In the case of the ant the nurse places the larva on its back, and the broad ventral service serves as a trough for the food, often predigested. The skill and devotion with which this is done are among the wonders in the life of the insect to which moralists have never tired of urging a visit. But listen to the sequel ! The larva is provided with a pair of rich honey-bags in the shape of salivary glands, big exudatoria from which is discharged an ambrosia greedily lapped up by the nurse, who with this considers herself well paid for her care. In the same manner, when the assiduous V.A.D. wasp distributes food to the larvae, the heads of which eagerly protrude from their cells, she must be paid by a draught of nectar from their exudatoria, while if it is not forthcoming the wasp seizes the head of the larva in her mandibles and jams it back into its cell and compels it to pay up. The lazy males will play the same game and even steal the much sought liquid without any compensatory gift of nourishment.[1]

What does the community at large, so careful of your comforts, expect from you ? Surely the honey-dew and the milk of paradise secreted from your classical exudatoria, which we lap up greedily in recensions, monographs, commentaries, histories, translations, and brochures. Among academic larvae you have for centuries absorbed the almost undivided interest of the nest, and not without reason, for the very life of the workers depends on the hormones you secrete. Though small in number, your group has an enormous kinetic value, like our endocrine organs. For man's body, too, is a humming hive of working cells, each with its specific

[1] Professor Wheeler in *Proceedings of Amer. Phil. Soc* vol. lvii, no. 4, 1918.

function, all under central control of the brain and heart, and all dependent on materials called hormones (secreted by small, even insignificant-looking structures) which lubricate the wheels of life. For example, remove the thyroid gland just below the Adam's apple, and you deprive man of the lubricants which enable his thought-engines to work—it is as if you cut off the oil-supply of a motor—and gradually the stored acquisitions of his mind cease to be available, and within a year he sinks into dementia. The normal processes of the skin cease, the hair falls, the features bloat, and the paragon of animals is transformed into a shapeless caricature of humanity. These essential lubricators, of which a number are now known, are called hormones —you will recognize from its derivation how appropriate is the term.

Now, the men of your guild secrete materials which do for society at large what the thyroid gland does for the individual. The Humanities are the hormones. Our friend Mr. P. S. Allen read before this Association a most suggestive paper on the historical evolution of the word Humanism. I like to think of the pleasant-flavoured word as embracing all the knowledge of the ancient classical world—what man knew of nature as well as what he knew of himself. Let us see what this University means by the *Literae Humaniores*. The " Greats " papers for the past decade make interesting study. With singular uniformity there is diversity enough to bear high tribute to the ingenuity of the examiners. But comparing the subjects in 1918 with those in the first printed papers of the School in 1831, one is surprised to find them the same—practically no change in the eighty-seven years ! Compare them, again, with the subjects given in John Napleton's *Considerations*, 1773—no change ! and with the help of Rashdall we may trace the story of the studies in Arts, only to find that as far back as 1267, with different names sometimes, they have been through all the centuries essentially the same—Greek and Latin authors, logic, rhetoric, grammar, and the philosophies, natural, moral, and metaphysical—practically the seven liberal Arts for which, as you may see by the name over the doors, Bodley's building provided accommodation. Why this invariableness in an ever-turning world? One of the marvels, so commonplace that it has ceased to be marvellous, is the deep rooting of our civilization in the soil of Greece and Rome—much of our dogmatic religion, practically all the philosophies, the models of our literature, the ideals of our democratic freedom, the fine and the technical arts, the fundamentals of science, and the basis of our law. The Humanities bring the student into contact with the master minds who gave us these things—with the dead who never die, with those immortal lives "not of now or of yesterday but which always were." As true to-day as in the fifth century B.C. the name of Hellas stands no longer for the name of a race, but as the name of knowledge; or, as more tersely put by Maine, "Except the blind forces of Nature, nothing moves [intellectually, he means] in this world that is not Greek in origin." Man's Anabasis from the old priest-ridden civilizations of the east began when "the light of reason lighted up all things," with which saying Anaxagoras expressed our modern outlook on life.

