MINISTRY OF HEALTH.

RECENT ADVANCES

IN

MEDICAL EDUCATION IN ENGLAND.

A Memorandum addressed to the Minister of Health

by

Sir George Newman, K.C.B., M.D., Hon. D.C.L., F.R.C.P., Chief Medical Officer of the Ministry of Health and of the Board of Education, Crown Nominee on the General Medical Council

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CONTENTS.

APPENDICES.

PREFATORY NOTE.

To the Right Hon. Neville Chamberlain, M.P.
Minister of Health.

SIR,

I have the honour to submit a Memorandum on some *Recent Advances in Medical Education in England*, which is supplementary to an earlier, introductory Statement published in 1918.

In view of the substantial subsidies contributed from the Exchequer to the maintenance of the Medical Schools, the President of the Board of Education (the Right Hon. H. A. L. Fisher, M.P., LL.D., F.R.S.) instructed me in 1921 to prepare a considered review of the situation ; but the insistence of current official work and the scantiness of my leisure have unavoidably delayed the production of the Report. As the subjects dealt with concern more intimately the Ministry of Health than the Board of Education, it has been deemed appropriate that the Report should be addressed to the Minister of Health. It is obvious that the education of the medical practitioner bears close and vital relation to the whole question of Preventive Medicine. Both in his private and in his public practice, he is inevitably its exponent and interpreter.

For the purpose of convenient reference the Report follows the form of the previous Memorandum ; it contains an account of the present position of Medical Education in England and a brief history of the circumstances of which that position is the outcome. I recognise that it deals with certain issues which cannot at present be resolved, which are, and must remain for some time, *sub judice* ; but it is expedient to be too early rather than too late in offering suggestions and comments in regard to them. That such comments should be submitted by a detached observer of the various branches of medicine and surgery, of preventive medicine and general practice, and of the science and art of medical education, rather than by a specialist engrossed in any one branch has some serious limitations but also probably some advantages. It provides fuller opportunity for true perspective.

It will be apparent how greatly I am indebted to various experts in England and America whose experience and counsel have been of the utmost value, and I feel sure they will make allowances if the text appears sometimes to be crude and fragmentary, or sometimes too frank and candid. I recognise, fully and cordially, the scientific and national work performed by the teachers of Medicine in the Universities of this country, and my

criticisms and observations are offered in no carping spirit, but in a sincere desire to be of constructive service to them in their labours. After many years' study of the subject few persons can appreciate better than I do the difficulties of their task, and the absolute necessity of its being fulfilled in an atmosphere of freedom and independence. Freedom is indeed their native breath ; but this should not preclude the financial assistance of the State being available for the institutions in which they work.

As one reads a summary statement of this kind one is apt to gain the impression that the medical curriculum imposes a burden on the student too heavy to be borne. In order to form a sound judgment on that point, however, we must remember what the pressing needs of the situation compel, and the circumstances and exigencies of time, space and knowledge ; that the course is five years in length ; that the Secondary Schools are able increasingly to make their preparatory contribution ; that the revised medical curriculum, whilst it adds little that is new in subject, has been designed to relieve and assist the student in his pursuit of the science and art of the great profession he has chosen ; that the numbers of systematic lectures he must attend have been substantially reduced ; that the methods of examination to which he is to be subjected tend to become less burdensome ; and that the most after all that can be accomplished within the five years is to provide him with the tools of learning in order that by experience he may become a reliable and effective workman.

It is proper to add that the responsibility for opinions expressed in this Memorandum rests solely with the writer. They do not necessarily represent the official views of the Ministry of Health or of the Board of Education.

I have the honour to be,
Sir,
Your obedient Servant,
GEORGE NEWMAN.

WHITEHALL,
March, 1923.

RECENT ADVANCES

IN

MEDICAL EDUCATION IN ENGLAND.

I.

INTRODUCTION.

1. Since my previous Memorandum entitled " Some Notes on Medical Education in England " was published by the Board of Education in 1918 (Cd. 9124) there have been significant developments in Medical Education in this country. As a result of the medical experiences of the War and the advance of medical knowledge substantial modification has taken place of its form and content. The General Medical Council has revised (*a*) the whole medical curriculum, (*b*) the dental course and (*c*) the training in Public Health, and new arrangements have been made for the provision of grants-in-aid.

2. The historical steps by which medical education in modern times has developed may be briefly summarised. After the Renaissance, medical teaching consisted of courses of anatomy and botany with a little bedside lecturing and an occasional autopsy. In the seventeenth century, Mayerne developed bedside study in England and lecturing increased. Alongside such medical work went mathematics and astronomy with a smattering of alchemy. In the eighteenth century came dissecting as a routine, and under the inspiration of Boerhaave were established Chairs of Clinical Medicine and Surgery and an apprenticeship system combined with hospital instruction. Private coaching or medical schools were undertaken by Smellie in obstetrics, Cullen in medicine, Black in chemistry and the Hunters in anatomy and surgery, and this lasted into the nineteenth century. Hospital pupilage was unorganized and mainly self-determined by the student. The Licensing Bodies subsequently instituted some form of curriculum and after the establishment of the General Medical Council in 1858 systematization commenced.

