VOL. XII, NO. 2
[OLD SERIES]

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[NEW SERIES]

Queen's Medical Quarterly

PUBLISHED BY THE MEDICAL FACULTY OF QUEEN'S UNIVERSITY.

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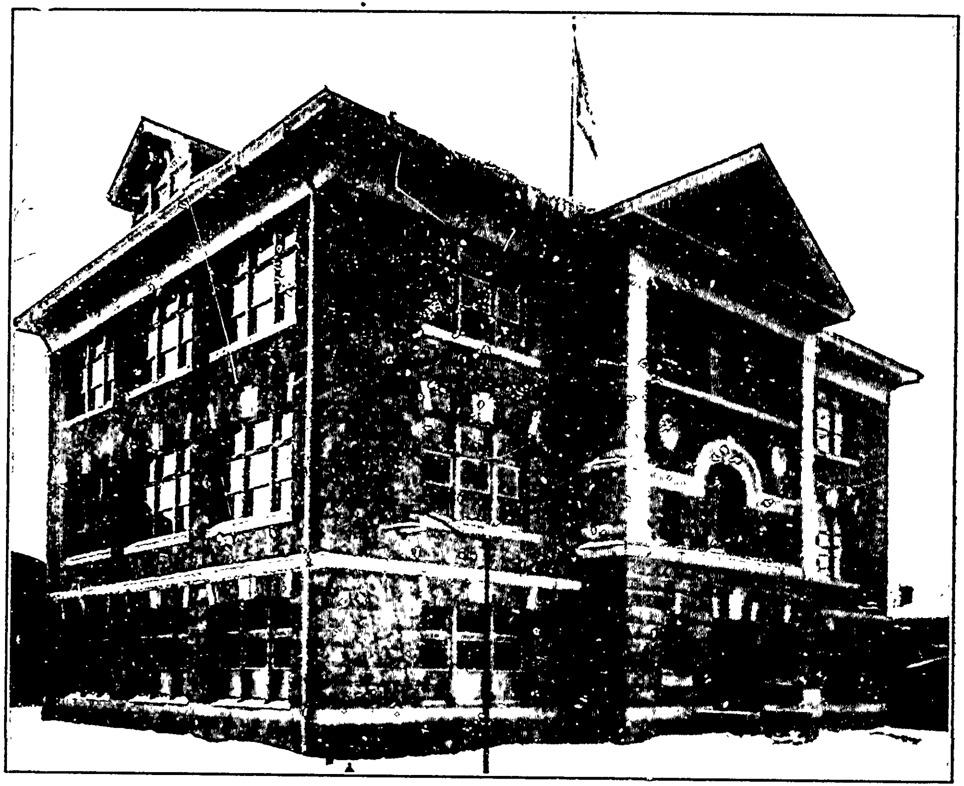

NEW MEDICAL LABORATORIES

QUEEN'S MEDICAL QUARTERLY

VOL. XII, No. 2 Old Series | JANUARY, 1908. | VOL. V, No 2 New Series

Queen's Medical Quarterly is presented to the Medical Profession with the compliments of Queen's Medical Faculty. Contributions will be gladly received from members of the Profession and willingly published.

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THE January number of the Medical Quarterly has been delayed to give its readers a full account of the opening of the new Medical Laboratories.

* * *

In reviewing the results of the last municipal elections, it can be readily seen that members of the medical profession are taking an active interest in civic government. This is as it should be, because every physician and surgeon should possess the education, tact and acquaintance with the interests and needs of his locality which are necessary qualities for a municipal representative. He should also be willing to sacrifice sufficient of his spare time for the good of his municipality and, by doing so, gain an experience amply remunerative for his sacrifice.

* * *

In the last number of the Medical Quarterly a criticism was made on the water supply of the military camps. There may be many faults in the present system but a short summary of a few radical changes in the Department rendered during the last few years may prove interesting and satisfy the people at large that the Medical Department of the militia is alive to its responsibility.

First, a fully organized Medical Corps has been formed and divided into a number of Field Ambulance, each one subdivided into a Hospital, Bearer and Transport section, and ready at any time for active service. Each unit has a very serviceable equipment in tents, ambulances, wagons, instruments, medical supplies, and a splendid acetylene apparatus for light. One wonders now how the old arrangement with a principal medical officer, regimental surgeons and a makeshift hospital was endured for any length of time. The Department also allows a reasonable expenditure for necessary medical supplies not contained in the regulation list.

Secondly, an examination of all camp water is made from time to time, but the supply and the source has often been changed owing to the contract system in vogue, which is largely operated by political pull, and to this the greatest amount of the dissatisfaction is largely due.

Thirdly. one needs only to visit the camps to see the greatest care exercised in caring for the sanitary conditions of the camps.

Lastly, a statistical report of the medical conditions and a list of diseases at each camp is published, by which a most useful comparison can be made of each camp.

Such are a few changes noted during the last few years, sufficient to show that the Medical Department is keeping stride with the best. The Medical Department is stimulated to greater usefulness and a keener endeavour to meet their responsibility in preserving the healthiest condition for the men in the service.

* * *

A most important step has been taken by the Faculty in the adoption of a five year curriculum based on the regulations of the Ontario Medical Council. This means that students beginning the study of medicine in September, 1908, and thereafter will require five years' study for the degrees of M.D. and C.M. At the end of four years the degree of M.B. will be available to those who complete the four years course as it now stands. For the fifth year there will be three optional courses of study. The full year may be spent as House Surgeon in a Hospital; or six months may be spent with a qualified practitioner and six months attending clinics at a Hospital; or six months with a practitioner and six months in a medical school.

To secure proper supervision it is proposed that the fifth year students inform the Secretary of the Faculty how the year is being spent and that the certificate presented at the end of the fifth year must be accompanied by a declaration as to the work done.

The examinations at the end of the fifth year will be clinical and practical.

The advantages to the student from the proposed regulations are, (1) supervision by the Faculty of the fifth year studies already required by the Council; (2) no material increase in the cost of the whole course; (3) the degree of M.B. will be available for those who propose to secure a license to practice from an examining body exacting only a four years course.

Further details will appear in the forthcoming Calendar.

ON January 14th, 1908, the new Medical Laboratory was formally opened for inspection and dedication to the study of particular subjects. The Faculty were fortunate in the choice of the bright day and the choice of a galaxy of brilliant and renowned men who extended to Queen's greetings and good feelings from other Universities.

The building is one of the most beautiful and when completed will be the most complete and artistic in its furnishing of all erected on Queen's campus. Dean Connell paid a well-earned compliment to the architect, the builder and the company who supplied the furnishings. Visitors to Convocation will be well repaid by a visit within its walls. If all grants from the Whitney Government are as well expended, the people of Ontario may well entrust to them the guardianship of the public money chests.

The addresses were so excellent, and so thoroughly enjoyed, that the delay in the issue of this number of the Quarterly will be forgiven and forgotten in the pleasure of reading them as contained herein. Owing to the illness of the Chancellor, Sir Sandford Fleming, Principal Gordon occupied the chair. After Rev. Dr. Macgillivray offered the dedicatory prayer, Dean Connell made the following address:

DEAN CONNELL'S ADDRESS.

THE exercises in which we are engaged to-day form an incident in the history of the medical faculty of the greatest importance to the university and the community.

Even in a progressive institution the changes come slowly and the pace may not be perceived by those most concerned except upon occasions such as the present which serve as landmarks in its evolution.

You will permit me to refer briefly to the events of importance in the life of the school. In 1855 the first class graduated. In 1858, just fifty years ago, the old medical building was erected. In '66 the Faculty left the University and abandoned the building, but continued its existence under the charter of the Royal College. In 1880 it returned to its own building. In '92 it again became a Faculty of the University. Then in 1901 a considerable addition was made to the old building.

That the school passed safely through the perils of its first fifty years was due to the self-sacrifice and devotion of the past generation of gentlemen composing the medical profession of this city. It seems most fitting that I should recall to-day the names of these gentlemen, once familiar and much loved in sick room and college hall, now for the most part long forgotten: John R. Dickson, John Stewart, Horatio Yates, Octavius Yates, M. Lavell, Thomas R. Dupuis, C. A. Irwin, A. S. Oliver, W. H. Henderson, H. J. Saunders, K. N. Fenwick, Fife Fowler, John Herald.

One other name I mention, the name of one who is still with us, but much to our regret, not of us, the Hon. Senator Sullivan, who for many years gave of his best to the school and brought lustre and renown to its reputation.

We have entered into their labors and profit by their example of self-denial and foresight.

To-day we are directly indebted to the present legislation of the province for the building which you have just inspected. In their wisdom and generosity they adopted the principle of state aid for medical education, a policy I am well assured has the approval not only of those engaged in this work, but of the whole people of the province.

We are fortunate in having with us to-day the Hon. Dr. R. A. Pyne, Minister of Education, representing the Legislature, and on behalf of the Faculty I thank him for his personal interest and I ask him to receive and to convey to Mr. Whitney and his colleagues the assurances of our appreciation of what they have done for the school.

The Building Committee had the sum of $50,000 available and it has been most carefully administered and will not be exceeded. The architects, Messrs. Power & Son, have given us most efficient and satisfactory service and are to be congratulated upon the design and arrangement of the building. Unfortunately all the equipment is not yet in place but enough can be seen to give a fair idea of what it will be when completed. The thanks of the Committee are especially due to the following contractors: Mr. Wm. McCartney, Messrs. Hunter and Harold, Messrs. T. McMahon & Co. and the Berlin Interior Hardwoor Co.

In the new building accommodation is provided for Biology, Physiology, Histology, Pathology and Bacteriology. There will also be rooms for the Public Health work which has grown in a few years to be a considerable tax upon our resources. During the year just ended no less than 1,545 examinations have been made free of expense to the public, and the specimens have come from all over the province, from Fort William and Essex County in the west to the extreme eastern limit. There will also be the department in connection with the dairy interests. Pure cultures are supplied to all the cheese factories throughout eastern Ontario from our laboratories, and problems connected with this important industry are constantly being studied. Dairy bacteriology has had a considerable development in the past fifteen years in our laboratories.

It is very gratifying that Dr. Barker has been good enough to come to speak to us to-day and in the name of the Faculty I bid him heartily welcome and venture to express the hope that this is only the first of a series of visits to us.

We are also honored with the visit of Dean Reeve and Dr. McCallum of Toronto, and of Dr. Adami of McGill, and we hasten to assure them that we desire to compete with them in the quality of the work done. We have as many students as we can properly care for and if there is any feeling of rivalry on our part it is only in the generous spirit of an endeavor to produce results at least equal to theirs, though we are blest with few of the material advantages which they enjoy.

Fellow-students and colleagues: To-day we dedicate another temple to Aesculapius and kindle upon its altar the divine fire. Let it be ours, throughout our day and generation, to strive to maintain and enhance the brilliancy of its flame so that its rays may penetrate to the four quarters of the earth.

The Principal then called on Dr. Barker, of Johns Hopkins University, to deliver the address of the day.

MEDICAL LABORATORIES; THEIR RELATIONS TO MEDICAL PRACTICE AND TO MEDICAL DISCOVERY

BY LEWELLYS F. BARKER, M.D.,

Professor of Medicine, Johns Hopkins University, Baltimore; Physician-in-Chief to the Johns Hopkins Hospital.

(An address delivered at the formal opening of the Medical Laboratories Building, Queen's University, Kingston, Canada, January 14th, 1908).

TO be asked to give an address on an occasion so worthy of joyful and honorable celebration as that which has brought us together to-day is an honor of which I am far from being insensible. When the invitation to the formal opening of your new building came in letters from my former schoolmate, Dr. Third, and the dean of your medical faculty, Dr. Connell, I was much pleased; though I knew that it came to me mainly on account of the fact that I happen to occupy a chair in an institution especially identified with medical laboratories, medical instruction and medical research, I could not help but feel grateful to fortuity for the favor she brought. Born in Canada, educated in Canadian schools, a graduate of a medical college in this Province and at one time licensed to practice among the people of Ontario, I have every reason for filial affection to this great country and rejoice in my right to share your pride in its phenomenal advance. And no advance seems to me greater than that which you have been making in the betterment of medical education and in the promotion of medical knowledge; one striking evidence of it is before us in the new building which you have just now met to dedicate.

The subject which I have chosen for my remarks, namely, Medical Laboratories, their Relations to Medical Practice and to Medical Discovery, is of such great importance that I wish I felt myself more competent adequately to discuss it. The topic has the advantage, however, that no skill on my part is necessary to excite your interest in it for the current of your thought is, by the occasion, set in its direction. The completion of this building indicates the lively sympathy of members of your university with laboratory medicine; the substantial aid which an enlightened legislature has given you is proof that there is already some appreciation of the fact that the benefit of such laboratories is not to individuals alone but also to the people at large and that the appropriation of public funds for their construction and maintenance is justifiable. Without occupying a great deal of your time or dissipating too much of your energy I shall try to make plain to the less medical portion of this audience how it is that medical laboratories such as have been built here have become a necessity, how indispensable they are for the training of doctors who are to care for the sick, of what use they may be in helping physicians actually to utilize, in cases of serious illness, the fruits of the more recent medical discoveries, and finally how, if provision be made in them, as should be and doubtless will be, for the undertaking of original investigations directed toward the solution of some of the medical problems now pressing, we may hope that here in Kingston new knowledge may be acquired which will make medical men able, better than now, accurately to predict, and give them greater power than they yet possess to cure and to control. And while I congratulate you heartily on the position to which you have now attained in the matter of laboratories, I intend to point out (what those among you best informed as to medical progress fully realize) that the policy of laboratory expansion upon which you have entered is in reality but a beginning and will lead irresistibly later on to still further, and perhaps fully as important, developments in your medical school.