The Humanities have been a subject of criticism in two directions. Their overwhelming prominence, it is claimed, prevents the development of learning in other and more useful directions; and the method of teaching is said to be antiquated and out of touch with the present needs. They control the academic life of Oxford. An analysis of the Register for 1919 shows that of the 257 men comprising the Heads and Fellows of the twenty-three colleges (including St. Edmund's Hall), only fifty-one are scientific, including the mathematicians.

It is not very polite perhaps to suggest that as transmitters and interpreters they should not bulk quite so large in a modern University. Twas all very well

> . . . in days when wits were fresh and clear
> And life ran gaily as the sparkling Thames—

in those happy days when it was felt that all knowledge had been garnered by those divine men of old time, that there was nothing left but to enjoy the good things harvested by such universal providers as Isidore, Rabanus Maurus, and Vincent of Beauvais, and those stronger dishes served by such artists as Albertus Magnus and St. Thomas Aquinas—delicious blends of such skill that only the palate of an Apicius could separate Greek, Patristic, and Arabian savours.

It is not the dominance, but the unequal dominance that is a cause of just complaint. As to methods of teaching—by their fruits ye shall know them. The product of "Greats" needs no description in this place. Many deny the art to find the mind's construction in the face, but surely not the possibility of diagnosing at a glance a "first in Greats!" Only in him is seen that altogether superior expression, that self-consciousness of having reached life's goal, of having, in that pickled sentence of Dean Gaisford's Christmas sermon, done something "that not only elevates above the common herd, but leads not unfrequently to positions of considerable emolument." "Many are the wand-bearers, few are the mystics," and a system should not be judged by the exceptions. As a discipline of the mind for the few, the system should not be touched, and we should be ready to sacrifice a holocaust of undergraduates every year to produce in each generation a scholar of the type of, say, Ingram Bywater. 'Tis Nature's method—does it not cost some thousands of eggs and fry to produce one salmon?

But the average man, not of scholar timber, may bring one railing accusation against his school and college. Apart from mental discipline, the value of the ancient languages is to give a key to their literatures. Yet we make boys and young men spend ten or more years on the study of Greek and Latin, at the end of which time the beauties of the languages are still hidden because of the pernicious method in which they are taught. It passes my understanding how the more excellent way of Montaigne, of Milton, and of Locke should have been neglected until recently. Make the language an instrument to play with and to play with thoroughly, and recognize that except for the few in "Mods." and "Greats" it is superfluous to know how the instrument is constructed, or to dissect the neuro-muscular mechanism by which it is played. It is satisfactory to read that the Greek Curriculum Committee thinks "it is possible in a comparatively short time to acquire a really valuable knowledge of Greek, and to learn with accuracy and fair fluency some of the most important works in Greek literature." I am sure of it, if the teacher will go to school to Montaigne and feed fat against that old scoundrel Protagoras a well-earned grudge for inventing grammar—*pace* Mr. Livingstone, every chapter in whose two books appeal to me, except those on grammar, against which I have a medullary prejudice. I speak of course as a fool among the wise, and I am not pleading for the "Greats" men, but for the average man whom to infect with the spirit of the Humanities is the greatest single gift in education. To you of the elect this is pure camouflage—the amateur talking to the experts; but there is another side upon which I feel something may be said by one whose best friends have been the old Humanists, and whose breviary is Plutarch, or rather Plutarch gallicized by Montaigne. Paraphrasing Mark Twain's comment upon Christian Science, the so-called Humanists have not enough science, and Science sadly lacks the Humanities. This unhappy divorce, which should never have taken place, has been officially recognized in the two reports edited by Sir Frederic Kenyon,[1] which have stirred the pool, and cannot but be helpful. To have got constructive, anabolic action from representatives of interests so diverse is most encouraging. While all agree that neither in the Public Schools nor in the older Universities are the conditions at present in keeping with the urgent scientific needs of the nation, the specific is not to be sought in endowments alone, but in the leaven which may work a much needed change in both branches of knowledge.

III

The School of Literae Humaniores excites wonder in the extent and variety of the knowledge demanded, and there is everywhere evidence of the value placed upon the ancient models; but this wonder pales before the gasping astonishment at what is not there. Now and again a hint, a reference, a recognition, but the moving forces which have made the modern world are simply ignored. Yet they are all Hellenic, all part and parcel of the Humanities in the true sense, and all of prime importance in modern education. Twin berries on one stem, grievous damage has been done to both in regarding the Humanities and Science in any other light than complemental. Perhaps the anomalous position of science in our philosophical school is due to the necessary filtration, indeed the preservation, of our classical knowledge, through ecclesiastical channels.