3. The General Council of Medical Education and Registration of the United Kingdom was constituted by the Medical Act, 1858, which was passed on August 2nd in that year, and the first meeting of the Council was held in the Hall of the Royal College of Physicians of London on November 23rd, 1858. As the name implies, the Council was equally concerned with Registration and Education, but while the latter subject was a matter which had been within the province of the Universities and other Qualifying Bodies, there existed no Register other than various local or general Directories. Accordingly, the compilation of the Register was the first matter taken in hand, and the first edition of that work was published in 1859.

4. The subject of education next received attention and the first steps were taken in 1858. Returns were required from the Licensing Bodies as to courses of study, examinations, age of students, etc., and these data were considered in 1859. Naturally, the general education of medical students formed the subject of preliminary consideration, which was followed by prolonged discussion and negotiation with the Licensing Bodies as to professional qualification.

5. In 1869 the Council was in a position to recommend that " without a knowledge " of certain subjects no candidate should be allowed to obtain a medical qualification entitling him to be registered, and the essential subjects were anatomy, physiology, chemistry, materia medica, medicine, surgery, midwifery, and forensic medicine. " Morbid anatomy " was included in the clinical subjects and Licensing Bodies were urged to ensure that " attendance upon lectures " did not interfere with hospital and clinical study. Further, the Council viewed with approbation the study of the Natural Sciences before medical work began. Such was the first formal curriculum.

6. It was not long before the Council suggested amendments, and from 1871 to the present date a vigilant eye has been kept upon the necessity of revision. The old-fashioned pharmacy was to be separated from Therapeutics, attendance on not less than twenty labours was required in Midwifery, and systematic Pathology found a place in the curriculum. Then in 1885, Chemistry and Physics were placed at the beginning of the Curriculum, and Hygiene and Mental Diseases at the end. Three years later dispensary work was added to the clinical instruction, and in 1890 a complete course of study was recommended with which the present student is familiar, and which in 1893 was planned to occupy five years.* In 1906, the administration of anæsthetics and post-mortem work were added, and ten years later medical ethics. In 1918 began the detailed revision which has provided us with the new curriculum of 1922—some of the potentialities and possibilities of which are discussed in this Memorandum.

7. It will be remembered that in 1908 the Board of Education was authorized by the Treasury to give grants in aid of education to Medical Schools of the Universities in England and Wales which applied to them, and which fulfilled the prescribed conditions. In Scotland and Ireland the aid given for Medical Education was in the form of Parliamentary grants for the whole of the activities of the University concerned. This is now the practice in England and Wales, except in the case of London where the various Medical Schools receive grants specifically for medicine. At the outset the grants made by the Board of Education in respect of Medical Education in England were made under its Regulations for Technical Schools and computed on the basis of

* For a valuable review of this subject see " *Some Considerations of Medical Education,*" by Sir Squire Sprigge, 1910.

student-hours. Later, the Board introduced a revised form of grant provisions known as the " Statement of grants available in aid of technological and professional work in Universities in England and Wales," under which provisions the grants were no longer calculated on student-hours but on a student-unit basis. The grant made in the case of each provincial University was in respect of the medical and technological work, but the University was not informed of the amount of money allocated to each, although the computation of the two sections of the grant was made in such a way as to show how much was in respect of Medicine and how much of Technological work.

8. Under these conditions all the Medical Schools attached to Universities in England and Wales were eligible for grant, either directly or through the grants to the Universities as a whole. In assessing the amount of the grant to be given the following specific medical points were taken into account :—(1) The number of whole-time and part-time students in attendance ; (2) the content and scope of each subject taught ; (3) the educational staff, number, status, remuneration and duties ; (4) the Departmental equipment and facilities for clinical instruction ; (5) the University standard and character of the teaching—lectures, demonstrations and practical and clinical work ; (6) the correlation of the subjects in the curriculum and inter-relation of laboratory and clinical work ; and (7) facilities for and nature of research work. As a result of the Board's grants, various improvements were effected in the efficiency of the instruction given, some of the principal developments being the creation of new professorships ; an improvement of salaries of whole-time teachers and the appointment of new whole-time assistants, especially in Anatomy, Physiology, Pathology and Pharmacology ; improvement in Laboratory equipment ; and the payment for routine clinical teaching and special clinical demonstrations.

9. During the Board's administration of the grants for Medical Education in England there were formed in 1919 the first University Clinics in London (" Clinical Units ").

The specific terms on which approval was given were as follows :—

(1) The Board would be prepared to recommend that a grant should be paid towards the cost of the proposed reconstruction of clinical teaching up to a total sum not exceeding three-fourths of the approved annual expenditure for maintenance incurred during Session 1919–20 on the fulfilment of certain general and particular conditions as applicable to the individual cases.

(2) Such assistance must be understood to be without prejudice to any arrangements that may ultimately be necessitated in the event of the reconstitution of the University of London.

(3) The Board regarded the scheme of reconstruction as a development supplementing and not superseding valuable features of present practice.

In order that the exchequer money in aid of university education might be allocated on the advice of a central " neutral "

body, in such a way that the Universities should retain an unfettered discretion in their own governance, the Treasury appointed, in July, 1919, the University Grants Committee. The Board of Education continued, however, to administer grants-in-aid of Medical Education until December, 1919, in order to afford the Committee an opportunity of briefly surveying the position before actually commencing its executive functions. The terms of reference of this Committee are :—

> " To enquire into the financial needs of University Education in the United Kingdom, and to advise the Government as to the application of any grant that may be made by Parliament towards meeting them."