THE DEVELOPMENT OF SCIENTIFIC MEDICINE AND OF MEDICAL LABORATORIES.

Everyone knows nowadays what is meant by the scientific method. It consists in gathering facts carefully, arranging them according to their similarities and sequences and finally epitomizing them in the form of brief formulas or so-called general laws. As a result thought is economized and suitable action follows most surely and quickly upon impressions of sense.

Medical science, like all natural science, began with simple observation. The physician first by means of his unaided sense-organs collected sense impressions. This simple observation could not, however, take him very far, for it was too inexact. It became necessary to invent artificial aids for extending the powers of the sense organs and for rendering their measurements more precise. Medical men learned how to experiment so that their observations could be made under peculiarly favorable circumstances. They have found out how to interrogate Nature and to compel her to answer;

on inquiry they see to it that their attention is specially prepared; their interest in observation is sharpened by the particular question asked.

Hippocrates, the most accurate of ancient medical observers, realized the importance of contact with natural objects; it was his opinion that this must be the basis of all medical knowledge. "The student must rub and grind at nature, using his reason at the same time; but his reason must be a perceptive and interpretative, not a productive faculty, for he who lends himself to plausible ratiocination will find himself ere long in a blind alley; and those who have pursued this course have done no enduring service to medicine." It was the accessibility of external medicine or surgery to direct observation that accounts for the more solid foundation early laid in that branch of medicine; inner medicine, in which there was but relatively little opportunity for direct observation, was the field for rank speculation for centuries, and it was not until experimental researches began to be undertaken systematically that inner, as contrasted with outer, medicine began to make significant progress.*

The history of the development of experimental work is very closely connected with the history of scientific laboratories. The bibliography of this subject is surprisingly small; an unusual opportunity for an interesting and instructive historical contribution lies open to him who will trace carefully the origins of laboratory work and their relation to the development of natural science in general.† In the third century before Christ several natural sciences, including anatomy, physiology and pathology, were cultivated in state-supported institutes in Alexandria. Though the apparatus was probably crude, there is evidence that students in these institutes studied nature by coming into direct personal contact with the objects of study. With the decline of the Alexandrian school, however, this method of practical study fell into desuetude, and, except for the experimental physiological methods of Galen (2nd century A.D.), and perhaps a little anatomical work at Salernum (13th century), it was chiefly the surgeons—men like Hugh of Lucca, Theodoric of

*cf. Allbutt (T. C.). The historical relations of medicine and surgery. Reports of the Congress of Arts and Science, Universal Exposition, St. Louis, 1904, Vol. vi; Boston and New York, 1906, 189-209.

†An excellent resume of the subject as far as medical laboratories are concerned is to be found in an address by Professor W. H. Welch, entitled, The evolution of modern scientific laboratories. An address delivered at the opening of the William Pepper Laboratory of Clinical Medicine. J. H. Hosp. Bull., Balt., 1896, vii, 19-24.

Cervia, Guy of Chauliac—who, keeping their hands at work, managed to cultivate medical studies more or less objectively. Benivieni (1448-1502), the founder of the craft of pathological anatomy and forerunner of Morgagni, seems to have been " the first to make the custom, and to declare the need of necropsy to reveal what he called . . . the hidden causes of diseases." In the 15th and 16th centuries came the great development of human anatomy. Vesalius published his wonderful volume in 1543, and anatomy has ever since his time been studied by dissection of the human body. Anatomical laboratories for teaching and investigation have been in existence for more than three hundred years; indeed the anatomical laboratory has priority in foundation over all other scientific laboratories.

It was not, however, until the 19th century that the scientific spirit and scientific work became the main characteristic of the age. The 19th century has been designated therefore the scientific century, just as the 18th was called the philosophical century, the 16th the century of the Reformation, and the 15th the century of the Renaissance.* The great inventions before the 19th century were made without special scientific knowledge and were brought about 'more by accident or by the practical requirements of the age than by the power of an unusual insight acquired by study.' During the last fifty years the great discoveries have been made in scientific laboratories. Whereas, formerly, necessity was the mother of invention, latterly the tables have been turned and scientific discoveries have produced new practical needs and created new spheres of labour, industry and commerce.

Though physical researches were carried on from the time of Galileo downward and chemical work goes back to the age of the alchemists who sought for the philosopher's stone, the first distinctly modern scientific laboratories appeared in Europe in 1824 and 1825. In the former year Purkinje established a physiological laboratory in Breslau, and the year after Liebig, in Giessen, opened a chemical laboratory for the use of students and investigators; the latter labtory, stimulated from two independent centres—Berzelius' laboratory in Sweden and Gay-Lussac's in Paris—and developing in the atmosphere of the German ideal of *Wissenschaft,* was destined to exert the greatest influence upon the development and organization of other laboratories for scientific work. In 1856 Virchow established the first pathological laboratory in Berlin. Dorpat was the

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*cf. Merz (J. T.). A history of European thought in the nineteenth century. Edinburgh and London, 1904, p. 89.

home of the earliest independent pharmacological laboratory, established there by Buchheim in 1849. Physiological chemistry was housed in a laboratory of its own in Strassburg in 1872 (Hoppe-Seyler), and hygiene at the instance of Pettenkoffer was given a special institute by the Bavarian government in 1872. The first clinical laboratory proper was started in the Munich Hospital by von Ziemmsen about 1886. Still later came special laboratories for psychopathic studies. Now every university in Germany has a complete set of these laboratories and there are in that country all told more than two hundred such medical institutes.

From Germany the exact spirit of research by means of organized laboratories spread rapidly to other countries—to England, Scotland and America—but Germany has the credit of the first and most extensive laboratory development; it is to this development that she owes her leadership in medicine and the biological sciences during the last eighty years.

Liebig's chemical laboratory was opened in a small town, not in a great city, and in this there were certain advantages. In an autobiographical memoir Liebig has said: "I always remember with pleasure the twenty-eight years which I passed at Giessen; it was, as it were, a higher providence which led me to the small university. At a large university, or in a larger town, my powers would have been broken up and frittered away, and the attainment of the aim which I had in view would have been much more difficult if not impossible; but at Giessen all were concentrated in the work, and this was a passionate enjoyment." "A kindly fate had brought together in Giessen the most talented youths from all countries of Europe . . . . Everyone was obliged to find his own way for himself. . . We worked from dawn to the fall of night: there were no recreations and pleasures at Giessen. The only complaints were those of the attendant, who in the evenings, when he had to clean, could not get the workers to leave the laboratory."*

The peculiar advance made by Liebig's laboratory was the introduction of systematic and methodical training on an especially devised plan by which young men were introduced to a thorough practical knowledge of chemical properties and manipulations. The laboratory became the training-school for the majority of chemists outside of Paris, and was used as a model for similar establishments in other cities in Germany as well as in other countries. This laboratory convinced the world of what can be done in an institution

*cf. Deutsche Rundschau, Vol. lxvi, 30-39. Cited by Merz.

containing suitable work-rooms and adequate equipment in apparatus, with proper materials for study including ready access to books and scientific journals, especially when a director, who can give his whole time to teaching and research and is filled with the enthusiasm of his subject, leads the way. Later on, in Berlin, Johannes Müller did for physiology what Liebig had done for chemistry, and many of the physiological chairs in European universities were filled subsequently by men who had worked under Müller.

It goes without saying that laboratory buildings alone, even when adequately equipped and with a liberal maintenance budget, are far less important than the men who work in them. Nevertheless experience teaches that in cities and countries where the laboratory facilities are most ample there, on the whole, more and better men apply for training, and a greater number of important discoveries are made.

An obstacle in the way of laboratory expansion has been the great cost of such institutions. While the buildings themselves are not necessarily very expensive, still the outfit needed often entails a large outlay, and unless the director and his assistants are paid sufficient salaries to permit them to devote all or almost all their time and energies to the work but little progress is likely to be made. Moreover, the expense of supplies for the experimental work in such laboratories is great and a liberal annual budget is therefore an essential. The scientific workers, too, should be provided with a certain number of paid mechanical helpers, for where the best brains in the laboratory are hampered by the necessity of doing the work which could just as well be done by laboratory servants a serious economic mistake is made.

The endowment necessary for modern laboratories has been one of the main factors in leading to the disappearance of proprietary medical schools, since a medical school conducted by modern methods can no longer be run for profit. Indeed large sums of money are absolutely necessary for the conduct of modern medical education, and unless these endowments are available through private benefaction they should be provided by the state. It may be asserted safely that at the present time money can not be invested to better purpose than in the judicious support of medical laboratory work. A survey of the results of such work shows a greater return in practical benefits to mankind than can be claimed perhaps by any other mode of utilizing the money. The medical discoveries of the last twenty-five years demonstrate conclusively that the endowment of medical science yields an enormous reward, and nothing seems more likely than the probability that those medical schools and those countries which fall behind in the maintenance of medical laboratories and of scientific workers in medicine are destined to occupy an inferior place in medical education and to remain behind in social and economic importance.

MEDICAL LABORATORIES AS A TRAINING PLACE FOR PHYSICIANS.

A large part of the education which medical students receive nowadays is given to them in laboratories. Instead of the didactic lecture of former periods the student in a medical school of our time does practical work in nearly all the subjects of the medical course. In the anatomical laboratory he dissects the human body and examines its constituent organs, tissues and cells under the microscope, making many of the preparations for himself. In the physiological laboratory he studies the functions of the animal body less from books and from lectures than from actual observation, as he repeats the experiments of the great masters who have made fundamental physiological discoveries. In the pathological laboratory he assists in the making of post-mortem examinations, studies the changes in form, consistence and color of organs in disease, and under the microscope investigates the finer changes in the cells and intercellular substances in pathological states. In the better laboratories of this sort, too, he has the opportunity of witnessing the phenomena of life as manifested under abnormal conditions, and though pathological physiology as such has not yet reached the place in our medical schools which it seems destined to occupy, it is rapidly being developed and promises to become in the near future one of the most important features of undergraduate medical instruction. In the bacteriological laboratory the student not only hears of bacteria and of their relations to fermentation and to disease, but he handles these bacteria himself, studies them, alive and dead, under an oil emersion lens, grows them artificially upon media prepared by himself, produces certain of the infectious diseases experimentally by innoculation of animals, and recovers from the bodies of the diseased the same microorganisms which he has inoculated. He is given, too, a practical acquaintance with the simpler methods of studying the phenomena of immunity, and gains in this way a unique conception of the nature of infection and the tendency to self-limitation of the infectious diseases; he becomes familiar with the fundamental principles of contagion on the one hand and of prevention on the other.

These studies, together with those which he makes in the laboratory of hygiene, prepare him, in a way unequalled by any other form of preparation, for meeting those problems of personal hygiene and public safety which confront the medical man in private practice and in the protection of the public health. In the laboratory of physiological chemistry the medical student perfects his methods of chemical manipulation and examines for himself the various chemical constituents of the human body and its secretions and excretions. One needs no special prophetic instinct to recognize how important a training of this kind is for the prospective physician who will wish to keep abreast of medical advance during the next two decades, for there seems to be but little doubt in the minds of those best informed that the laboratories of physiology and physiological chemistry are to stand in much the same important relation to medicine during the next twenty years as that occupied by the laboratories of pathology and bacteriology since 1880. Furthermore, practical pharmacological studies are now essential for the medical student. The undergraduate who in the pharmacological laboratory studies the physiological effects of drugs by actual observation of the effects produced after administration to animals, making accurate measurements by the precise methods of physics and chemistry, will acquire an insight into the possibilities and limitations of treatment by drugs which will protect him from a pessimistic nihilism on the one hand, and, even more important, from uncritical enthusiasm on the other. The student thus trained will be less likely to fall a prey to the proprietary medicine manufacturer and the nostrum monger than the physician who has obtained all his knowledge concerning the action of drugs from books, lectures or the circulars of manufacturers.

In the clinical laboratories associated with the wards of the hospital the student will be taught how to apply the knowledge gained in all the laboratories just mentioned to the problems of diagnosis and treatment as he actually meets them in his study of patients in the hospital wards and dispensaries. These hospital clinical laboratories have only just begun their development, and there are but few medical schools which have made adequate provision for them. I have in another place* called attention to the great importance of these laboratories for the training of medical students as well as for the advance of practical medicine, and have tried to show that it is

*Barker (L. F.). The organization of the laboratories in the medical clinic of the Johns Hopkins Hospital, Johns Hopkins Hosp. Bull., June-July, 1907.

just as necessary for physicians and surgeons to have their own special laboratories attached to their wards, in which chemical, physical, bacteriological and psychic investigations can be made as it is for aniline dye manufacturers to have chemical laboratories attached to their plants for solving their special problems, or for brewers to have bacteriological laboratories and skilled bacteriologists constantly at work to maintain and improve the standard of their products. It will not do for the sciences of diagnosis and therapy to rely upon the laboratories of chemistry, physiology and pathology in the medical school to solve their particular problems for them. The more fundamental sciences have their own problems of a more abstract nature which it is their duty to investigate, and the time has certainly come for diagnosis and therapy to develop the laboratory sides of these sciences for themselves.