[1] *Education, Scientific and Humane,* 1917, and *Education, Secondary and University,* 1919.

Of this the persistence of the Augustinian questions until late in the eighteenth century is an interesting indication. The moulder of Western Christianity had not much use for science, and the Greek spirit was stifled in the atmosphere of the Middle Ages. " Content to be deceived, to live in a twilight of fiction, under clouds of false witnesses, inventing according to convenience, and glad to welcome the forger and the cheat "—such, as Lord Acton somewhere says, were the Middle Ages. Strange is it not that one man alone, Roger Bacon, mastered his environment and had a modern outlook.[1]

The practical point for us here is that in the only school dealing with the philosophy of human thought, the sources of the new science that has made a new world are practically ignored. One gets even an impression of neglect in the Schools, or at any rate of scant treatment, of the Ionian philosophers, the very fathers of your fathers. Few " Greats " men, I fear, could tell why Hippocrates is a living force to-day, or why a modern scientific physician would feel more at home with Erasistratus and Herophilus at Alexandria, or with Galen at Pergamos, than at any period in our story up to, say, Harvey. Except as a delineator of character, what does the Oxford scholar know of Theophrastus, the founder of modern botany, and a living force to-day in one of the two departments of biology, and made accessible recently to English readers, —perhaps indeed to Greek readers!—by Sir Arthur Hort.[2] Beggarly recognition or base indifference is meted out to the men whose minds have fertilized science in every department. The pulse of every student should beat

[1] How modern Bacon's outlook was may be judged from the following sentence: " Experimental science has three great prerogatives over all other sciences—it verifies conclusions by direct experiment, it discovers truths which they could never reach, and it investigates the secrets of nature and opens to us a knowledge of the past and of the future."

[2] Loeb Series.

faster as he reads the story of Archimedes, of Hero, of Aristarchus, names not even mentioned in the " Greats " papers in the past decade. Yet the methods of these men exorcised vagaries and superstitions from the human mind and pointed to a clear knowledge of the laws of nature. It is surprising that some wag among the Examiners has never relieved the grave monotony of the papers by such peripatetic questions as " How long a gnat lives," " To how many fathoms' depth the sunlight penetrates the sea," and " What an oyster's soul is like "—questions which indicate whence the modern Lucian got his inspiration to chaff so successfully Boyle and the Professors of Gresham College.

May I dwell upon two instances of shocking neglect ? It really is amusing in Oxford to assert neglect of " the measurer of all Art and Science, whose is all that is best in the passing sublunary world," as Richard de Bury calls " the Prince of the Schooles." In Gulliver's voyage to Laputa he paid a visit to the little island of Glubbdubdrib, whose Governor, you remember, had an Endorian command over the spirits, such as Sir Oliver Lodge or Sir Arthur Conan Doyle might envy. When Aristotle and his commentators were summoned, to Gulliver's surprise they were strangers, for the reason that having so horribly misrepresented Aristotle's meaning to posterity, a consciousness of guilt and shame kept them far away from him in the lower world. Such shame, I fear, will make the shades of many classical dons of this University seek shelter with the commentators when they realize their neglect of one of the most fruitful of all the activities of the Master. In biology Aristotle speaks for the first time the language of modern science, and indeed he seems to have been first and foremost a biologist, and his natural history studies influenced profoundly his sociology, his psychology, and his philosophy in general. The beginner may be sent now to Professor

D'Arcy Wentworth Thomson's Herbert Spencer Lecture, 1913, and he must be indeed a dull and muddy-mettled rascal whose imagination is not fired by the enthusiastic—yet true—picture of the founder of modern biology, whose language is our language, whose methods and problems are our own, the man who knew a thousand varied forms of life, of plant, of bird, and animal, their outward structure, their metamorphosis, their early development; who studied the problems of heredity, of sex, of nutrition, of growth, of adaptation, and of the struggle for existence.[1] And the senior student, if capable of appreciating a biological discovery, I advise to study the account by Johannes Müller[1] (himself a pioneer in anatomy) of his rediscovery of Aristotle's remarkable discovery of a special mode of reproduction in one of the species of sharks. For 2,000 years the founder of the science of embryology had neither rival nor worthy follower. There is no reference, I believe, to the biological works in the Literae Humaniores papers for the past ten years, yet they form the very foundations of discoveries that have turned our philosophies topsy-turvy.