10. Practically all of the fifteen Universities in Great Britain, except London and Durham, now receive their assistance from the State in the form of block grants assessed in respect of all their activities taken together ; these block grants are distributed by the Governing Bodies at their discretion over the various Faculties, including that of Medicine. For reasons arising out of the peculiar constitutions of the Universities of Durham and London, grants are paid direct to the Durham College of Medicine and to the twelve London Medical Schools, instead of to a central University authority. Over and above the ordinary grants paid to the London Medical Schools for their maintenance, a few selected London Schools are now receiving special grants for the " Clinical Units " which have recently been established in them. In providing these special grants in aid of this particular form of clinical education in Medicine the University Grants Committee have made it a general stipulation that the organization of the Clinical Units should be in accordance with the requirements of the University of London in order that the Directors of the Units may be in the fullest sense professors of the University working under proper University conditions. And the University has in each case formulated specific regulations governing these professorial appointments.

11. Thus it will be seen that during the last five years much has happened which directly concerns the disposition and nature of the subjects comprised in an adequate course of medical education—there have been the reorganisation of the grant in aid system, the establishment of clinics of University standard, and the developments which have crystallized in the new curricula in medicine, dentistry and public health. Other influences have also been at work. Changes have been taking place in Secondary Education, there has been growth of knowledge in the intermediate sciences, a fuller sense of the importance of Preventive Medicine has occupied men's minds, the effects of the War have stimulated the appreciation of, and need for, a more practical application of science to the practice of Medicine, and the necessity of medical research and the use of its findings have become widely recognized. It is the relation of some of these questions to the advancement of Medical Education in England which receive consideration in the present Report.

II.

THE TEACHING OF THE PRELIMINARY SCIENCES.

12. The pursuit of Medicine requires a basis of general science, both in training and in practice. Look where we will in any direction the principles of Chemistry, Physics, and Biology prove to be fundamental. They form the basis of a general education in Science; by their study and understanding the principles of Science are appreciated and grasped; they furnish an immense and necessary body of knowledge, and, what is more important, a training in observation, accuracy, technique and the methods of measurement and interpretation; they provide the student both with his scientific tools and the elements with which he builds; their study stimulates his critical faculty, his judgment of evidence, his reasoning powers, and thus affords a discipline of mind; they are the true basis of sound generalization. "Science is not a material to be bought round the corner by the dram," writes Professor Bateson, "but the one permanent and indispensable light in which every action and every policy must be judged. . . . The splendid purpose which Science serves is the inculcation of principle and balance, not facts."* The great medical subjects consist of chemistry, physics, and biology as they are concerned in the form, function and life of the human body in health and disease. The patient is, in fact, the embodiment of anatomy, of physiology, of pathology to be interpreted and treated on grounds and by means which are in their essence chemical, physical and biological. He is, of course, something much more, but that is the root idea.

Fully to comprehend the normal mechanisms of labour or the rationale of the most ordinary appliances of the orthopædist, involves a wide grasp of the governing principles of statics and dynamics; hydrostatics and hyrdrodynamics illuminate the technical procedures employed in the measurement of blood pressure and the interpretation of sphygmographic records; clinical instruments of precision, such as the laryngoscope and ophthalmoscope demand of their intelligent manipulator more than a smattering of optics; modern electro and thermo-therapy imply still further preliminary study.

13. Nor is it only in practical medicine that we see signs of expansion—there is the new work on the cell—in physics, in chemistry and in biology. In Science, as in every other field of human endeavour, the centre of knowledge is for ever shifting, but whether it shifts in the direction of the infinitely great (as in astronomy) or the infinitely little (as in physics), it is towards unity and order. In 1801 Dalton announced his atomic theory. He pictured the elements consisting of indivisible atoms, a view that was based on the proportions by weight of different elements

* *Cambridge Essays on Education*, 1917, Chap. vii.

in various chemical compounds, the constituent particles of which were of one kind. But now our physicists are visualizing the structure of the atom itself as a minute solar system consisting of a heavy positively charged nucleus surrounded by attendant rings of electrons or corpuscles of negative electricity.

The organic cell is also being reduced to its component parts. The cell theory—cell basis, cell division, the nucleus, the nucleolus—is yielding its secrets, and we now know something of the hidden powers of the chromosome of the germ cell and the internal secretion of chemical substances, whether they be hormone, toxin, or antitoxin. "The greater part of natural philosophy," says the Master of Trinity, "is the outcome of the structure and mechanism of the atom," and it is equally true that biological science is built upon the structure and function of the living cell. As we pass from the morphology of the cell to its physical and chemical powers and their interaction, there is unfolded an even larger field of vision, first of the functions of the human body as an aggregate of cells, secondly of their regulation, and thirdly of their powers of regeneration and defence. It seems impossible to exaggerate the effect on the science of Medicine of the new knowledge of the chemical and electrical changes going on in the cells of living tissue. From the discovery of hepatic glycogenesis by Claude Bernard in 1855 to the work of Schafer, Bayliss and Starling on internal secretion, one chain of evidence runs. It is certain that we must establish the student on this foundation of the cell, its potentialities in individual or aggregate form, and the operation of natural influences upon it—internally the power of growth, secretion, reproduction, adaptation; externally a variety of factors, heat, light, electricity, stress, strain and pressure.