By far the greatest advantage of instruction of the medical student by the laboratory method is, however, his training in the scientific habit of thought. What helps him is less the facts which he learns, or the memory of the experiments he makes, than the establishment in him of the conception that in order really to understand it is necessary to come into direct personal contact with the object to be understood. If some of his teachers are, and certainly some of them should be, productive investigators, he is likely to be impressed with the necessity of accuracy in work, of patience in it, if things are to be accomplished, of steady industry and persevering effort. He learns also to have a love for detail and a desire for complete and exhaustive knowledge; he comes to appreciate skill in invention and in the application of new and precise methods, and there grows in him a desire for full appreciation of the value of all existing methods or principles which will prevent him from falling a prey to sectionalism in medicine or to any single idea or principle which is limited in its nature. In other words he develops in those three directions of thought which characterize three more or less distinct and important attitudes of the human mind, namely, the exact habit or attitude of thought, the historical and the critical.

THE UTILIZATION OF LABORATORIES BY PRACTITIONERS AND HEALTH OFFICERS FOR THE DIAGNOSIS, CURE AND PREVENTION OF DISEASE.

I have referred incidentally to the use of hospital laboratories by hospital physicians and surgeons as direct aids in the diagnosis and treatment of their cases. The chemical, physical, microscopical and bacteriological studies now made in hospital wards form a large part of the occupation of resident and attending physicians in those institutions; indeed the examinations of the blood, of the urine, of the stomach juice, of the sputum, of the fæces, of the cerebro-spinal fluid, of the contents of abscesses and cysts, of portions of tissue removed at operation and X-ray and electrical examinations have become so potent a factor in medical diagnosis that many have begun to fear that physicians and medical students in their enthusiasm for the clean-cut results which they yield may come too much to neglect the older fundamental methods of inspection, palpation, percussion, auscultation and mensuration. And it is certainly wise that a note of warning should in this connection be sounded, for it would be a grave error to deprive ourselves of what is good in the old because of the helpfulness of the new. That such a fear should be expressed, however, shows how tremendous a hold laboratory methods are taking of the minds of developing clinicians.

Aside, however, from the laboratories connected with hospital wards there has been in recent years a phenomenal growth of private and public laboratories in our towns and cities for the use of private practitioners of medicine and officers of public health. I am sure that the laity scarcely realizes how much such laboratories promote the early diagnosis and facilitate the treatment of disease, and especially to how great an extent through them infectious and contagious diseases in the community are prevented and controlled. Time will not permit me to enter upon an enumeration of these particular benefits. I desire, however, to express my gratification at learning that at least some portion of these new laboratories which you have built in Kingston is to be devoted to the service of the public health, and I predict that no small part of the usefulness to this community and to the people of this province will result from the activities of the public health division of your laboratories.

MEDICAL LABORATORIES AS CENTRES OF RESEARCH.

In addition to being necessary and desirable places of instruction for medical students and also institutions for practical use in the prevention and cure of disease by physicians and officers of the public health, medical laboratories subserve a still higher purpose, to which we should for a few moments advert,—I mean the function of medical research. In university circles no special plea for original research is necessary, I know, for in those circles the advantages of creative inquiry, both from the economic side and from the standpoint of the highest human ideals, are well understood. It is to be feared, however, that the general public sympathetic as it is with scientific advance in general and with the efforts made by scientific investigators in the struggle for enlightenment, has no adequate realization of the results which have already attended the studies of medical scientists or of the urgency for the promotion of original studies in strictly medical domains. The public has always been willing to pay for hospitals to care for the sick, but it is only in recent years that it has begun to awaken to the possibilities of preventing disease by the endowment of research specifically directed thereto.

The advances which have been made in our own time by investigative medicine are truly phenomenal, and no layman, unless he has made a special point of looking into the matter, has any conception of the increased power medical men now possess to lessen physical suffering from disease and accident, or the means at their command for controlling the spread of infectious and contagious disease. Not only has the prospect of life for each human individual been markedly lengthened, but immeasurable advantages have accrued to the race as a whole, no small part of our industrial development at home and the opening up of countries abroad hitherto inaccessible to civilized whites having been due to the protective discoveries of modern medical science. It is not my purpose at this time to review even briefly the triumphs of modern preventive medicine, interesting as it would be to outline to you what has been done regarding the cause and the prevention of diseases like typhoid fever, Asiatic cholera, bubonic plague, yellow fever and malaria. The advances made in the prevention and cure of diphtheria and in the lessening of infant mortality are familiar even to the layman, and in the great crusade against tuberculosis now in progress all over the world we have a demonstration of the growing consciousness of the public that it is necessary for it to combine with physicians in applying scientific methods to the extermination of that dreadful malady which is the cause of death of one out of every eight of our people. Since scientific methods when applied to the solution of medical problems have so soon been able to yield the striking results at which I have hinted, what may not be done if more men and more money can be made available for the study of the diseases which as yet cannot be controlled? Think of the benefits to the human race which would follow the discovery of a means for preventing or curing pneumonia, an infection which in spite of all the work yet done upon it kills as many people to-day as it did one hundred years ago; or what a boon it would be to human society if the secret of cancer and sarcoma and other malignant tumors could be unravelled and these dire diseases become as controllable as have diphtheria and wound infection. Another most important field for investigation is that which deals with the disorders which affect human beings after middle life is past and account for much of the misery which leadens the sky of so many men and women in their advancing years; I mean those degenerations of the blood vessels, kidneys, liver and brain, the origins of which are as yet obscure and the prevention of which we have yet to learn.

Germany took the lead in the recognition of this special research-function of the medical laboratory and of its significance for social progress. In 1880 the German government endowed a special laboratory—that of the Imperial Health Office—for the investigation of the infectious diseases, and put Koch at its head. France followed quickly with that great institution of international reputation founded for Pasteur after his epoch-making discovery of a method for preventing the development of hydrophobia after mad-dog bites. Since then special institutes for purely investigative purposes have been springing up like mushrooms, part of them supported by national governments, others endowed by private individuals of wealth and insight. I need only mention the Imperial Institute for Experimental Medicine in St. Petersburg (1890), the Institute for Infectious Diseases in Berlin (1891), the laboratory now known as the Lister Institute in London (1891), the Institute for Experimental Therapeutics in Frankfurt (1896), the State Laboratory for the Investigation of Cancer in Buffalo, the Rockefeller Institute for Medical Research in New York (1901), the Institute for Infectious Diseases in Chicago (1902), and the Phipps Institute for the Study of Tuberculosis in Philadelphia (1903)—all establishments dedicated to original medical inquiry—to show you how rapid has been the expansion in this direction. Nor does such an enumeration exhaust by any means the list of medical laboratories engaged in special research. The better university laboratories combine research work with the work of instruction, and much excellent scientific labor is also performed in the laboratories of boards of health in our larger towns and cities.*

The people of Canada and the United States are to be congratulated upon the increase in public interest in medical research on

*cf. Welch, W. H. The benefits of the endowment of medical research. New York, 1906.

this side the Atlantic during the last few years; nevertheless there is still a great shortage of men here as compared with the number available for such work in European countries. It must be confessed, too, that the scientific output of individual workers in this country is smaller than it should be and could be were the conditions for work made more favorable. As yet we have only a handful of men who devote their whole time and energies to this kind of study and these are hampered in their work by serious defects in the conditions which surround medical research in America. In our medical schools the professors who are able to do investigative work and have the desire therefor, are often so overloaded with the routine work of lecturing, laboratory instruction and administration that they really have not the time for the intense and absolutely undisturbed work necessary for the creative mind. Further, it is rare in this country to find an investigating professor supplied with research assistants to help him practically to carry out his ideas, whereas in Germany, by means of a graded staff and a department-budget which permits the employment of several assistants, the hands of the man with original notions are multiplied several fold and there is a much more rapid conversion of new ideas into new results.*

Another hindrance to research lies in the insufficient financial rewards of academic work. We are undoubtedly holding back our people and the prestige of the country in which we live by the inadequate provision we are now making for the material side of the lives of professors in our universities and medical schools. This is false economy; commercially speaking, it is bad business. Until university trustees and the public generally recognize the necessity of retaining the best brains which develop among us in the service of instruction and research the activities of those brains will inevitably, in many instances, be diverted to other fields. The man with investigative ability, with the power of observing closely, of reasoning accurately, of thinking originally and of experimenting rigorously, is rare. The critical attitude of mind, the inspiration to originate, the training which makes men able to extend the boundaries of knowledge and to win new power from nature is not common. Only a few men have the faculty of determining and grasping facts, and of verifying and digesting them; and still fewer the ability to conceive fruitful hypotheses connecting these facts or explanations,

*cf. Stieglitz (J.). Chemical Research in American Universities, Science, N. Y., 1907.

united with the initiative necessary to test the validity of the hypotheses by experiment. Research work requires a patience and an enthusiasm, a self-denial and a perspicacity unknown to the average man. When we discover a worker who can find his way in medical regions as yet untrodden, who can discern new relationships among facts, who can elucidate some of the mysteries which for centuries have puzzled us, we should cherish him. He needs all our sympathy and support, for the condition under which he works are lonely and difficult. He has, as a rule, but few companions, and his work is not in the public eye. He has to set his own tasks and to establish his own standards of excellence. Fortunately, he is a man of high ideals and his reward comes chiefly from his work, from the actual joy of the labor. But since the results not only increase knowledge but promote the safety and happiness of the people, it is the duty of society to provide the facilities and conditions for his work, to elevate his position in life and to give him the honor and appreciation consonant with his high calling.*

In bringing my remarks to a close I hope that their main intent, despite their rambling and somewhat desultory character, may have become plain to you. I have tried to show you that medical laboratories such as these are indispensable in medical schools which are at all worthy of being known as the medical departments of true universities, and I have maintained that only in such laboratories can students be properly taught for they come there into direct personal contact with the objects of study, a requisite if the scientific habit of thought is to be engendered. To them, too, your physicians and your guardians of the community's health may resort for making the special laboratory examinations now necessary for the diagnosis, the cure and the prevention of the ills by which your people are afflicted. And, above all, opening off these halls there are some rooms which will, I trust, become the workshops of mature original investigators, and others which will serve as nurseries in which will be cultivated those qalities of mind, heart and hand which make men dissatisfied with knowledge as it is and compel them to try to extend it.

Untrammeled by the traditions and ultra-conservatism which are holding medicine back in the Mother Country, yet protected by intimate connection with her from the whimsical vagaries, the wild-

*cf. Eliot (C. W.). The qualities of the scientific investigator. Address at the opening of the laboratory of the Rockefeller Institute, New York, May 11, 1906.

ness and the freakishness which might otherwise tend to bring medical science here into disrepute, Canadians have an opportunity and a privilege in medicine they will not be slow to take advantage of, a duty they are sure manfully to assume. There are many young men and women in this country and this province capable of devotion to an ideal cause, *independent of personal gain and glory.* It is to the credit of Canadian parents that they instil into their children high and noble aspirations, that they teach them to endure privations cheerfully for the sake of things greater than mere physical comforts, and that they cultivate that generosity and elevation of spirit which *makes unselfish human effort not only possible but really* desirable. The fruits of this training will, I dare prophesy, become evident sooner or later in the activities of these laboratories. In them there will be professors and students who will choose as their life work the pursuit of medical truth and the acquisition of medical knowledge for its own sake; as a result of *this ennobling* and worthy occupation human suffering will be ameliorated, and, perhaps, some patients suffering from maladies now incurable, may be healed. May the good that you hope for be the outcome of work in the laboratories which with suitable solemnity and earnest purpose you have set apart and consecrated to a special service to-day!

After Dr. Barker's address, the Hon. R. A. Pyne, the Minister of Education in the Province, to whose sympathy and recommendation the Faculty are indebted for the amount expended in the erection and furnishing of the new building, spoke as follows:

ADDRESS BY DR. R. A. PYNE, MINISTER OF EDUCATION, TORONTO.

Mr. Principal, Mr. Dean, Ladies and Gentlemen: I am sure I have felt it a very great privilege to-day to have had this opportunity of mingling with my old friends in the medical profession of Canada, and I may say I possibly had a selfish motive in coming here to-day. I may as well confess it. I was very anxious to hear my old friend, Dr. Barker, and I have had very much pleasure in listening to the very learned and instructive and intelligent address delivered to us by him. I am sure the address delighted us all.

In the position I find myself occupying, as Minister of Education, and the great responsibility I find connected with that part of the Government's work, I can assure you that the experience I have had with my old friends the medical students, some of whom I see here to-day, has stood me in good stead. In the work of 27 years we have had an opportunity of coming into contact with the students of Queen's, Toronto, of the Western University, and McGill, Laval and others, and I want to pay this little compliment, that the students taught at Kingston have always stood well in the examination, that trying examination, for the license to practice on their fellow-men. Sometimes, of course, there are disappointed students. We cannot avoid that. I have always tried to console the poor fellow by telling him to go on, and try again. There was one poor fellow who, I think, tried five times. I just want to say here that ambition and ability do not belong to any one family in this Province, and that the student who has perseverance will very often come to the front, and I very often buoyed them up with this.