Nothing reveals the unfortunate break in Humanities more clearly than the treatment of the greatest Nature-poet in literature, a man who had " gazed on Nature's naked loveliness " unabashed, the man who united, as no one else has ever done, the " functions and temper and achievement of science and poetry " (Herford). The golden work of Lucretius is indeed recognized, and in Honour Moderations, Books I—III and V are set as one of seven alternatives in section D; and scattered through the " Greats " papers are set translations and snippets here and there; but anything like adequate consideration from the scientific side is to be sought in

[1] Summarized from D'Arcy Wentworth Thompson.
[2] *Ueber den Glatten Hai des Aristotles.* (Berlin, 1842.)

vain. Unmatched among the ancients or moderns is the vision by Lucretius of continuity in the workings of Nature—not less of *Le silence éternel de ces espaces infinis* which so affrighted Pascal, than of "the long limitless age of days, the age of all time that has gone by"—

> . . . longa diei
> infinita aetas anteacti temporis omnis.

And it is in a Latin poet that we find up-to-date views of the origin of the world and of the origin of man. The description of the wild discordant storm of atoms (Book V) which led to the birth of the world might be transferred verbatim to the accounts of Poincaré or of Arrhenius of the growth of new celestial bodies in the Milky Way. What an insight into primitive man and the beginnings of civilization! He might have been a contemporary and friend, and doubtless was a tutor, of Tylor. Book II, a manual of atomic physics with its marvellous conception of—

> . . . the flaring atom streams
> and torrents of her myriad universe,

can only be read appreciatively by pupils of Roentgen or of J. J. Thompson. The ring theory of magnetism advanced in Book VI has been reproduced of late by Parsons, whose magnetons rotating as rings at high speed have the form and effect with which this disciple of Democritus clothes his magnetic physics.

And may I here enter a protest? Of love-philtres that produce insanity we may read the truth in a chapter of that most pleasant manual of erotology, the *Anatomy of Melancholy*. Of insanity of any type that leaves a mind capable in lucid intervals of writing such verses as *De Rerum Natura* we know nothing. The sole value of the myth is its causal association with the poem of Tennyson. Only exsuccous dons who have never known the wiles and ways of the younger Aphrodite would take the intensity of the feeling in Book IV as witness to anything but an accident which may happen to the wisest of the wise, when enthralled by Vivien or some dark lady of the Sonnets !

In the School of Literae Humaniores the studies are based on classical literature and on history, "but a large number of students approach philosophical study from other sides. Students of such subjects as mathematics, natural science, history, psychology, anthropology, or political economy became naturally interested in philosophy, and their needs are at present very imperfectly provided for in this University." This I quote from a Report to the Board of the Faculty of Arts made just before the war on a proposed new Honour School, the subject of which should be the principles of philosophy considered in their relation to the Sciences. That joint action of this kind should have been taken by the Boards of Arts and of Science indicates a widespread conviction that no man is cultivated up to the standard of his generation who has not an appreciation of how the greatest achievements of the human mind have been reached ; and the practical question is how to introduce such studies into the course of liberal education, how to give the science school the leaven of an old philosophy, how to leaven the old philosophical school with the thoughts of science.[1]

It is important to recognize that there is nothing mysterious in the method of science, or apart from the ordinary routine of life. Science has been defined as the habit or faculty of observation. By such the child grows in knowledge, and in its daily exercise an adult lives and moves. Only a quantitative difference makes

[1] Since writing this lecture, Professor J. A. Stewart has sent me his just-published essay on *Oxford after the War and a Liberal Education*, in which he urges with all the weight of his learning and experience that the foundations of a liberal education in Oxford should be " No Humane Letters without Natural Science and no Natural Science without Humane Letters."