14. Chemistry progresses in all fields. From Hippocrates to Galen and from Galen to the herbalists little was done, but in modern times there has been prodigious advance. Iron and mercury; quinine, digitalis, opium, strychnine, and belladonna; the coal-tar derivatives; ether, chloroform, salvarsan; fermentation, decomposition; the chemistry of colloids and of hormones; bio-chemistry and chemical physiology—all these remind us of our debt to chemistry, a debt which must be added to that for our growing knowledge of the chemistry of the cell. Further, we are in need of a closer association between physics and chemistry on the one hand and biology and medicine on the other. It is 120 years since Bichat and Dalton blazed this trail; it is for us to construct the broad highway. We are too apt to ignore the mutual relationship of chemistry and physics, and forget their current contribution to medicine. We shall do well to remember Huxley's warning that :—

> "Teaching in biology cannot be attempted with success until the student has attained a certain knowledge of physics and chemistry; for, though the phenomena of life are dependent neither on physical nor chemical but on vital forces, yet they result in all sorts of physical and chemical changes, which can only be judged by their own laws."

The Teaching of Science in Secondary Schools.

15. If, broadly speaking, that is the case for the teaching of Preliminary Science to the student of Medicine, the necessity of handling it in a thorough and satisfactory way is obvious. The General Medical Council having given the matter prolonged consideration, concluded in 1922, first, that the *elements* of these preliminary subjects should be taught in the Secondary or Public School before the student is registered, and that he should pass an examination in them before he enters on his course at the University; and, secondly, that in the Medical School should be taught the *applications* of science to Medicine, and that such teaching of applied science should be continued throughout the medical curriculum. In a word, the medical curriculum itself should be relieved of the teaching of elementary science, and yet the fundamental subjects of Chemistry, Physics and Biology should be integrated with the whole science and art of Medicine and made a living and practical part of it.

16. The General Medical Council had good grounds for its decision. To grasp the principles of these sciences calls for earlier and longer study than is practicable in the medical student's first *annus medicus;* the medical curriculum itself has become, by medical progress in recent years, detrimentally overloaded; and those same advances of Medicine have established the need for a fuller application of these sciences to the effective practice of Medicine, Surgery and Midwifery. The Council had also abundant collateral support. The Royal Commission on Public Schools in 1864 and the Royal Commission on Scientific Instruction (1871–75) recommended, on the advocacy of Huxley, Tyndall and others, that science teaching (Chemistry, Physics, Physiology and Natural History) should be undertaken in all such schools.* Since 1866 the British Association for the Advancement of Science has exerted a positive though intermittent influence in favour of such teaching in Secondary

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* The position of science in some Public Schools in the early part of the last century may be illustrated by the following quotations from the autobiography of Charles Darwin:—"Nothing could have been worse," he writes, "for the development of my mind than Dr. Butler's school, as it was strictly classical, nothing else being taught, except a little ancient geography and history. The school as a means of education to me was simply a blank . . . I believe that I was considered by all my masters, and by my father, as a very ordinary boy, rather below the common standard in intellect . . . . My brother worked hard at chemistry . . . and I was allowed to aid him as a servant in most of his experiments . . . The subject interested me greatly . . . This was the best part of my education at school, for it showed me practically the meaning of experimental science. The fact that we worked at chemistry somehow got known at school, and as it was an unprecedented fact, I was nicknamed "Gas". I was also once publicly rebuked by the headmaster, Dr. Butler, for thus wasting my time on such useless subjects."—(*Life and Letters of Charles Darwin*, Vol. I., Chap. II.).

Schools, and has done very much to guide, reform and inspire it from time to time.*

17. The work of the Science and Art Department must also be mentioned. It created science teaching in the schools, subsidizing teaching with grants and giving substantial aid in the building of science schools and laboratories, while under its direction the Royal College of Science educated some of the best teachers of science in the land. It opened the doors of the secondary schools to inspection and made the later work of the Board of Education possible. In 1913 the Royal Commission on University Education in London recommended that " the study of the preliminary science " should not be included in the medical curriculum ; that the " undergraduates should not be admitted to the Faculty of Medicine in the University, until they have received instruction in the principles of pure science ; and that, whenever it is possible, the best time and place for this instruction are the last two years of a good Secondary School course."†

18. In 1916 the Prime Minister appointed a Committee with Sir J. J. Thomson, F.R.S., as Chairman to enquire into the position of Natural Science in the Educational System of Great Britain. They reported in 1918 and recommended that Natural Science should be included in the general course of Education of all pupils in Public and other Secondary Schools up to the age of sixteen, to be followed by more specialized study up to eighteen ; that the science course for pupils under sixteen should be planned as a self-contained course, and should include, besides Physics and Chemistry, some study of plant and animal life ; that there should be close correlation between the teaching of Mathematics and Science at all stages in school work ; that the amount of time devoted from sixteen to eighteen to the subjects of Physics, Chemistry or Biology should be not less than one-half to two-thirds of the school week ; that those " specializing " in Science should continue some literary study ; and that the course should be accepted as the normal qualification for entrance to the Universities and professions.‡

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* *Report on Science Teaching in Secondary Schools,* 1917. This report contains much practical advice on the whole subject, by Mr. Vassall of Harrow, the late Mr. Sanderson of Oundle and others.—(Offices of the Association, Burlington House, 1*s*.).