I must compliment Queen's University on this great addition to their teaching facilities here in this very fine building. I hardly know out of the small provision how they carried it to completion. It seems to me the most beautiful building I ever saw for the amount of money involved in its erection. I may say that I will take back a message to Mr. Whitney that I never saw $50,000 so well expended, and our good friend the Dean ought to feel very proud, for he tells me that the building stands there and they will have something to their credit. I might here tell a little story I once heard of an Irishman who was given a beautiful present and found himself in the unique position that he was the only Irishman in Ireland without a grievance. I should say that Dr. Connell would be like the Irishman, he must be without a grievance.

Mr. Principal, in the position I find myself in as Minister of Education in this Province, and having the necessity of overlooking the whole educational field put upon me, and being desirous of doing something for the masses of the people in the educational line, I thought we should strike at the part most defective. In looking over the whole field, the part we find most defective, the part where remedies could be introduced, is the Public School system, and we are trying to do something for the great Public Schools of this Province. Like any one of you who to-morrow or next day, when you get your first patient, your first consultation, you look your patient well over, thoroughly examine him, are particular in your diagnosis; so we in looking over this great system felt the pulse, diagnosed carefully and saw the defects. Then came the question, how can this be remedied? It seemed to me only by one way. You may have magnificent buildings, great accommodation for schools, but if you have not the teacher in the school you are not going to succeed. It is just so with the Faculty of Queen's University, the Medical Faculty in particular. They have always had from the day of Dickson, Yates, Fenwick and Fowler, good teachers in this school. So that the higher side of educational life corresponds with the primary side of educational life. You need good teachers. We have undertaken to try and provide good teachers, better teachers for this Province. We have increased the Normal School accommodation with a view of getting better training. When we give the better article, we ask the people to give a better salary. We are trying to improve the condition of the teacher. In University life it is much the same way. I know in this Province that not long ago the Provincial University of Toronto, the University of the people, was practically starved. You cannot do anything without money. You cannot give the equipment that is necessary. We get a good lesson in the Old Country Universities, particularly in Oxford and Cambridge. Then there is the great research side that you get from the University in Germany, and to carry out research means an immense expenditure. Then we have State Universities. Wealthy people, here, never think of giving aid to these institutions; therefore we are depending upon ourselves. If we were magnificent, we did not go as far as I wished, because we did not spend as much as Michigan. They spend about $500,000 a year, a sum much beyond what is spent in Toronto. I wish that the grant for this side of education had been larger, but I would also call attention to the fact that a grant was also given to the Western University, and they are now having in course of erection a building for the study of hygiene.

As a member of this Government let me say, I am not going to make a political speech. My mind is far away from such a thing, and I am glad to be away from it for awhile. But if, sir, we have given aid to this part of the profession, I think I may say for the future, you will still have the sympathy of the Government in anything of that kind. I do not know why this great Province of ours cannot have more of this sort of thing. If we look at England, it is a small country, and if you travel through it you find University after University. In connection with all these matters I often think of the Hon. Joseph Chamberlain when he was addressing a meeting in his own native city, and he was talking of the preferential tariff, that he hoped to see soon all over the British Dominions. He said: "I am making this request because I feel I am acting in the interest of every Britisher, be he a colonial or otherwise." I often think we ought all to join together and that has been our policy in the treatment of the Public Schools, to join together, to get the cities, towns and townships to unite with us. Let us help one another and the burden will become easy.

We all know, we all recognize, every public man recognizes (perhaps not to that degree that the educationalist recognizes), that changed conditions mean changed methods and changed educational systems. This is not the only country where people are struggling and striving with the educational problems. We find it across the line, and in England. Lord Rosebury and Mr. Balfour were wondering how it was that there seemed to be a decline in the great commercial life of England. It is not the same in Germany where it is said you can get the technical system of education, that education on all lines. One little province, Wurtemburg, has 287 technical schools. So that you see changed conditions bring about changed ideas in education. I would like to see more attention given in this country to that side of education, the technical side of education. This would help much in practical science departments. It is something between that and the schools of the Province that I am speaking of, and if there is any member of the Dominion Parliament here, or any aspirants—and there must be among a lot of young men like this—just let me say that this would be a good matter to take up. I have for some time contended that on that branch of education, that most important part of education, we are behind; that in Canada with its numerous facilities for manufacturing, our great water powers, this ought to become a great work, and I would say to the young man, that when he goes to the Dominion House he ought to ask the Dominion Government to think seriously of doing something towards giving each Province a large grant specially for technical education to be carried out by the province itself. They will say no doubt "that cannot be done. The B. N. A. Act will not permit you." That is so, but if they had a grant they could carry it out very much better. My reason is this. The Dominion Government deals with the tariff of this country. The very coat I wear has a tax upon it. The very feathers in the hats of the ladies have a tax upon them. The people who levy the tax and expect great results from products in Canada, and build this high tariff wall—one recently said that he would be glad to see it go up as high as Haman's gallows—should, I say, exert themselves in building up this raw material in products for the people. I think a man would make a name for himself in getting technical education forward.

Mr. Principal, Ministers of Education have to be very careful like Ministers of God, and it does not do to talk too long. I think sometimes it is a mistake to go on talking, and that is one of the faults that is found with political speakers. They never know enough to stop. It reminds me of what happened to a parson in the Old Country. He was a bachelor with a very estimable housekeeper. The parson was not looking very well for some time and his housekeeper suggested that he should go and consult his physician. "Oh," he says, "do you think so?" "Yes, I think you had." "Well," he said, "perhaps I had better," and he did. The physician said to him after giving him a very thorough examination—as you would expect—"I do not think there is very much the matter with you. Perhaps what would do you the most good would be every morning to take a little drop of whiskey in hot water. It would tone up your system." "Oh, but how do you think I could do such a thing; what would they think of me? My housekeeper is an estimable woman, but she gossips a little." "Oh," the physician said, "you get a little vial and have it in your cabinet, and just call for a little hot water in the morning for shaving purposes." Well, it struck the parson that he might be able to do that and so he thought he would try it. About a week after, the doctor met this estimable housekeeper and said: "Oh, by the way, how is the parson?" "Oh," she says, "I do not know what has come over the parson. Really, I believe he is a little bit touched in the head. He shaves in the morning, he shaves at noon, he shaves at night, and on Friday he shaved five times." So that you see I am not going to set a bad example to any of these medical friends who will follow in my footsteps.

After the very beautiful prayer of dedication offered by Dr. Macgillivray there is very little for me to say in dedicating that new building for the purpose intended. I hope it will give inspiration to the young men who will have the privilege of going through these laboratories, and that they will be able to look back upon it with gratitude. I have very great pleasure and considerable privilege in dedicating this building for the purposes for which it was built.

ADDRESS BY PROF. WESLEY MILLS.

MR. Principal, Mr. Dean, Ladies and Gentlemen: Taking up the comparison of the Principal I am in entirely the opposite condition to those people he has just referred to, for I come from a University who has suffered. You have been erecting buildings; we have been losing buildings. In fact, I come unclothed largely because of these fires. I was one who lost even my College robes. I should be thankful, however, for we had an official who escaped with his life, but with the loss of the garments very many degrees thinner than College robes.

But I should first explain that I represent the University and the Faculty. The Principal of the University is absent in the North-West. The Dean of the Medical Faculty recently suffered from laryngitis and thought it unsafe to come, but I convey to you their hearty congratulations on your progress here in Kingston. The Dean of the Medical Faculty, Dr. Roddick, is one who, I am sure, has endeared himself to all medical students everywhere by his noble efforts to endeavour to do away with the spirit of Provincialism in medicine, at least with regard to the admission of the license to practise. It seems to me that there is no better occasion than the present more desirable of uniting this country as one medically. We should endeavour to find out how far one is weak and another strong, but on what grounds we can unite to put a good face on medicine in Canada before the world.

Dr. Barker addressed us so well to-day that he has left little for us to say on the question of laboratories, and I think the best plan for the man that now occupies the floor is to say little, to show respect for the attention and patience of this audience by really saying little. However, perhaps you will allow me to speak very briefly of two or three sentiments. Dr. Barker alluded to that teaching which made us so dissatisfied with the knowledge we had that we should wish to increase it. We can remember the time when one of the greatest merits in a teacher was to dogmatize. Yesterday I spent a good part of my lecture in making, or trying to make, the students of Physiology dissatisfied with the state of knowledge even as published in the recent text-books. I know of no state of mind so healthy as appeared in the words of your Dean when he addressed you as "fellow-students." In the laboratory we get beside the man. We encourage him to find out something better than is in the syllabus, in the book, to see what is there in the ·· ·et, not in the syllabus. Students coming from the Public Schools are so bookish, and the first thing is to get them to look and to see what is really there, and then we attempt to teach students so much that they will be up to the very latest that I fear we do not give them a chance to develop individuality. There is nothing more important for doing away with prejudices than just this, to make the student feel that he and the Professor, the highest member of the staff in his department, are but fellow-students, one older and more experienced than the other. It is no question of loss of dignity. It is the surest guide to getting the absolute confidence if not love of the student for his teacher. We say or should say to our students, go forth and be better men than we are for you have had greater opportunities.

I congratulate the Minister of Education, I congratulate this Province, and I wish I could congratulate my country, on the recognition of the principle of Government support for Medical Schools. These schools, and particularly these laboratories, exist for the people, the education of men who are engaged not in pulling the patient out of his bed alone, all that medicine once could do, but in preventing the trouble which is a far more important matter. We never can set the machine right by any means that we know of, when certain formations have set in, but we may prevent them setting in. The public is getting ready for this. The Government in Germany are ahead of the people, and yet the people in this country are wonderfully ready for anything the Government will do.

Now I am not going to speak further at this late hour, but I just want to convey my personal admiration for the quiet, unostentatious work that is done at Queen's. May you go on and prosper and may we all in this country feel that we are working some here and some there, but all for the general good of the science of medicine and of this great country, which, sir, it seems to me has an opportunity which no country under the sun ever had of developing a system of medical education untrammeled by the past, free to be original, free to grant the needs of the country and to be an example of what education may be.

On Wednesday morning, the students and professors were addressed by Prof. Adami, of McGill, and Prof. McCallum, of Toronto University, as follows:

SUBINFECTION.

An Address Delivered to the Final Years in Medicine, Queen's University, Kingston,

BY

J. G. ADAMI, M.A., M.D., F.R.S.,

Professor of Pathology, McGill University,
Pathologist to the Royal Victoria Hospital, Montreal.

LET me before launching into my subject express my appreciation of the invitation to be present at the opening of your new laboratories and to address you here. The old days of University provincialism are being rapidly left behind. Just as in matters political we are more and more coming to place the nation before the province, and this with no lessened love for our own immediate people, but with a broader interest in and reverence for Canada as a whole: just as the old rivalries that were unworthy are dying out and we are attaining to a higher and better national life, so it is, and even more markedly, in University affairs. And thus, realizing the part that the Universities can and must play in developing this higher Canadian life, it is with an eager pleasure that one seizes such an opportunity as is now afforded to me, to come to another University and talk familiarly to the students there gathered together.

I say familiarly, for, gentlemen, it has seemed to me, whether wisely or mistakenly, that I should be of more service to you were I to take up some general pathological subject and talk to you round about it just as I would talk to my own students, not pretending to give you anything that is very novel: at most hoping to present things in what for some of you may be a new light. After the thoughtful and entrancing address from Professor Macallum I fear greatly that what I shall have to say will be very humdrum: that just as he has soared up to the stars like a rocket so I shall come down like the stick. Following one who has dealt with matters of vital concern, nay, who, doing this has indulged in the very poetry of science, what I have to say must appear but dull prose: my subject does not permit that I bring before you a protozoan Venus coming into existence out of the primæval sea foam.

Nevertheless, as the life to which you have dedicated yourselves is devoted to seeking the causes of disease and, determining those causes, is concerned with the rational means of treating and preventing those diseases, it may be that what I have to say will not be wholly without interest. You have been born into a generation of medical men that is above all interested in the subject of infection and the infectious diseases. The science of bacteriology has brought with it a medical renaissance. Never in the long history of Medicine has there been such an upheaval, such a development as during the last thirty years, and this all through the demonstration of the fact that in case after case a particular disease is due to the entrance and growth within the tissues of specific microbes.

Now Pasteur, the great founder of the science of bacteriology, laid down that the normal organism, or more correctly, the tissues in a state of health, are as devoid of bacteria as Paradise before the fall was devoid of a devil,—or again to seek precision—let us rather say, of sin. It is upon this postulate that our science has been based and no one would gainsay that the postulate was absolutely essential for the development of the science. For employing the Euclidic method, let us suppose that healthy tissues are not sterile: how difficult it would have been for Pasteur and the early bacteriologists to convince the world that the organisms they isolated were the causes of infection! As it was their task was difficult enough. It is to this assumption that we owe the greatest advance in surgical technique the world has ever known, and with it the saving of innumerable lives: upon it Lister based his antiseptic method, from which has developed logically the rêgime of surgical asepsis. The whole modern treatment of wounds, surgical and otherwise, has been determined and evolved from this primary conception that the healthy tissues are germ free and that, therefore, if the entrance of germs into the wound from without be prevented there will be a natural healing, uncomplicated by infection and suppuration.