observation scientific—accuracy—in that way alone do we discover things as they really are. This is the essence of Plato's definition of science as " the discovery of things as they really are," whether in the heavens above, in the earth beneath, or in the observer himself. As a mental operation, the scientific method is equally applicable to deciphering a bit of Beneventan script, to the analysis of the evidence of the Commission on Coal-mines, a study of the mechanism of the nose-dive, or of the colour-scheme in tiger-beetles. To observation and reasoned thought, the Greek added experiment, but never fully used it in biology, an instrument which has made science productive, and to which the modern world owes its civilization. Our everyday existence depends on the practical application of discoveries in pure science by men who had no other motives than a search for knowledge of Nature's laws, a disinterestedness which Burnet claims to be the distinctive gift of Hellas to humanity. With the discovery of induced currents Faraday had no thought of the dynamo. Crookes' tubes were a plaything until Roentgen turned them into practical use with the X-rays. Perkin had no thought of transforming chemical industry when he discovered aniline dyes. Priestley would have cursed the observation that an electrical charge produced nitrous acid had he foreseen that it would enable Germany to prolong the war, but he would have blessed the thought that it may make us independent of all outside sources for fertilizers.

The extraordinary development of modern science may be her undoing. Specialism, now a necessity, has fragmented the specialities themselves in a way that makes the outlook hazardous. The workers lose all sense of proportion in a maze of minutiae. Everywhere men are in small coteries intensely absorbed in subjects of deep interest, but of very limited scope. Chemistry, a century ago an appanage of the Chair of Medicine or even of Divinity, has now a dozen departments, each with its laboratory and literature, sometimes its own society. Applying themselves early to research, young men get into backwaters far from the main stream. They quickly lose the sense of proportion, become hypercritical, and the smaller the field, the greater the tendency to megalocephaly. The study for fourteen years of the variations in the colour-scheme of the 1,300 species of tiger-beetles scattered over the earth may sterilize a man into a sticker of pins and a paster of labels; on the other hand, he may be a modern biologist whose interest is in the experimental modification of types, and in the mysterious insulation of hereditary characters from the environment. Only in one direction does the modern specialist acknowledge his debt to the dead languages. Men of science pay homage, as do no others, to the god of words whose magic power is nowhere so manifest as in the plastic language of Greece. The only visit many students pay to Parnassus is to get an intelligible label for a fact or form newly discovered. Turn the pages of such a dictionary of chemical terms as Morley and Muir, and you meet in close-set columns countless names unknown a decade ago, and unintelligible to the specialist in another department unless familiar with Greek, and as meaningless as the Arabic jargon in such mediaeval collections as the Synonyma of Simon Januensis or the Pandects of Matheas Sylvaticus. As *Punch* put it the other day in a delightful poetical review of Professor West's volume:[1]

> Botany relies on Latin ever since Linaeus' days;
> Biologic nomenclature draws on Greek in countless ways;
> While in Medicine it is obvious you can never take your oath
> What an ailment means exactly if you haven't studied both.
> (17. iv. 19.)

[1] *The Value of the Classics*, Princeton University Press, 1917.

Let me give a couple of examples.

Within the narrow compass of the primitive cell from which all living beings originate, onomatomania runs riot. The process of mitosis has developed a special literature and language. Dealing not alone with the problems of heredity and of sex, but with the very dynamics of life, the mitotic complex is much more than a simple physiological process, and in the action and interaction of physical forces the cytologist hopes to find the key to the secret of life itself. And what a Grecian he has become! Listen to this account which Aristotle would understand much better than most of us.

The karyogranulomes, not the idiogranulomes or microsomenstratum in the protoplasm of the spermatogonia, unite into the idiosphaerosome, acrosoma of Lenhossék, a protean phase, as the idiosphaerosome differentiates into an idiocrytosome and an idiocalyptosome, both surrounded by the idiosphaerotheca, the archoplasmic vesicle; but the idioectosome disappears in the metamorphosis of the spermatid into a sphere, the idiophtharosome. The separation of the calyptosome from the cryptosome antedates the transformation of the idiosphaerotheca into the spermiocalyptrotheca.[1]