† It was not until the Technical Instruction Act of 1889 came into operation and was supplemented by the Local Taxation (Customs and Excise) Act of 1890, which made the residue grant or " whisky money," as it was called, available for the purposes of the Technical Instruction Act, that chemical and physical laboratories became common in endowed Secondary Boys' Schools, and chemical or botanical laboratories and domestic science rooms in Girls' Secondary Schools. Under the Education Acts of 1902 and 1903, many Secondary Schools were established by Local Education Authorities, and in the meantime the more progressive School Boards had introduced " Science Rooms," and in some cases laboratories in higher grade schools.

‡ Report of the Committee to enquire into the Position of Natural Science in the Educational System of Great Britain. 1918. (Cd. 9011, pp. 72–79).

19. This is an impressive confirmation of a similar recommendation, from 1864 to 1918. It is manifest that the design involves some training in Science at School and some at the University. For practical purposes we may think of it thus :—

(*a*) School Education in Science before sixteen.
(*b*) More advanced School Education after sixteen.
(*c*) Education of University standard in the Medical School.
(*d*) Applied Science in practical Medicine and Surgery.

Such a scheme will work somewhat as follows. Take Physics as an example. A boy at school under sixteen will have his interest awakened in and directed to, say, Heat, its physical phenomena, its personal and industrial applications—the domestic fire, the warmth of the sun, the heating of buildings, changes from ice to water and steam, the steam engine, the internal-combustion engine. Thus he would learn of the sources of heat, expansion by heat of liquids, changes of the state of water, thermal effects due to pressure, the transformation of heat into mechanical work. He would be taught the ways and means of measuring heat, the expansion of mercury, the thermometer, the melting and boiling points of substances, temperature charting, radiation, convection, and so forth. In Biology he might study the life history and habits of the wasp, dragon fly, spider, ant, water beetle, and other forms of animal life ; birds' eggs, butterflies, shells ; typical plants and trees ; seeds bulbs, flower, fruit ; the forms of life in soils ; assimilation by plants, yeast and fermentation ; the form and function of types ; simple adaptation to environment, nutrition, species, evolution, natural selection, heredity. Similar beginnings would be undertaken in Chemistry. There would be variety and intermittency, variation with the kind and age of boy, the locality and type of school. Boys are interested first in phenomena and in mechanisms, and then in their use or application. " What is it ? How does it work ? What's the use of it ? " Hence the course should not be stereotyped. It must march, it must live and move, be adapted to what Bateson calls " the congenital diversity of the individual type " of pupil.

20. It is at a later stage, after sixteen, that the meaning, purpose and philosophy emerge. After the First School Examination, the studies in the preliminary sciences may approach to the so-called Advanced Courses of the first professional standard Some degree of specialization becomes desirable as the imaginative and logical faculties can be best trained by intensive study. Systematic laboratory work may be developed in both Zoology and Botany ; the experimental method of Roger Bacon may be developed to the full ; there may be introduced greater detail of knowledge, and its classification and organization ; a beginning can be made in animal and vegetable metabolism and the principles of physiology, in exact observation and recording, in accuracy and thoroughness, in the critical faculty and reasoning ; above all, the unity and homogeneity of truth can be inculcated.

" All the sciences," said Roger Bacon in 1266, " are connected ; they lend each other material aid as parts of one great whole, each doing its own work, not for itself alone but for the other parts : none can attain its proper result separately, since all are parts of one and the same complete wisdom."

21. Many excellent courses of this nature are now established, and a substantial number of elder boys now pass their First Professional Examination from school. The Regulations of the Board of Education for Secondary Schools in England, 1922, provide that a school may be recognized by the Board for advanced courses of two years in Science (Chemistry and Physics) and Mathematics (the latter may be waived for pupils who do substantial work in the Biological Sciences if the course is otherwise suitable and includes work reaching an adequate standard in the Physical Sciences). In such advanced courses one primary condition should be paramount, namely, that proper provision should be made for the concurrent study of English language, literature and history. We cannot afford to allow early " specialization " in Science to lessen or impair the essential education of the boy in general culture. The Board also require that the organization of the school as a whole shall be satisfactory, that the Staff required for the course should be adequate and well-qualified, and that the number of qualified pupils taking the course is reasonable. It will be understood that the amount and character of the science teaching now being introduced in Secondary Schools varies, but substantial progress has been made. At present the position is as follows :—

(*a*) The elements of Chemistry and Physics are a normal part of the curriculum in all grant-earning Secondary Schools (boys aged twelve to sixteen years). Such a course rarely extends to less than three years.

(*b*) In the Public Schools similar provision is also made for the teaching of Science, though boys specialising in classics may not be able to take full advantage of it.

(*c*) More advanced courses in Science are now provided in not less than 250 Secondary Schools (including those receiving Exchequer grant in aid of the education provided and those which, though not receiving such aid, are recognized by the Board as " efficient "). In London, Lancashire and Yorkshire there are some forty in each county ; in only half-a-dozen counties is there at present no such provision. Similar advanced work is usually provided in the Public Schools.

(*d*) The teaching of Science is, as a rule, in the hands of masters specially qualified, most of whom hold a degree in Science, and in the advanced courses this rule is almost invariable.

(*e*) Schools providing Advanced Courses are furnished with laboratories in Chemistry and Physics, and some schools have a special room or a laboratory for Biology, though in many of these schools, under present circumstances of overcrowding, limited financial resources and difficulties of building, there is insufficient laboratory accommodation and equipment. In all these advanced courses the particular Physics and Chemistry necessary to the foundation of Medicine can be taught.