What I want to discuss with you to-day is whether this postulate is what may be termed a whole truth, or only a half truth, whether bacteria under normal conditions do not gain entrance into the normal tissues, or whether they do. Let me admit at the outset that if only half a truth, this Pasteurian postulate must be very near the truth; for otherwise we could not explain the marvellous results that have followed the advent of Listerism. Nevertheless, time and again we encounter cases which are difficult to solve save on the assumption that the postulate is incorrect, and does not represent the whole truth; cases for example in which a local injury of an internal organ, a joint, for example, in an otherwise healthy individual without superficial wound or abrasion is followed by the appearance of local infection of the part with the presence and growth in it of pathogenic microbes. How, it may be asked, did those microbes find themselves in the injured area, unless it be admitted that under normal conditions a certain number of bacteria gain entrance into the blood and so into the tissues? It may be said, it has been said that in such cases there happens to be elsewhere,—in the digestive tract, it may be, or on some mucous surface,—an ulcer or abrasion through which pathogenic bacteria gain entrance: that, in short, individuals in whom occurs this succession of events are not in a normal state. But this is purely an academic assumption that is not proved. There is the other alternative, and it is this, and what it signifies, that I want to bring before you this morning; namely, that the tissues of the normal healthy individual are *not actually* sterile and devoid of bacteria, but only *potentially* sterile: that constantly throughout life bacteria, pathogenic and non-pathogenic, gain entrance into the blood and lymph and so become conveyed to the various tissues, but as constantly, in health, these bacteria, whether pathogenic or non-pathogenic, undergo relatively rapid destruction through the various bactericidal agencies at the disposal of the organism: and lastly that without abrasion or destruction of the protective outer layers it may happen that bacteria thus gaining entrance may proliferate and cause infection and this either (1), when the number gaining entrance and carriage to one focus is excessive, or, (2), when the resisting powers of a tissue have undergone local diminution. I want to point out to you that the weight of evidence is so great in favour of this alternative that we are forced to regard it not as a postulate but as a matter that is positively proved. There is, that is, abundant experimental evidence bearing upon the subject.

This evidence may be classified under a series of headings.

1. HISTOLOGICAL: the determination of the presence of bacteria in sections of healthy tissue.

If we examine sections from most tissues of normal animals, stained by appropriate stains, we gain no clear evidence of the presence of bacteria within them. There are, however, certain organs in which with a remarkable frequency microbes are to be detected. This was pointed out twenty years ago by the Italian pathologist Bizzozero and has been abundantly confirmed by Ribbert, Ruffer, Nicholls and others. If one takes the lymph nodules of the tonsils, the mesentery, the neighborhood of the bifurcation of the trachea, from the dog or rabbit, among a large number of small granules taking on the same stain as bacteria a certain proportion of perfectly formed bacteria is to be encountered. The impression given is that bacteria are conveyed to the lymph node in fair quantities, and then undergo destruction, and that at the moment of death and removal of the tissue certain of the recent arrivals are still intact. In our own laboratory Dr. A. G. Nicholls has more especially worked at this subject. He has shown that if a healthy dog or rabbit be killed, if its abdomen be opened immediately with full aseptic precautions, and if without injuring or opening the intestines a thin piece of the mesentery be spread over a glass slide, pencilled with a sterile camel's hair brush so as to remove the endothelium, and then after fixation in formalin, a piece be cut off and removed with the underlying slide, then appropriate staining and clearing constantly reveals this same appearance of minute stained granules, often in pairs, along with definite bacilli and cocci. These lie in certain tracts, apparently lymphatic channels, sometimes in small groups, as though within endothelial or other cells, sometimes free and isolated.

2. CULTURAL: evidence of the presence of bacteria in normal organs by gaining cultures from the same. The evidence afforded by this method has been very contradictory, but upon careful study of the articles by those who have obtained negative results, it is seen that almost without exception their methods have been faulty. Let me give you an illustration of what I mean. For long years it was taught that typhoidal rose spots were of non-microbic origin. Observer after observer upon attempting to make cultures from them gained negative results. Then Richardson of Boston showed that if a rose spot be frozen by a minute spray of ethyl chloride, cut into, and cultures made from it, colonies of typhoid bacilli could constantly be obtained. Previous observers had neglected to take into consideration the bactericidal action of the blood removed along with material from the rose spot. By freezing, the vessels became contracted and the blood driven out, and hence the bacilli are not destroyed and are demonstrable.

Upon removal of tissues there would appear to be an active liberation of bactericidal substances, and this more abundantly in healthy tissues than in those the subjects of active infection. And this has to be taken into account. The mere smearing upon solid media of the juice from healthy organs is bound to give ambiguous results. Results only can be expected where the bactericidal substances are neutralized or so diluted (by the employment of abundant fluid medium of culture) that they cease to be effective.

Taking the necessary precautions Dr. W. W. Ford in our laboratory showed that of 34 apparently healthy animals (dogs, cats, rabbits and guinea pigs) furnishing ninety-three organs (in the main livers and kidneys) and one hundred and twenty-two cultures, *80.6 per cent. of the organs afforded cultures*; 65 per cent. of the animals gave positive results in one or more of their organs. That this was not due to contamination during removal is indicated by the facts that (1) each species of animal showed its own peculiar bacteriology, and, (2), each individual animal showed its distinct bacteriology; certain species of bacteria, that is, were peculiar to one particular species of animal, but along with these each individual animal might show some special form of microbe present both in liver and kidney, and not present in other animals of the series.

It is interesting to note the evidence of arrest of growth through the influence of bactericidal substances, shown by the fact that, contrary to usual experience with cultures made from the subjects of disease, Dr. Ford's growths did not show themselves as a rule until after three days, often indeed not until after a week or more. The bacteria were distinctly attenuated.

3. THE MODE OF ENTRANCE OF MICROBES THROUGH HEALTHY SURFACES. How do these bacteria, then, gain entrance through healthy surfaces? Here again we have evidence that cannot be negatived. We have, that is, to recognize the activity of the leucocytes. All my hearers, I take it, have in the course of their routine bacteriological work taken a swab from the back of their throats, made a smear from the same, and staining it have seen the constant presence, in this fluid bathing the pharyngeal surface, of leucocytes containing a larger or smaller number of bacteria. If one makes a section of the fresh human tonsil, similar bacteria containing leucocytes can be made out in the outer layers, or otherwise, of the leucocytes which find their way out on to mucous surfaces, and there act as scavengers, keeping those surfaces clean, while some are swallowed and others break up *in situ*, some, at least,

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*Ford, W. W. The Bacteriology of health organs. Trans. Assoc. Amer. Physicians, Vol. 15, 1900. P. 389.

make their way back between the surface cells and so into the tissues.

The best demonstration of this re-entrance of leucocytes from the alimentary tract has been afforded by one to whom you have already listened to to-day, by Professor Macallum. The lake lizard, Necturus, found here in Lake Ontario, has the admirable capacity to undergo complete deprivation of solid food through the intestines for long periods. It may be starved for many months and the experimenter may be sure that its gut is empty. Taking such starved lake lizards Dr. Macallum fed them with albuminate of iron. You all know Perls' test—the Prussian Blue test—for the presence of loosely combined iron in tissues. Making sections of the intestines and other organs of the lizards, at successive intervals and using this test, Dr. Macallum found, that the iron is taken from the gut into the system through the agency of leucocytes. At the earliest period the granules or iron were present only in the lumen of the intestine. Then leucocytes, devoid of iron containing granules, were to be made out in increasing numbers between the columnar cells of the mucosa, next these leucocytes were seen in the lumen of the gut and now they contained iron-holding granules: later such iron-laden leucocytes were present in abundance in the mucosa and villi of the intestine and lastly, similar iron-containing leucocytes were made out in sections of the liver, kidney and other distant organs, being present in the capillaries.

Now what is true regarding one order of particles taken up by these phagocytic leucocytes must obtain for other orders of particles taken up by the same form of cells. It is the leucocytes primarily that transport bacteria, patnogenic and non-pathogenic, through the mucous membranes of the organism.

We are gradually gaining a knowledge of the conditions that favour this transport of bacteria.

(1). We find in the first place, as shown by Lemaire, Wrczosek and others, that feed animals with a pure culture of a harmless organism like the M. prodigiosus and in four hours or so cultures are obtainable from the liver, kidney and other distant organs. Given, that is, the presence of huge numbers of a given species of bacteria in the digestive tract, some are sure to be carried into the circulation.

(2). Alimentary leucocytosis also favours the importation of bacteria. This was shown years ago by the great French veterinarian and bacteriologist, Nocard, who investigating why if blood serum be gained aseptically from various animals to serve as culture media a certain proportion of these serums become contaminated, discovered that with scarce an exception the sterile sera came from fasting animals, while the contaminated had been drawn from animals a few hours after the main forenoon or midday meal: all had been withdrawn with the same precaution: the afternoon specimens were not contaminated from without but from within: they were non-sterile.

(3). The presence of abundant fat in the food favours the importation. This was noted by Nocard and by Porchard and Desoubry and has been confirmed by Ravenel and other recent workers upon the importation of the tubercle bacillus. As shown years ago by the great physiologist Heidenhain, part at least of the fats of the food gain entrance into the lymph and blood through the agency of leucocytes. Two possibilities suggest themselves: either the migrated leucocytes actively engaged in taking up fatty globules ingest along with them an increased number of bacteria, or, what seems to be more probable, the presence of fat within the intestines sets up chemiotactically an active emigration of leucocytes from the submucosa into the lumen of the gut: there are more leucocytes in the gut, and therefore these return into the tissues carrying their burdens of ingested bacteria.

(4). Then again, active congestion of the mucosa, whether local or general, undoubtedly favours a great determination of leucocytes into the dilated capillaries and favours also their passage out. Along these lines is to be explained the observations of Posner and Lewin that the mere clamping of the anus or ligation of the rectum, without setting up any gross lesion of the mucosa, leads within eighteen or twenty-four hours to a general bacteriæmia, the whole organism becoming infected with intestinal bacteria. The irritation set up by disturbed function must be recognized as producing the mucosal congestion just noted.

The more, in short, I work at this subject the more is it impressed upon me with what relative ease bacteria pass through the intestinal walls—as also with what relative ease individual bacteria, even when definitely pathogenic, become destroyed, by the leucocytes that carry them, by the endothelium of the lymph and blood vessels and by other agencies. One swallow does not make the spring: one microbe does not cause infection. Either several must be brought to one place producing in their growth or in the destruction of certain of them, sufficient toxins to neutralize the protective powers of the immediately surrounding cells, or, as before mentioned, the resistant powers of the tissues here or there must have undergone a preliminary lowering before such bacteria can manage to proliferate and become sufficiently numerous to set up infection.

Only recently my colleague, Dr. Archibald, in the course of a long series of experiments upon the mode of prevention of intestinal adhesions has afforded an interesting example of this free migration of bacteria. Setting up the mildest grades of aseptic irritation of the peritoneal cavity he has found that notwithstanding all precautions the majority (66 per cent.) of the recent fibrinous adhesions gave cultures or gave microscopic indication of the presence of bacteria.

What does all this indicate? This, I think, that we must not presume that every infection is necessarily preceded by some relatively gross surface lesion: what is termed *cryptogenic infection* may well be much more common than is usually held to be the case. So also,—though this must seem to be a dangerous doctrine to enunciate,—that not all infective surgical complications are due to the entrance of germs through the wound. The lesson to be learnt here is assuredly not that of carelessness in the treatment of surgical wounds, but increased care in the preliminary 'toilet,' so-called, of the surgical patient. If as these observations seem to indicate such bacterial subinfection occurs most commonly through the walls of the alimentary canal, then the nearest approach to actual sterility of the tissues is to be gained by placing the bowels in the most healthful state, nay by a complete flushing out of the bowels prior to operation. Empirically the surgeon has already learnt the wisdom of this course.

When I brought forward these considerations some years ago in an address given in Chicago* I went on to consider the bearing of these considerations upon the possible causation of certain chronic conditions such as pernicious anæmia and cirrhosis of the liver. Time prevents that I should take up these matters now beyond saying that I still adhere to the opinion that conditions of continued low congestion and inflammation of the gastric and intestinal musoca, by favoring increased leucocytosis of these regions must bring about increased entry of microbes, pathogenic and non-pathogenic, into the system and must result in increased liberation into the blood and lymph of the endotoxins and other products of disintegration of these microbes which cannot be without effect upon the system: nay must eventually result in such exhaustion of the cells mainly devoted to the destruction of these bacteria that eventually a terminal active in-

*Journal of the Am. Med. Assoc., Dec., 1899.

fection may succeed these conditions of subinfection. From the laboratory of the Royal Victoria Hospital a few years ago Dr. Maude Abbott in discussing the etiology of that remarkable condition Hæmochromatosis—a condition of diffuse pigmentation of the skin and other organs found associated with hepatic cirrhosis—enunciated the view that this was due to an increased destruction of the red blood corpuscles associated with intestinal inflammation and subinfection of the order here indicated. I have seen no reference to the recent confirmation of these views by Stokvis, Gibson of Edinburgh, Blackader of Montreal and others* who have newly described a condition of Microbic cyanosis, which Gibson and Blackader have independently found to be due to the presence in the blood of intestinal bacteria—B. coli. Grown in the presence of red blood corpuscles the coli bacillus shows itself actively hæmolytic: the cyanosis and extreme discoloration of the tissues in these cases is clearly due to the liberated hæmoglobin which under the action of nitrites in the blood becomes converted into methæmo-globin. Microbic cyanosis in short is to be regarded as an acute form of hæmochromatosis.