Or take a more practical if less Cratylean example. In our precious cabbage patches the holometabolous insecta are the hosts of parasitic polyembryonic hymenoptera, upon the prevalence of which rests the psychic and somatic stamina of our fellow-countrymen; for the larvae of *Pieris brassicae*, vulgarly cabbage butterfly, are parasitiased by the *Apantales glomeratus*, which in turn has a hyperparasite, the *Mesochorus pallidus*. It is tragic to think that the fate of a plant, the dietetic and pharmaceutical virtues of which have been so extolled by Cato, and upon which two of my Plinean

[1] Of course I have made this up out of a recent number of the *American Journal of Anatomy*, 24. 1.

colleagues of uncertain date, Chrysippus and Dieuches, wrote monographs—it fills one with terror to think that a crop so dear to Hodge (*et veris cymata!* the Brussels sprouts of Columella) should depend on the deposition in the ovum of the Pieris of another polyembryonic egg. The cytoplasm or ooplasm of this forms a trophoamnion and develops into a polygerminal mass, a spherical morula, from which in turn develop a hundred or more larvae, which immediately proceed to eat up everything in and of the body of their host. Only in this way does Nature preserve the Selenas, the Leas, and the Crambes, so dear to Cato and so necessary for the sustenance of our hard-working, brawny-armed Brasserii.

From over-specialization scientific men are in a more parlous state than are the Humanists from neglect of classical tradition. The salvation of science lies in a recognition of a new philosophy—the *scientia scientiarum*, of which Plato speaks. "Now when all these studies reach the point of intercommunion and connection with one another and come to be considered in their mutual affinities, then I think, and not till then, will the pursuit of them have a value." Upon this synthetic process I hesitate to dwell; since like Dr. Johnson's friend, Oliver Edwards, I have never succeeded in mastering philosophy—cheerfulness was always breaking in.

In the proposed Honour School the principles of philosophy are to be dealt with in relation to the sciences, and by the introduction of literary and historical studies, which George Sarton advocates so warmly as the new Humanism,[1] the student will gain a knowledge of the evolution of modern scientific thought. But to limit the history to the modern period—Kepler to the present time is suggested—would be a grave error. The scientific student should go to the sources and in some way

[1] *Popular Science Monthly*, September 1918, and *Scientia*, vol. xxiii. 3.

be taught the connection of Democritus with Dalton, of Archimedes with Kelvin, of Aristarchus with Newton, of Galen with John Hunter, and of Plato and Aristotle with them all. And the glories of Greek science should be opened in a sympathetic way to "Greats" men. Under new regulations at the Public Schools, a boy of sixteen or seventeen should have enough science to appreciate the position of Theophrastus in Botany, and perhaps himself construct Hero's fountain. Science will take a totally different position in this country when the knowledge of its advances is the possession of all educated men. The time too is ripe for the Bodleian to become a *studium generale*, with ten or more departments, each in charge of a special sub-librarian. When the beautiful rooms, over the portals of which are the mocking blue and gold inscriptions, are once more alive with students, the task of teaching subjects on historical lines will be greatly lightened. What has been done with the Music-room, and with the Science-room through the liberality of Dr. and Mrs. Singer, should be done for classics, history, literature, theology, etc., each section in charge of a sub-librarian who will be Doctor perplexorum alike to professor, don, and undergraduate.

I wish time had permitted me to sketch even briefly the story of the evolution of science in this old seat of learning. A fortunate opportunity enables you to see two phases in its evolution. Through the kind permission of several of the Colleges, particularly Christ Church, Merton, St. John's, and Oriel, and with the cooperation of the Curators of the Bodleian and Dr. Cowley, Mr. R. T. Gunther, of Magdalen College, has arranged a loan exhibition of the early scientific instruments and MSS. A series of quadrants and astrolabes show how Arabian instruments, themselves retaining much of the older Greek models, have translated Alexandrian science into the Western world. Some were constructed for the latitude of Oxford, and one was associated with our astronomer-poet Chaucer.

For the first time the instruments and works of the early members of the Merton School of astronomer-physicians have been brought together. They belong to a group of men of the fourteenth century—Reed, Aschenden, Simon Bredon, Merle, Richard of Wallingford, and others—whose labours made Oxford the leading scientific University of the world.