(*f*) While Chemistry and Physics thus form a regular part of the education in boys' Secondary Schools in England, the teaching of Biology (apart from nature study) is exceptional, though it forms a part of some of the Advanced Courses, particularly for future medical students.

22. The Science work undertaken in the Advanced Courses at these schools falls under the supervision of the Board of Education, and H.M. Inspectors visit and report. Some of their recent opinions may be quoted as evidence of the practicability of the work, evidence which is being abundantly confirmed in the Medical Schools by the arrival of students better equipped in Science than was formerly the case.

A.

(Upwards of 700 boys.) The feature of the work is that it is essentially based upon practical work done by the boys themselves, the teaching groups throughout are small and all the conditions of teaching most favourable. The boys work with great interest and discuss their problems with intelligence. Progress is easy and natural, and while the duller boys may not acquire very many facts, they certainly get an intelligent habit of working. The more gifted boys develop most satisfactorily under the system of teaching, and show great interest and capacity. (1921.)

B.

(Upwards of 500 boys.) The present organization is frankly and admittedly a makeshift one, but it is cleverly thought out to give boys the fullest opportunity possible in the trying and difficult circumstances. The time which can be given to practical teaching for the ordinary boy is far too limited, but by a system of alternatives boys really interested in Science can get more adequate teaching, and the higher forms and specialists are well taught and are obviously keenly interested in their work.

The general scheme of work includes nature study (in the Junior School), practical mathematics, physics, and chemistry with, in addition, some biology for a few intending students of medicine.

A feature worthy of mention is the excellent little library of the Science Sixth, provided by their own efforts. A science society exists, but its activities seem to be confined to the winter months. The school library is very meagre on the scientific side; it should be greatly extended and made accessible to many of the upper forms. (1919.)

C.

(Upwards of 400 boys.) The conditions under which Science is taught have been greatly improved by the erection of the Science block; but

there is need both for a biological laboratory and for an advanced laboratory, and, when conditions allow, the whole of the Science block should be allocated to Science.

The course of work in Science begins with introductory physics and chemistry in the Middle and Upper Removes, which is continued in Lower and Upper IVB. This is followed by heat and light and more formal chemistry in the Forms up to and including Upper VA and B, where boys take the combined subjects physics and chemistry in the School Certificate Examination. No electricity and magnetism and very little mechanics are taken in the ordinary course. The scope of the work is somewhat unduly restricted. It is suggested that a simple course of mechanics might be introduced in the Removes; and it should not be impossible to include a preliminary treatment of electricity and magnetism before the School Certificate stage. The work at the top of the School is well done, but in the Middle School the pace might be quickened with advantage, especially in chemistry. A more stimulating and vigorous handling of this subject with more practical work by the boys themselves would have improved some of the lessons seen. It is most important to secure that every lesson drives home something definite, so that the boys feel that they have made some tangible advance in knowledge and experience. (1921.)

D.

(Upwards of 300 boys.) The teaching of Science begins in the Third Forms with general elementary science, differentiating into chemistry and physics. There is no biology or nature study. It is suggested that a course of practical observational and experimental work, chiefly botanical, but including the life history of the moth or butterfly and of the frog, should be carried out in the Junior School, with occasional illustrated lectures to awaken interest in other branches of Science.

The courses of chemistry and physics are well planned, and lead up to work of a good standard in the Sixth Form. The time given to Science is sufficient in the lower Forms, but is inadequate in the Middle School, and should be increased to six periods a week, arranging double periods for laboratory work.

The laboratories for chemistry are very satisfactory rooms, but the accommodation for physics is on much too small a scale, and a good, large physical laboratory, or, better, a pair of laboratories, for elementary and advanced work would be a great improvement. (1920.)

E.

(Upwards of 500 boys.) The courses of work in both physics and chemistry are ably arranged, and the teaching is stimulating and very effective. The classes are rather large for practical work, but in some cases a demonstrator is employed with great advantage.

Excellent teaching is provided for the Advanced Course, but the practical work suffers at this stage from the lack of special accommodation; inconvenience is felt at every turn, with consequent loss of time and efficiency. (1921.)

F.

(About 600 boys). The Science work is particularly well done. The Senior Science Master is in control of the whole subject, the scope and nature of the courses of study, and their general organization. There are six other members of the Science staff, with three laboratory attendants and three laboratory boys. The junior pupils receive instruction in physiography and biology. The class immediately above them is graded in suitable divisions, and the subjects of instruction are hydrostatics, mechanics, chemistry and electricity. A senior group of boys are prepared for the School Leaving Certificate, and take chemistry and

physics with astronomy, geology or physiology. The boys who propose to take up Medicine attend for an additional course in biology and geology. Then there are a corps of 64 boys who are specializing in Science, and who devote to it 19 " periods " per week, confined to chemistry, physics and biology; the whole course is carefully planned and based upon well-devised schemes of practical work. They are more comprehensive in scope than the examinations necessitate, and are intended to give a wide outlook upon Science which shall include not only chemistry, physics and biology, but also the elements of astronomy and geology. There is the acquisition of a knowledge of useful facts and formulæ, but there is also aroused in the boy an active intellectual interest in nature phenomena on a wide and comprehensive basis. (1921.)