But before bringing my remarks to a conclusion I would call your attention to the more recent developments in connection with this subject of the natural passage of bacteria into the tissues, and this if only to demonstrate to you that we are dealing with a very live topic.

You must know that years ago Baumgarten gave out the hypothesis that tuberculosis in the adult is in general not a condition of recent acquirement, but is due to the active proliferation of bacilli which may, indeed, have gained entrance into the tissues during fœtal life and for long years have lain latent in one or other tissue. It cannot be said that this view gained many adherents, although coming from so well-known a bacteriologist it has always obtained respectful mention. Now some few years ago the yet more celebrated bacteriologist von Behring, the discoverer of the antitoxic treatment of diphtheria, came forward with the view that tuberculosis is most commonly acquired through the intestinal tract, and then in childhood, through drinking the milk of infected cows. He based this view upon the observation that young guinea pigs fed with bacilli show these in the mesenteric glands and other tissues within

*Stokvis. *Nederlandsch Tijdschr v. Geneesk.* 1902, II, 678. Van den Bergh, Deutsch. Arch. F. Klin. Med., 1905, p. 86. Gibson and Douglas Lancet, Lond., 1906, II, 72. Gibson Quart. Jl. of Medicine, 1, 1907, 29. Blackader, New York Med. Jl., 1907.

a few hours, whereas in older individuals it is the exception not the rule to find them. So he like Baumgarten laid down that the bacilli lie latent for years and then take an active growth.

You know, of course, how lively has been the contest regarding the relative frequency of air borne and milk borne infection in tuberculosis, and regarding the relationship and properties of human and bovine tubercle bacilli. And knowing this you can understand how von Behring's observations have been put to the test.

Suffice it to say that prior to Behring Ravenal of Philadelphia, now of Madison, and others had demonstrated that in adult animals (dogs, etc.) tubercle bacilli could be detected in the lymph of the thoracic duct after appropriate feeding with the bacilli: that others have abundantly demonstrated that tubercle and other bacilli can gain entrance through the intact mucous membrane into the peritracheal and other lymph nodules connected with the respiratory tract.: that it has to be recognized that all that is proved is, not that the bacilli cannot and do not gain entrance in the adult, only that the entrance in the very young is apt to be more abundant. What has more particularly stimulated these investigators is the relationship of primary intestinal entrance of the bacilli to secondary active and selective growth of the bacilli in the lungs. Years ago Koch pointed out that guinea pigs infected through the alimentary tract by feeding might show no abdominal tuberculosis but primary pulmonary lesions. The observations I would bring to your attention bear upon the paths of this infection from the one area to the other. I do not think it is an exaggeration to say that there have been some fifty recent researches bearing upon this subject. At least a score of these have been stimulated by Calmette, an adherent of von Behring's hypothesis, who came out with a striking paper to the effect that anthracosis, —the pigmentation of the interstitial substance of the lungs seen in coal miners,—is not, as had hitherto been taught, due to direct inspiration of coal dust into the air sacs of the lungs, with carriage of the particles of leucocytes from the air sacs into the lung tissue proper, but is due to swallowing of the dust and carriage of the same by leucocytes into the mesenteric lymphatics and so eventually by leucocytes through the thoracic duct to the lungs as the organs of selective deposit and possible eventual discharge. So heterodox a view immediately stirred up workers in laboratories throughout France and Germany and while a few came out in Calmette's favour a baker's dozen and more have obtained contrary results. All that may be said to be proved so far is that if sufficient sepia or finely ground carbon be given to rabbits by the mouth for a sufficient length of time along with bland pappy food (so as not to cause any abrasion of the intestinal mucosa) then, eventually, the mesenteric glands become absolutely black with the particles that have been conveyed to them.

Observations with bacteria have indeed shown results which seem opposed to the theory of leucocytic carriage from intestine to lungs. Thus Uffenheimer* has made the remarkable observation, which has been confirmed by some others, that if pure cultures of specific and easily distinguishable bacteria be administered to rabbits by rectal enema, in four hours time cultures of the specific bacteria are obtainable from the mucous membrane and contents of the whole length of the alimentary canal, from the œsophagus, the mouth, and even from the trachea and lungs, whereas the liver, kidney and deeply placed organs are found sterile. He calls attention to the need for extreme caution in laying down the course of the bacteria from one viscus to the other, there being evidently reverse currents which may be set up in the digestive tract, capable of carrying bacteria upwards within the viscera from the rectum and so eventually down into the lungs. One would suggest that these reverse currents account for the bad breath of the constipated! But here again we find other observers giving the lie direct. For us the interesting part is that even Uffelheimer admits that in a certain proportion of his animals he gained cultures of the specific bacteria from the mesenteric glands although they were absent fro mthe heart blood. He admits, that is, the importation of non-pathogenic bacteria through the intestinal mucosa.

I would suggest that von Behring's observations upon the more active importation of bacteria in the very young animal is to be found not so much in the more active importation (though possibly that occurs) as in the lesser capacity of the leucocytes and endothelial cells of the young individual to destroy bacteria rapidly. What I would lay lown in conclusion is the lesson that throughout life we are training ourselves to get the better of, and to destroy, bacteria. Our leucocytes are in continual training. It is not only when there is an abrasion and acute superficial infection that these cells gain their first call to take up and destroy bacteria, but constantly day by

*Uffenheimer, Deutsch. Med. Wochenschr, 1906, p. 1851.

day and hour by hour they may encounter occasional stray microbes within the system, and aided, let us note, by the opsonins normally developed in the tissues, and by yet other agencies, they become progressively more and more adapted to cope with microparasites of different orders. You as future medical men in your future immunity from various infectious diseases, despite constant exposure to infection, will yourselves demonstrate this development of a progressive latent immunity, will demonstrate the training of your leucocytes.

THE ORIGIN OF LIFE ON THE GLOBE.

Address by A. B. Macallum, M.A., Ph.D., LL.D., F.R.S., Professor of Physiology, The University of Toronto.

MR. Dean Connell, Members of the Medical Faculty, and Gentlemen: When I was invited to give an address to you at this hour I first proposed to take a subject which would cover questions of medical curriculum, but when I thought over what the programme would entail, and what the occasion might suggest it occurred to me that you might have a surfeit of such subjects, and, in consequence, I thought it best to break away from the usual course and take a subject which would interest you, a subject which perhaps is not often touched upon in your courses of lectures, but which is all the same of intellectual, absorbing interest. That subject is the Origin of Life on the Globe. I am conscious of its magnitude, and in so expressing myself I make an apology for selecting it. Perhaps my sense of fitness, or rather unfitness, may be indicated thereby, or at least the knowledge that I feel so. But that is not the greatest difficulty I have. It is a difficulty I always feel in dealing with a subject of this sort, so near to the sentiments and creeds of mankind. When, therefore, I touch upon the subject I may say that in dealing with it there is a part of it I do not wish to refer to. There is an aspect of it which does not come within my ken this morning, and in leaving something about it unsaid you will understand why I do so.

The other part of the subject comes within our scientific jurisdiction, if I may so express it. That part is subject to discussion even in so public a place as the market-place. It is peculiarly the subject for thought, for speculation, in the study and particularly in an Academy of Learning.

Now the origin of life on the globe belongs to that class of subjects which will always interest mankind. There are others, for example, the origin of the universe, the eternity of matter, the nature of matter itself, and the development of mankind, the history of man from his first appearance or from his first developmental stage till to-day. These with the question of the Origin of Life will always be choice subjects for intellectual review so long as mankind has any intellectual curiosity at all.

In every consideration of the question of the origin of life we must allow a certain doctrine to play its part. That is the theory of the evolution of species. If we do not grant that we need go no further. The vast majority of those who have given some attention to this department of knowledge do not believe that species of animals and plants have had separate origins independently of each other, that they have had each as their origins special creative acts, but accept unreservedly the theory of evolution.

According to that theory every form of life at present on the globe and every distinct form in the past, has been evolved from a primary organism which existed at the beginning or dawn of the geological age, a form of life which must have been extremely simple, without even those peculiarities of structure that we find in the simplest form that we can study under the microscope. It was in all probability without a nucleus, very homogeneous in structure and perhaps not large enough to permit us to see it with even the highest powers of our best microscopes at our service. This form, I say, appeared on the globe at a certain time and the question is: how did it originate?

In answer thereto have been advanced three different hypotheses. The first of these which I shall take is that which postulates that it was the result of creative intelligence, the intelligence residing in or behind or above matter. When we accept the doctrine of evolution yet hesitate at the point of the origin of life and say that it shall not apply there, we take a position which we cannot intellectually defend. Why should we believe that natural laws could evolve species and deny that they could not so result as to originate life? Is it intellectually necessary for us to take that position?

Then there is the so-called Panspermic Theory, the second hypothesis concerning the origin of life. This was first advanced by Lord

Kelvin, in 1871, and according to it all forms of life on the earth owe their origin to an organism which was carried by meteorites through interstellar space to the earth. The organism meeting favorable conditions began its career and from it were evolved all the forms of life which have appeared or are appearing on the globe.

This theory was advanced again in 1903 but in a modified form by the Swedish chemist, Arrhenius. More recently he has published further observations upon the subject and in these he claims that the modified theory is an intellectually acceptable explanation of the origin of life upon the globe. He points out that the difficulties which beset the Kelvin theory cannot be urged against his and that the conditions which an organism would undergo in interstellar space would neutralize that action of light which is capable at ordinary temperature and full exposure to the sun's rays, of sterilizing micro-organisms. Further low temperature and a partial desiccation of the organism would favor its continuance as a living form with, of course, suspended powers and properties.

The difficulty that one encounters here is that it would take millions of years for such an organism to reach the earth, but Arrhenius points out that a recently discovered property of light, namely the pressure it exercises on all objects in the direction of its course, diminishes that time to an enormous extent. To illustrate this property fully, one would have to arrange an elaborate experiment and of a rather complicated character, but I may explain how this pressure acts by referring to a phenomenon which for a time puzzled astronomers. When a comet approached the sun the tail was always in the rear; in sweeping about the sun it was found on the far side, that is, on the side remote from the sun, but when the comet completed the course about the sun the tail was in advance. The tail is known to be largely gaseous, or composed of minute particles which collide with one another and the heat arising from such collisions produces gases which glow with their own light. On these particles and on the gases arising from them the light from the sun exercises a driving force and that is why the tail of the comet is directed away from the sun. Arrhenius points out that a microscopic organism which would be carried into interstellar space would experience the same pressure of light and that this pressure would hasten its course in the direction of the path of the light. It would not be the pressure of the light of the sun necessarily, but often the pressure of the light of a fixed star.

The difficulty, however, in the way of accepting this theory, is that the distances to be traversed are enormous. We are apt to think that the fixed stars are comparatively near, but many of them are at incalculable distances. The nearest one is that which is known as Centauri. Its parallax is the largest of all the fixed stars, and its distance has been estimated as that of 25,000,000,000 miles. That distance is about 4,500 times the measure of the radius of our stellar system, that is, supposing we consider the radius of the orbit of Neptune, the outermost planet of our system, as one mile, the star known as Centauri would be 4,500 miles away. You can understand from this the difficulty that organisms would experience in reaching the earth and the extraordinary amount of time it would take to do so. The risks of failure to reproduce, to which such an organism would be exposed, would also be enormous; and in accepting the theory we would have to believe that incalculable numbers of such organisms were traversing interstellar space, and some of them capable of life happened to penetrate the atmosphere of our globe at the right moment.

In accepting any theory we must first find out whether it satisfied our intelligence, but one would have to have, to a certain extent, the faculty for the marvellous to become a partizan of this doctrine. There is a further difficulty, it does not finally explain the origin at all. It is only placing the origin of life further back, back to an earlier time and to some other stellar system the inhabitants of which would have to face the question, " What is the origin of life?" as we are facing it. Therefore the Panspermic theory is not an explanation at all.

The third theory is what is known as abiogenesis or the theory of the spontaneous origin of life. This is as old as Aristotle for it was he who first defended it. I am not aware that he proposed it first. It was one of those ideas which were floating in the minds of the Greek Philosophers of that wonderful period, the fifth and fourth centuries B.C. The Latin Poet-Philosopher, Lucretius, accepted it and since his day there have been not wanting many who have also been its advocates. An exponent of this view is Bastian, who has devoted many years and much energy to the defence of it, and who claims that he has been able to develop bacteria de novo, in pieces of animal tissue and in infusions which living bacteria had not been allowed to penetrate.

Bastian's view was not well received on account of the fact that he advanced no unquestioned evidence in support of it. Huxley and Tyndall vigorously opposed it, both claiming that forms of life under the present physical conditions of the globe could not originate de novo. Both accepted instead biogenesis, but Huxley confessed that if were given him to look beyond the abyss of geologically recorded time to the still more remote past when the earth was passing through certain physical changes he would expect to be a witness of living protoplasm out of non-living matter. I hold that it would have been impossible for him, if he had been a spectator, to see the transition from non-living to living matter, and why I take this position you will see presently. Living matter to-day consists of particles which are beyond the range of ordinary or even highest microscopic vision. The highest power will not answer for particles of less diameter than 175,000 part of an inch, that is, about the seventh part of a micron. Do what we will that is the utmost limit. On the other hand, the ultra-microscope which has been recently introduced as an additional instrument of research has enabled us to see particles smaller than this with it, as flashing points of light on a dark field. We can thus observe images of bodies which are between one-seventh of a micron and one-hundredth of a micron.