Little remains of the scientific apparatus of the early period of the Royal Society, but through the kindness of the Dean and Governing Body of Christ Church, the entire contents of the cabinet of philosophical apparatus of the Earl of Orrery, who flourished some thirty years after the foundation of the Society, is on exhibit, and the actual astronomical model, the "Orrery," made for him and called after his name.[1]

The story of the free cities of Greece shows how a love of the higher and brighter things in life may thrive in a democracy. Whether such love may develop in a civilization based on a philosophy of force is the present problem of the Western world. To-day there are doubts, even thoughts of despair, but neither man nor nation is to be judged by the behaviour in a paroxysm

[1] Among other notable exhibits there are:

1. A series of astronomical volvelles in manuscripts and printed books.

2. The printed evidence that Leonard Digges of University College was the inventor of the telescope many years before Galileo.

3. The mathematical work of Robert Recorde of All Souls' College, in which he suggested the St. Andrew's Cross as the sign of multiplication, and uses symbols +, −, =.

4. The earliest known slide-rule in a circular form, recently discovered in St. John's College.

5. The early vellum and wooden telescopes of the Orrery Collection.

6. An original Marshall microscope.

7. Early surveying instruments, including the great quadrate of Schissler.

of delirium. Lavoisier perished in the Revolution, and the Archbishop of Paris was butchered at the altar by the Commune, yet France was not wrecked; and Russia may survive the starvation of such scholars as Danielevski and Smirnov, and the massacre of Botkin. To have intelligent freemen of the Greek type with a stake in the State (not mere chattels from whose daily life the shadow of the workhouse never lifts), to have the men and women who could love the light put in surroundings in which the light may reach them, to encourage in all a sense of brotherhood reaching the standard of the Good Samaritan—surely the realization in a democracy of such reasonable ambitions should be compatible with the control by science of the forces of nature for the common good, and a love of all that is best in religion, in art, and in literature.

Amid the smoke and squalor of a modern industrial city, after the bread-and-butter struggle of the day, "the Discobolus has no gospel." Our puritanized culture has been known to call the Antinous vulgar. Copies of these two statues, you may remember, Samuel Butler found stored away in the lumber-room of the Natural History Museum, Montreal, with skins, plants, snakes, and insects, and in their midst, stuffing an owl, sat "the brother-in-law of the haberdasher of Mr. Spurgeon." Against the old man who thus blasphemed beauty, Butler broke into those memorable verses with the refrain "O God! O Montreal!"

Let us not be discouraged. The direction of our vision is everything, and after weltering four years in chaos poor stricken humanity still nurses the unconquerable hope of an ideal state "whose citizens are happy . . . absolutely wise, all of them brave, just, and self-controlled . . . all at peace and unity and in the enjoyment of legality, equality, liberty, and all other good things." Lucian's winning picture of this "Universal Happiness" might have been sketched by a Round Table pen or some youthful secretary to the League of Nations. That such hope persists is a witness to the power of ideals to captivate the mind; and the reality may be nearer than any of us dare dream. If survived, a terrible infection, such as confluent smallpox, seems to benefit the general health. Perhaps such an attack through which we have passed may benefit the body cosmic. After discussing the various forms of Government, Plato concludes that "States are as the men are, they grow out of human characters" (*Rep.* VIII), and then, as the dream-republic approached completion, he realized that after all the true State is within, of which each one of us is the founder, and patterned on an ideal the existence of which matters not a whit. Is not the need of this individual reconstruction the Greek message to modern democracy? and with it is blended the note of individual service to the community on which Professor Gilbert Murray has so wisely dwelt.

With the hot blasts of hate still on our cheeks, it may seem a mockery to speak of this as the saving asset in our future; but is it not the very marrow of the teaching in which we have been brought up? At last the gospel of the right to live, and the right to live healthy, happy lives, has sunk deep into the hearts of the people; and before the war, so great was the work of science in preventing untimely death that the day of Isaiah seemed at hand "when a man's life should be more precious than fine gold, even a man than the gold of Ophir." There is a sentence in the writings of the Father of Medicine upon which all commentators have lingered, "ἢν γὰρ παρῇ φιλανθρωπίη, πάρεστι καὶ φιλοτεχνίη [1]— the love of humanity associated with the love of his craft!—philanthropia and philotechnia—the joy of working joined in each one to a true love of his brother.