23. As long ago as 1909 the Board of Education issued a valuable and timely educational pamphlet on the teaching of Science in public schools represented on the Association of Public School Science Masters.* The work done at Rugby, Charterhouse, Clifton and some forty other schools is reviewed. Even fourteen years ago, a chemical laboratory existed in forty-six of these schools, a physical laboratory in forty-five, and a biological laboratory in ten, and the Schedules of work undertaken were often comprehensive and advanced. Since that date there has been the substantial growth to which attention has been drawn in these pages, and which is steadily increasing. This fact must not lead us to forget some wider considerations. First, the teaching of science in Secondary Schools must not be to the exclusion of, nor must it be divorced from, " those literary and historical studies which touch most naturally the hearts and hopes of mankind." This is quite as important for the medical student as for others. Moreover, as Dryden said, " here is God's plenty." Secondly, as a very small percentage of the pupils in the secondary school proceed to the Universities, the teaching of Science up to sixteen should be general and not special; it should guide the pupils' study and be humanistic as well as scientific.

" The essential mission of school science," said Sir Richard Gregory at the British Association in 1922, " is to prepare pupils for civilized citizenship by revealing to them something of the beauty and the power of the world in which they live, as well as introducing them to the methods by which the boundaries of natural knowledge have been extended and Nature herself is being made subservient to her insurgent son. Acquaintance with scientific ideas, methods, and applications is forced upon everyone by existing circumstances of civilized life with its facilities for rapid transport by air, land or sea, ready communication by telephone, telegraph and other means by which space and time have been brought under control and man has assumed the mastership of his physical and social destiny. Science permeates the atmosphere in which we live, and those who cannot breathe it are not in biological adjustment with their environment—are not adapted to survive in the modern struggle for existence. School instruction in Science is not, therefore, intended to prepare for vocations, but to equip pupils for life as it is and as it soon may be."

Thirdly, the gulf between pure science and applied (or vocational) science should as far as practicable be filled up or bridged.

* Report on Science Teaching in Public Schools. Educational Pamphlet No. 17, 1909.

Fourthly, at secondary schools, Science should be approached from the practical and concrete side, and its systematic or specialized treatment should be deferred, though not discarded. A broad view is necessary, and premature attempts to give medical purpose to early scientific studies are to be strongly deprecated.

24. When the Advanced Course in Physics and Chemistry at the Secondary School becomes the rule for boys intending to study Medicine, the part which the Medical School will take in teaching the Preliminary Sciences will be threefold. It will provide a Science course in Biology for students who have not taken the subject at school ; it will give instruction in Chemistry, Physics and Biology in their application to Medicine ; it will provide at subsequent stages of the curriculum for Bio-chemistry, Biophysics and Medical Biology. This provision is actually being made at Edinburgh and other schools. A few notes should be added in regard to the general methods of teaching Preliminary Science in the Medical School.

Biology.

25. The claim of Biology seems to me to be supreme. It is the foundation of Medicine, which is indeed but one of its forms and expressions. If the medical man be not a biologist, he is nothing. It is not an accident that Biology was the inspiration of Ancient as well as of Modern Medicine. Aristotle, the Alexandrians, and Galen were forerunners. In modern times, Leonardo da Vinci, Linacre, Edward Wootton, Vesalius, Gesner, Harvey, Malpighi, Borelli, Morgagni, Hunter, Bichat, Jenner, Darwin, Huxley, Pasteur, gave the true touch of the biologist to medical science. In Biology we see a new light on the universe.

" The life, the fortune, the happiness of everyone of us," wrote Huxley, " depend upon our knowing something of the rules of a game infinitely more difficult and complicated than chess . . . The chess-board is the world, the pieces are the phenomena of the universe, the rules of the game are what we call the laws of nature. The player on the other side is hidden from us. We know that his play is always just and fair and patient. But also we know, to our cost, that he never overlooks a mistake or makes the smallest allowance for ignorance. To the man who plays well the highest stakes are paid with that sort of overflowing generosity with which the strong shows delight in strength. And one who plays ill is checkmated—without haste but without remorse . . . Well, what I mean by education is learning the rules of that mighty game."*

In such parable does Huxley urge the case for Biology. He was not content to press its utility upon us. He proclaimed the grandeur of its meaning, the nobility of its quest, the supreme worth of its study to the mind of man. To him it was the secret of the universe and he read in its methods and ways the very laws of life. What is our life ? he asks, and why is it, and what is its goal ? And his answers are the answers of Biology.

26. When therefore we turn to consider the Medical Curriculum, we must think large things of Biology, for it " touches the

* *Collected Essays.* No. 4. A Liberal Education and where to find it.

problems of life at every point " as Sir William Osler said, "and may claim as no other science completeness of view and a comprehension which pertains to it alone." In this regard, we shall do well to remember both general and special aspects. There is one of Darwin's final conclusions at the end of the *Origin of Species* which reads : " When we no longer look at an organic being as a savage looks at a ship, as something wholly beyond his comprehension ; when we regard every production of nature as one which has had *a long history* ; when we contemplate every complex structure and instinct as the summing-up of many contrivances, each useful to the possessor, in the same way as any great mechanical invention is the summing-up of the labour, the experience, the reason, and even the blunders of numerous workmen ; when we thus view each organic being, how far more interesting—I speak from experience—does the study of natural history become."* These simple words strike the keynote of modern biological thought—the organism, and each of its organs, is to be interpreted historically ; it is a stage, a word, a syllable, a link, in an endless evolutionary process, expressing variation, correlation, the effects of use and disuse, and the action of external conditions. Another general aspect of Biology which is equally important to the student of Medicine is the application of its principles to human society, a pathway where Huxley and Spencer led. Man is a social animal, and all disease has a social aspect. The student must be taught this ; he must learn to think how to use his stock of knowledge and insight socially as well as medically. The great problems which will face him at once in his practice have a social and biological setting—tuberculosis, infant mortality, physical impairment, venereal disease, mental abnormality, the infective diseases—they all bear a highly complex relation to the forms, customs and claims of human society, industry and government. The answer to these medical-social problems will be found as we understand Biology, for it is the basis of sociology—it deals with the problem of the real and ultimate life. There the student may find what Wordsworth predicted he would find—