Now when we disintegrate living matter, and put a drop of the material so derived under the microscope we find that it consists of a solution in which myriads of particles below the size of one-seventh of a micron are suspended. These particles are colloidal particles. If we take any solution of a colloid, it matters not what it is, and carefully filter it, there still remains in the filtrate what are called the ultra-microscopic particles. In fact a colloid is not a solution at all, it is a suspension and a suspension in which all the particles are firmly held in their place, and the particles are seen to be in constant vibration. I should be more careful in using the word "see"; we do not see. When we are in a darkened room in which a beam of sunlight penetrates we see the path of the beam by the dust particles in its course. If we stand and look at the source of the light we see no particles whatever, but when we stand to one side we "see" these particles. They are visible because the sunlight is reflected from their numerous facies, and the rays, divergent, reach the eye where they give the sensations of flashing points of light. In the ultra-microscope the light is so adjusted that it passes through the object (drop of colloid solution) at an angle more or less with the optical axis of the tube of the microscope. If there are ultramicroscopic particles in the drop these scatter the light which falls on them and thus divergent rays arise which penetrate the tube and reach the eye. In consequence every particle appears as a minute, flashing, vibrating point of light placed on a dark back ground.

When we take living matter and disintegrate it mechanically we find that it is composed of ultramicroscopic particles. These in living matter are alive and living matter is formed of a collection of them in which the particles are interdependent and consequently incapable of separate existence, but there are particles no larger than these ultramicroscopic structures which are alive and lead each an independent existence. Such are the organisms causing yellow fever, the mosaic disease of tobacco, the foot and mouth diseases and some forms of chicken cholera. Such ultramicroscopic organisms differ from bacteria that we can demonstrate with the ordinary powers of the microscope only in their size.

Living matter may then be of ultramicroscopic size and if we could account for the origin of organisms of such a magnitude we would explain the origin of life.

Such organisms, as well s protoplasm itself, consist of substances called proteins and these constitute the physical basis of life. Now proteins are chemical compounds of such extraordinary complexity of constitution as to have defied the efforts of chemists for a long time to determine it. Within the last ten years very considerable progress has been made in elucidating their chemical structure and in this Kossel and his ppuils have done great service. Kossel studied the decomposition products of proteins and found that they consist in large part of what are called amino compounds of fatty acids. A fatty acid is one of the series to which acetic acid belongs and the series includes such members as stearic, oleic and palmitic acids which go to constitute, with glycerine, the principal fats of the body. When in any of these fatty acids, one of the hydrogen atoms is replaced by the amino group NH_2, we say that it is animated and that it is an amino acid. Such a compound is both a weak acid and a weak base, that is, each is capable of uniting with a base to form a salt and likewise with an acid to form a salt. Because of their acid and basic characters the amino acids are capable of uniting with one another to form salts.

There is, however, another way in which the amino acids combine. If one amino acid is chlorinated, that is, with the atom group

HO in the acid replaced by the chlorine atom Cl, this compound can unite with the unchanged, unaltered compound in this way.

$CH_2\,NH_2\,CO\,Cl + NH_2\,CH_2\,COOH =$
Amino acetylchloride + amino acetic acid =

$CH_2\,NH_2\,CONHCH_2\,COOH + H\,Cl$
glycyl-glycin + *hydrochloric acid.*

This glycyl-glycin can in its turn be chlorinated and made to unite in the same way with amino-acetic acid:

$CH_2\,NH_2CONHCH_2COCl + NH_2\,CH_2\,COOH =$
glycyl-glycin + glycin =

$CH_2\,NH_2\,CONHCONHCH_2\,COOH + H\,Cl$
diglycylglycin + hydrochloric acid.

This method of synthesis has been employed to a very large extent by the German chemist, Emil Fischer, and the bodies which result he calls peptides, because they give the same reactions as do peptones. Further, peptones when they are decomposed give amino acids. Fischer has succeeded in building up peptides which contain as many as eighteen amino acid groups. The size of such a synthesized peptide may be judged from the fact that in the last equation given above the synthesized product contains only three atom groups or construction blocks as one would term them after the German fash (Bausteine). Such a huge molecule as that consisting of eighteen groups is very nearly related to the peptones and it, as well as the other peptides which Fischer has produced, suggests that at last the chemist has found the method by which he will ultimately succeed in synthesizing proteins.

What has this to do with the origin of life? Much, indeed, as we shall presently see.

In the early history of the globe the temperature was high and in consequence many of the constituents of the present rock crust as well as all the water of its oceans were in the atmosphere as gases and vapours. Amongst these were carbon monoxide, carbon dioxide, chlorine, nitrogen, and various hydrocarbons, all mingled with water vapor and oxygen. The pressure of such an atmosphere must have been enormous. When the temperature fell to a certain extent many of the mineral constituents were removed from the atmosphere and the lowering of the temperature proceeded till a great part of the water vapor condensed also, but the atmosphere still held a large quantity when the temperature was between 80°C and 120°C. At this stage any condensations must have resulted in enormous electrical discharges which, coursing through air containing nitrogen, chlorine, carbon monoxide, carbon dioxide and hydrocarbons, must have resulted in the synthesis, countless missions of times, of amino acids of all kinds and their union together not only as peptide-like compounds but also as proteins. In fact, the surface of the earth during this period must have been a vast laboratory in which the production of such compounds may have taken place on a vast scale. The presence of hydrocarbons such as those in petroleum we can safely postulate, for they are found associated with meteorites, and as it is not improbable that the petroleum compounds of our oil wells and perhaps especially those of Baku, on the Caspian, are due to the action of water on hot metallic carbides at considerable depths below the surface, we may infer that similar carbides immediately under or on the hot rock-crust's surface, when acted on by condensed water, would give hydrocarbons which at the temperature prevailing would volatilize.

The formation of the amino compounds at such a stage in the earth's history must have gone on for a very long period, perhaps for a million years, and during that period proteins must have been formed, though of a simple character, myriads of times, and as ultramicroscopic particles in the surface waters of the globe, before particles of the right composition and complexity were produced which would be capable of life in its simple form. Once so endowed, however, and with the power of reproducing itself in the environment in which it found itself, it began its career as a living form out of which slowly and imperceptibly other forms must have arisen and eventually all the forms of life which our planet has borne.

How far such living ultramicroscopic organisms differed from other non-living ultramicroscopic particles produced in the same period of the earth's history it is not as yet possible to say, but as such particles must have been formed countless millions of times it is likely that every variation in the range of their composition was produced and that the composition of the particle which of all finally had the cast of life differed perhaps by only the finest line's breadth from some of the non-living particles. The production, however, of such living ultramicroscopic particles out of non-living matter, a Huxley, had he been present as a spectator, would not have seen and he would have to wait perhaps millions of years before such ultramicroscopic organisms developed into forms which could have been seen with the microscope.

These ultramicroscopic forms cannot be produced under the conditions which obtain to-day on this planet. These conditions as Huxley has well said " this planet can no more reproduce than a man can recall his infancy."

Those very conditions every planet in every stellar system in the universe at some time in its history illustrates, and the final product of such conditions would be living forms, simple at first, but ultimately, as here on earth, complicated and highly differentiated.

Whether the Universe is endless as some postulate cannot be decided. From the studies of star drift the conclusion has been recently drawn that there are two separate Universes streaming in opposite directions. There may be others, perhaps an endless series of them, but at such distances from ours that their light is extinguished in the ether before it reaches us and of course the faintly luminous haze of far distant space may be derived from such a course.

If we leave the possible Universes beyond the range of telescopic vision out of consideration we have still 100,000,000 suns like our own, each with its own planets. These have gone, are going or are to go through the same stages of development that the earth has undergone and in the repetition of that history in each case living forms have been or are to be produced. Life, therefore, must proceed in an endless procession throughout the Universe!

THE TREATMENT OF HAEMORRHAGE FOLLOWING TONSILLECTOMY.

TO the medical man, be he throat specialist, physician or surgeon or country practitioner, who must of necessity be both, who attempts the operation of removing the faucial tonsils, nothing is more essential than a thorough knowledge of how to control the bleeding that may result from or be coincident with this operation.

As a general rule to be observed, no case should be operated on outside of a hospital, unless the patient is within immediate reach of competent medical assistance. Fortunately, or perhaps it would be as correct to say unfortunately, only a comparatively small percentage of cases bleed, and as a consequence " fools rush in where angels fear to tread " and the lives of patients are frequently put in jeopardy by the non-observance of this rule.

In the throat department of the Manhattan Eye, Ear and Throat Hospital of New York, where the number of Adenoid and Tonsil cases operated on in a year runs anywhere from 1,400 to 1,800, the number of cases with severe hemorrhage following is only about two per cent. Of these the majority are adults, women oftener than men, and the Jewish nationality predominating.

In the routine procedure followed in this hospital all patients are operated on under general anæsthesia of nitrous oxide gas with ether sequence, except in case of children under four years, when ether alone is used. Immediately following the operation and while the patient is still on the operating table, he is turned on his side, face down and over the side of the table, and towels soaked in ice water are applied to the face and neck as a means of stopping the bleeding and restoring the patient to consciousness. The ice water acts as a hæmostatic agent through the sudden shock which its application produces and in most cases it seems to have a markedly beneficial effect.

When the bleeding persists after two or three minutes of ice water or ice itself rubbed over the face and neck, peroxide of hydrogen is injected into the pharynx and generally produces the desired effect. Failing this a small gauze sponge on a long holder is dipped in adrenalin solution 1-1000, or tannic-gallic acid paste (tannic acid 3 parts, gallic acid 1 part), and applied directly to the bleeding surface, the sponge being held there with moderate pressure for two or three minutes. In most cases this will be all that is required, but occasionally further measures are imperative. If the patient is still on the operating table and is very restless and combative it may be advisable to give him a little more anæsthetic, sufficient to allow the operator to carefully examine the faucial pillars, etc., for bleeding points. The patient must be turned on his side, face down, during the further administration of ether in such cases. In many of these cases it will be found that the bleeding is coming from some one or two small vessels on one or other of the pillars, that have been injured during the operation, and by catching the bleeding points in artery clamps the hemorrhage is completely controlled. If the hæmostats are left on for one or two hours no further bleeding should occur.

Where the bleeding is from no one spot but is a general oozing from the whole tonsillar bed, put the patient in bed lying face down or on his right side, so that the blood and saliva will run out of the mouth or into the pouch of the cheek; take a small gauze sponge on a long handled holder, dip in tannic-gallic acid paste, apply this directly into the tonsillar fossa and hold there with some pressure for ten to twenty minutes; counter pressure may be made with the head placed externally on the side of the neck, but is not essential. In the meantime a hypodermic of morphine or codeine should be given to control the patient. In young children paregoric is preferable, given by the mouth.

The presence of this pressure plug in the throat is surprisingly well borne by most patients; even young children can readily be persuaded to tolerate it and remain perfectly quiet if the head is so placed that the mucous and saliva, which is secreted rather freely owing to the manipulations, drains away from the pharynx and out through the mouth.

Should bleeding still persist on removing the pressure sponge it may either be reapplied for another 15 or 20 minutes, or the oozing surface may be mopped dry and immediately pointed with silver nitrate solution, 480 grains to the ounce, applied on a small cotton applicator. Pure glacial acetic acid may be similarly used, care being taken not to have any excess of the silver or acid on the cotton and to apply it to the raw bleeding surface only. The tincture of the chloride of iron and the liquor ferri perchlor fortis have been used in this connection, but while either is good in some cases it has not half the styptic property of silver nitrate in stick form or strong solution and is open to the objection of being considerably dirtier to use. Failing to get a result with chemical styptics the actual cautery may be tried. It is much preferable where possible to use only the electric cautery as it can be used with so much more safety to the patient from the danger of burning other parts and there is very much less mental shock and aversion to treatment, the patient never seeing the glowing point of the cautery.

Failing to stop the bleeding with styptics or cautery the tonsil clamp should be applied. This is an instrument devised for the purpose of making direct pressure on the tonsil bed inside the mouth and counter pressure on the neck outside. Several patterns are in use, that known as the Miculicz-Stœrks being probably the simplest and best. In applying this instrument it is customary to cover the mouth end with a small sterile gauze pad securely tied on and a larger soft gauze or wool pad should be fastened under the external end. It is an added advantage to cover the inner pad with tannic-gallic acid paste. The amount of pressure applied should never be very great but only just sufficient to control the oozing, as any degree of pressure long continued becomes very painful to the patient and if the circulation is completely stopped for any considerable length of time sloughing is apt to occur. As regards the length of time to leave on, it is advisable not to leave a clamp on a young child longer than from one to two hours and in adults four to five should be the maximum time for continuous application. I have seen two cases where the clamp was left on an adult for from eight to twelve hours without any ill effect resulting; but on the other hand I know of one case where the whole mass of tissue compressed sloughed; and in another case that of a child four years of age, that came under my care during the past summer, although the clamp was only on for about three hours, the patient developed a partial facial paralysis which lasted for weeks and for days she suffered considerably from a hard indurated swelling at the site of application and the tissues for several days looked as if they might slough. In this case the patient lost so much blood that intra-venous infusion of normal saline solution was necessary.