[1] *Œuvres complètes d'Hippocrates.* Par E. Littré, t. ix, 258.

Memorable sentence indeed! in which for the first time was coined the magic word *philanthropy*, and conveying the subtle suggestion that perhaps in this combination the longings of humanity may find their solution, and Wisdom—philosophia—at last be justified of her children.

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BIOGRAPHY.

Sir Victor Horsley: A Study of his Life and Work. By STEPHEN PAGET. (London: Constable & Co.) 21*s.* net.

Victor Horsley died of heat-stroke in Mesopotamia in September 1916—by far the most distinguished medical victim of the War, whether among our own troops or with those of the Allies.

He was the outstanding British surgeon of his generation—the only one who had the good fortune to create a new department of Surgery. Lister's work had enabled surgeons to open with safety the cavities of the body—the joints, the abdomen, and thorax. Horsley demonstrated that with equal safety the skull and the spinal canal could be explored for the removal of tumours and foreign bodies, abscesses, &c. Starting as a physiologist, and working with Schäfer at the localization of the functions of the brain, he acquired a technique hitherto unequalled. Operating on monkeys, he found that with proper precautions the most extensive explorations of the brain and cord could be done successfully.

In 1886 he was appointed Surgeon to the National Hospital for Nervous Diseases, Queen Square. There had been operations on the brain before Horsley began his epoch-making work that year. Macewen of Glasgow, in particular, had done pioneer work, but, as Mr. Paget says, "We can count on our fingers the cases of modern brain-surgery recorded in our surgical literature up to the time of Horsley's appointment to Queen Square." Then came a revolution: in that year he operated upon ten cases of serious brain disease, in nine successfully. He was in his twenty-ninth year, and already the story of his extraordinary results had begun to bring visiting surgeons from all parts of the world. In 1887 he removed successfully a tumour from the spinal cord—perhaps the most brilliant operation in the whole history of surgery. The victory was won. The young physiologist, trained in surgery by operating upon monkeys, had done what the leading authority on diseases and injuries of the spinal cord had declared only a few years before to be "not within the range of practical surgery." It was a great triumph, and deservedly brought fame and success. With two other pieces of work Horsley's name will always be associated—the functions of the Thyroid Gland, and the nature and control of Hydrophobia, but they are not in the same class as the studies just referred to.

Though absorbed in hospital and private practice, Horsley never lost touch with experimental work, and was never happier than directing the researches of his students. The pity is that a man of his type and talents should have had to leave the laboratory to gain a living; but an unparalleled success seemed to justify it. There is a tragedy in Horsley's life—so full, so complete, so satisfactory. For a man to have an avocation is wise, but to get mixed up as he did with politics, in such a way as to alienate his friends, was a sad ending in a great career. And it was so unnecessary. With this aspect of his life Mr. Paget deals fully and most discreetly, but it is not pleasant reading. I have received a letter from one of Horsley's oldest pupils writing about this book, and from it I must quote a paragraph:—

> . . . A pathfinder, who unravelled difficulties in most various branches, a European—or, indeed, a world-wide celebrity at an age when other young medical men are hardly ever heard of, the most generous collaborator and friend to all young scientific workers, most unselfish, animated by none but the noblest feelings, a protagonist of all oppressed, chaperoning their causes without the least regard to his own career. . . .

Such was Victor Horsley, as many of us knew him, and as we love to think of him.

Mr. Stephen Paget has performed a very difficult task with rare ability. As Lady Horsley says in a prefatory note, it would be hard to find two men more widely separated in their mental attitude—differing in religious convictions, in politics, in social ideas; and it was both courageous and gracious on her part not to attempt to suppress or to soften in any way the critical attitude of the author.

The peace which would have been denied him at home he finds in a soldier's grave in Mesopotamia—and perhaps better so:—

> He has outsoared the shadow of our night;
> Envy and calumny and hate and pain,
> And that unrest which men miscall delight,
> Can touch him not and torture not again;
> From the contagion of the world's slow stain
> He is secure, and now can never mourn
> A heart grown cold, a head grown grey in vain.

WILLIAM OSLER.