Another most excellent procedure is that of sewing the tonsillar pillars together, with a compression pad of gauze or Bernay's sponge between. If the hemorrhage is from the naso-pharynx a posterior plug of proper size should control it completely. This should not be left in longer than thirty-six hours at most. Usually much less will suffice.

A still further method advised by some is that of putting two stout rubber catheters for breathing purposes through the nose or mouth and reaching into the pharynx about one-quarter of an inch past the epiglottis and there plugging up the whole pharynx with gauze.

Where the patient is known to be a "bleeder" or to come of a family of bleeders and the indications for tonsillectomy are imperative, it is most advisable to put him on tonic treatment with plenty of fresh air and sunlight for some time previous to operation. In addition, liberal doses of the salts of Calcium should be given during the three or four days immediately preceding operation, for the purpose of increasing the coagulability of the blood. Of these, probably the best is the Calcium Lactate given in 10 to 20 grain doses. A small glass of milk should be given first and fifteen or twenty minutes later the Calcium Lactate may be given well diluted in water. Calcium Sulphate is also very commonly used in these cases, and should be administered along similar lines, as it is very irritating to mucous membranes. It may also be given in the form of capsules.

If the patient is an adult and not of a highly nervous temperament removal of the tonsils can best be accomplished under local anæsthesia by means of the cold wire snare, the patient sitting in the upright position. It is found that bleeding following the snaring operation is always much less than where the ordinary Mackenzie or Mathieu guillotine is used.

If bleeding does occur in spite of your prophylaxis, any or all the milder methods of treatment may be tried, but if the more radical procedure of tying the faucial pillars together requires some little skill in technique, a knowledge of how to proceed and a considerable amount of patience. Special needles have been devised for this particular operation, the best known being perhaps the Douglas tonsil needle. This is nothing more than a modified aneurism or hernia needle, the handle being longer and S shaped and the curve of the needle itself having a diameter of about two inches. However, an ordinary full curved Hagedorn or a "cervix" needle on the end of a long holder will answer the purpose just as well as any other. The suture material should be about number ten black silk and not less than twenty-four inches in length. A pad or compress about one inch to an inch and a half long and half an inch thick, made from Bernay's sponge wrapped with plain gauze, should be placed between the pillars in the space formerly occupied by the tonsil and the pillars drawn together over this. The object of this pad is of course to produce direct pressure on the bleeding surface and in order to insure its remaining in place one at least of the sutures must pass through it. As this would obviously be a most difficult procedure with the pad in situ, it is best performed thus: A long silk suture is passed first through the posterior pillar, then brought out of the mouth, passed through the pad, then back in the mouth and through the anterior pillar and out again, the pad being left outside the mouth all the time. The remaining sutures are now passed from back to front, the ends being left untied and hanging outside the mouth. When all the sutures deemed necessary have been inserted, the pad is lowered into place on the end of a long hæmostat or sponge holder and the sutures tied over it. When properly carried out as detailed above the procedure is easily accomplished and should control all tonsillar hemorrhage. The pad and sutures should be left in place from twenty-four to thirty-six hours, by the end of which time all the small capillary mouths will have become occluded with clot and the bleeding controlled. To leave it in longer than this would subject the patient to considerable risk from sloughing of the compressed tissues and still more to the dangers of infection, as the pad by this time will have become very foul and fœtid.

During all this time the patient should be kept at rest in bed and sufficiently under the influence of codeine or morphine to ensure perfect quietude. The room should be darkened, no visitors, no talking and only liquid food allowed. Ice to suck will be both gratifying to the patient and is a valuable additional hæmostatic agent. If swallowing is in any way difficult or painful the patient should be fed per rectum. An ice bag applied to the neck will have a quieting mental effect though its actual therapeutic value is doubtful. Should the bleeding still persist after tying the pillars as above, or subsequent to removal of the pad, further compression may be applied by means of the tonsil clamp or it may be deemed more advisable to at once proceed to tying off of the external carotid artery. Where all other means have failed and the patient has lost a great deal of blood, the surgeon should not hesitate to ligate the external carotid, which should be done just above the bifurcation of the common carotid trunk. The tonsils are supplied with blood from a comparatively large number of arterial sources, i.e., the tonsillar branch of the facial; the pharyngeal branch of the ascending pharyngeal; the dorsalis lingual of the lingual, and a small twig from the inferior dental branch of the internal maxillary. As all of these come from the external carotid, tying the latter below the lowest of the branches implicated, i.e. the lingual, will necessarily control the hemorrhage.

That the number of cases requiring ligature of the carotid is small goes without saying, but that such procedure is justifiable and even imperative in some cases is most strikingly shown by a case that came under my care about two months ago. The patient was a young married woman, twenty-six years of age, apparently in perfect general health, a Hungarian by birth but had lived most of her life in New York city. She was operated on by a well-known New York throat specialist in his office, both tonsils being removed under cocaine anæsthesia. Failing to stop the bleeding after persistent efforts in his office, the surgeon sent her at once to the Manhattan Eye, Ear and Throat hospital for treatment. Examination showed a slow general oozing from the tonsil bed of the right side, with little or no tendency to clotting on the part of the blood. The left side was covered by a thick clot and was not bleeding. Tannic-gallic acid mixture was applied persistently with no effect; direct pressure with a gauze pad on the end of a sponge holder was tried for several hours with only temporary effect, then 480 grain silver nitrate solution was painted over the surface and this stopped it for about twelve hours, when the oozing commenced again. This time, however, it was found to be coming from the opposite side; no further bleeding occurred from the right side. Pure acetic acid, five per cent. chloroform spray, Tr. Ferri Mur., silver nitrate in stick form and the actual cautery, each representing the recommendations of as many different consultants, were all tried in turn, in addition to the tonsil clamp and pressure pad. After from two to three hours' efforts the bleeding was stopped again and remained so for twenty-four hours when it again recurred. In two to three hours efforts along similar lines were again necessary to get the bleeding stopped and for eight days these recurrences of the bleeding occurred with intervals of twenty-four to thirty-six hours between the outbreaks, which occurred mostly in the small hours of the morning between midnight and dawn. On the eighth day the tonsil pillars were sewn together, five sutures of black silk being inserted. This controlled the hemorrhage completely for about thirty-six hours when the blood again began to ooze out from between the sutures. Styptics locally and ice to suck and morphine hypodermically all were tried without effect. The patient's condition from the excessive aggregate loss of blood, the continued loss of sleep and increasing mental anxiety was becoming decidedly alarming and as a last resource it was decided that the external carotid artery should be ligated. The patient was put under chloroform anæsthesia and the operation performed without incident. The hemorrhage was completely controlled and did not recur. The patient was kept under observation in hospital for one week, by which time the external wound in the neck had completely healed and the patient's strength sufficiently restored to allow of her removal home.

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BOOK REVIEWS.

"Diseases of the Nervous System," by Archibald Church, M.D., Professor of Nervous and Mental Diseases, and Medical Jurisprudence, Northwestern University, Chicago. D. Appleton & Co.

This is an authorized translation from "Die Deutche Klinik," edited by J. L. Salinger, M.D., the contribution of noted German neurologists.

The book seems to us to be a very complete presentation of the subject, and its arrangement will commend itself to those who desire a text-book on the nervous system; and to the specialist it should be a desirable addition to the library as a work of reference.

The abundance of diagrams and plates will be especially pleasing to teachers as aids in presenting a difficult subject.

The conception of nervous diseases as based on the neuron theory is adhered to, though the Fibrillar theory is explained in connection with the neuron theory.

The section on "General Neurological Diagnosis" is very complete, while that by Funicke on "Lumbar Puncture" is of especial interest, now that examinations of the cerebro-spinal fluid in certain mental conditions are of such value as a means of diagnosis.

The method, in dealing with the nervous diseases, of giving a complete history of a case before proceeding to a general analysis of the disease is to be commended. The histories are so excellent as to give the student a mental picture of the patient, and the patient's condition, especially valuable upon turning to a general consideration of the disease.

W. G.

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A Text-Book of Minor Surgery, by E. M. Foote, A.M., M.D., formerly Chief in Surgery at the Vanderbilt Clinic, New York, and published by Appleton and Company, New York and London.

This is a book of some seven hundred and fifty pages and is illustrated by four hundred and seven engravings from original drawings and photographs.

Minor surgery, whether in text-books or in systems of surgery, is generally confined to one or at the most two chapters, and as a rule deals only with such subjects as bandaging, bloodletting, counterirritants, transfusion, catheterization and electricity. The author of this book, however, takes a much broader view of the idea of minor surgery as evidenced not only by the number of subjects considered in the work, but also by the breadth of scope and the practical application of remedial measures to surgical disease. He evidently considers minor surgery as synonymous with practical surgery for the busy practitioner. As he very aptly remarks in the preface: " It has been my purpose to apply to the less serious every-day problems of surgical practice the new knowledge which the discoveries of the last twenty-five years have revealed. . . . And yet this neglected field of minor surgery is the only one into wihch the average practitioner will ever enter and is also the one in which most surgeons will find the majority of their patients."

The arrangement of the sections is such that one can readily refer to any particular disease of any special part of the body, while the photographs of the clinical cases, the treatment of the ordinary surgical diseases, and the methods of performing the ordinary minor operations are so clearly described that the whole makes a valuable contribution to the needs of the class the book is designed to reach, viz., the general practitioner; and after a careful study of the work we have no hesitation in saying that we are confident it will be of great service to the profession at large, and would strongly urge the young practitioner to become familiar with it since it contains so much practical information on subjects which he will meet with almost daily—information difficult to obtain in the ordinary text-books on surgery.

D. E. M.

WHAT OTHERS ARE SAYING ABOUT US.

Queen's Medical Quarterly for October, published by the Medical Faculty of Queen's University, Kingston, deserves notice. It gives an admirable account of the work which is being done in Kingston with much matter of historical interest. It appears that the medical school had its origin in the fact that certain students of medicine, who had spent three sessions pursuing their studies in a city west of Kingston, were unable to obtain a degree in medicine unless they subscribed to certain religious tests which were obnoxious to them. This city "west of Kingston" is presumably Toronto, though we never before heard that great city assigned a geographical situation according to its relation to Kingston. So far as we know Toronto does not now exact religious tests, and Queen's Medical School must find another reason for existence than that which lies in theological protest. We agree unreservedly that the student "must study at the bedside of the sick," and that opportunity must be difficult of access in a city of 17,000 inhabitants.—*Montreal Medical Journal*, November, 1907.

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The *Montreal Medical Journal*, October, 1907, in an article on "Halifax Medical College," says:

"The only hope for the smaller medical schools is that McGill has raised its requirements to five years, and Toronto will follow next session. No one contends that this is too much, but there are always students who will be content with the second best. These will seek the smaller schools and give to them a renewed though temporary lease of life. Halifax may take courage from what has happened in Kingston where, in a city of 17,000 inhabitants, with corresponding hospital facilities, there are registered this year 230 medical students."

* * *

The *Montreal Medical Journal* has of late been saying some pretty plain things about some of the medical colleges of this country. It had some rather hard comments to pass upon the medical college in Halifax. Now we have always thought that this college was doing good work, and we are still of this opinion. The students receive very good didactic teaching, and the clinical facilities are all that could be desired. Socrates taught a class of one and that class was Plato. The usefulness of a medical college is not to be measured by its buildings, the number of its teachers, the size of the classes, but by the quality of its teaching, both theoretical and practical. Some of the great medical schools are not found in the largest cities.

Coming to Queen's Medical College, in Kingston, in the November issue we read: "Queen's Medical School must find another reason for existence than that which lies in theological protest. We agree unreservedly *that the student 'must study at the bedside of the* sick' and that opportunity must be difficult of access in a city of 17,000 inhabitants." A glance at the Government returns of the hospitals in Ontario shows that in the Kingston General and the Hotel Dieu there was a daily average of 140 patients last year. This is ample for clinical purposes, so that it matters little whether Kingston contains 17,000 or 34,000, provided there is enough clinical material for bedside teaching. But records speak well for the work done in Kingston. The students from this college acquit themselves well when placed side by side with those from other colleges. It is quite wrong even to suggest that "Queen's Medical School must find another reason for existence than that which lies in theological protest." Queen's Medical College is a medical college pure and simple, and exacts no other test than that of a thorough knowledge of the subjects in the medical curriculum.

Also in the same issue of our contemporary we are told it would be folly for McMaster University to establish a medical college in opposition to the one now in existence. "If McMaster University can equip and train better physicians than the strong, well-equipped University of Toronto, there is reasonableness in their idea. We know they cannot, because the University of Toronto has a strong hold on the clinical facilities of the city." This is, again, an expression of opinion from one who may not be familiar with all the facts. It is true that the University of Toronto has a strong and capable staff of teachers, and has much clinical material at its control, and gives a thorough course, both theoretical and practical. But, while all this is true, it would be possible to arrange for a second teaching staff of able physicians and surgeons, and competent incumbents of the scientific subjects. As for clinical material, there are three available hospitals in Toronto with a total bed accommodation of at least 325, and under the control of thoroughly trained physicians, surgeons, specialists, and clinicians. McMaster University has now over 200 students in the general Arts course.

The medical colleges in London and Winnipeg have been doing good work for many years. While we have nothing but words of praise for the splendid work that is done in the medical departments of the Universities of Toronto, McGill and Laval, we cannot stand by and see any asperse criticism offered upon the teaching in Halifax, Kingston, or other Universities, without raising a voice of protest.—*Canada Lancet*, January, 1908.