" a Power
That is the visible quality and shape
And image of right reason ; that matures
Her processes by steadfast laws ; gives birth
To no impatient or fallacious hopes,
No heat of passion or excessive zeal,
No vain conceits ; provokes to no quick turns
Of self-applauding intellect ; but trains
To meekness, and exalts by humble faith ;
Holds up, before the mind intoxicate
With present objects and the busy dance
Of things that pass away, a temperate show
Of objects that endure."†

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* *Origin of Species*, Chap. XV.
† *Prelude*, Book xiii.

It is not a device here or an adjustment there which is needed, not only the dissection of certain " types," not only laboratory work, which can easily be overdone, but the biological outlook and spirit—the capacity " to see great truths than touch and handle little ones "—for Biology, pure and applied, is the most educative, germinative and dynamic subject in the whole curriculum. It opens the windows of the mind, it makes possible a conception of the unity of things, and it tends to give proportion and measurement through the entire range of Medicine.

27. Yet devices, adjustments and types are necessary. In the first place, we must continue to teach Zoology and Botany separately. They cannot be compounded. They are complementary to each other, though it is probable that much of the Botany can in future be learned at the Secondary School—including the elements of the origin and stock of organic matter and combined nitrogen in the world, and the inter-relation of vegetable and animal life. Zoology, on the other hand, calls for University instruction, atmosphere and methods. Special equipment and specialist teachers engaged in biological research are necessary to its proper exposition ; its effective exposition moreover is, as a rule, insufficiently appreciated by schoolboys who have not had a full course of chemistry and physics. These are the grounds for its present retention in the University, unless under exceptionally favourable Secondary School conditions. Moreover, there are advantages in the same teacher dealing with systematic Biology who will, at a subsequent stage of the curriculum, be concerned in the teaching of Parasitology in practical medicine.

28. Secondly, whilst there was much to be said for the introduction of the " type " system of Huxley at South Kensington in 1870, the biological course for a medical student should not be dominated by " types." The morphological method is convenient, easy for the student to understand, and representative of the concrete facts which are obvious to his senses, yet it is not exclusively basic to the whole subject, and it affords an incomplete framework upon which to graft the necessary teaching in physiology and the principles of Biology. In several of the English Universities steps have been taken in recent years to encourage a preliminary and introductory course of Natural History at Secondary Schools, and when the student enters the Medical School to give him a full and scientific course in Zoology in which the special work on the " type " is balanced with comparative physiology, and the more general themes of embryology, organic evolution, heredity, variation and genetics. Attempts are now being made also to introduce the elements of comparative physiology and pathology in plant and animal life—a matter of importance as being illustrative of biological principles and of nutrition, and as being preparatory to subsequent medical work. There can be no doubt as to the value of these reforms. What is necessary is a widening of the basis, less imposition of details on the memory of the student, and an introduction to scientific thought and method.

29. Much emphasis is laid in the Scottish Universities on the value of the Preliminary Sciences and on their being undertaken in the University alongside the medical curriculum, and this arrangement has been adopted in many of the English Schools also. As the biology of the invertebrates has become of more direct significance in medical science its importance has increased, and a statement by Professor Ashworth, of Edinburgh, on this issue may be quoted as an illustration of the way in which the subject may be presented. He writes as follows (1920) :—

" My object has been to change the emphasis from the pure description of the animals chosen for study to the significance of the principles they illustrate in relation to the studies of the subsequent years. A certain amount of description of structure is necessarily retained, but this is kept carefully within bounds. Further modifications will be made as experience suggests, as indeed they have repeatedly been made since I took over this course four years ago. To give some examples of the method :—

" *Hydra* is taken as an example of a two-layered animal and as affording a clear-cut instance of the differentiation of functions of the two cell-layers :—the ectoderm, protective, sensory, and giving rise to the reproductive products ; the endoderm, digestive. The process of digestion is easily followed and understood in this simple case, and one points out the absence of blood-system and that there is no need for such a system in this animal where the two cell-layers are in such intimate contact. Reference is particularly made to the " diffuse " nervous system—a plexus of fibrils and cells—better seen and better known in sea-anemones. The consequences of this type of nervous system are briefly considered, *e.g.*, it is pointed out that such a nervous system makes each part of the animal practically autonomous, and one or two well-chosen examples of this are given. This is contrasted with the condition in animals with a central nervous system. Reference is made to the fact that nervous networks are present in man, *e.g.*, in the wall of the small intestine, which is largely autonomous. A brief account of a jelly-fish gives opportunity for a discussion of the original function of sense organs in the control of movement. *Cf.* in man the semi-circular canals in orientation, the sense of touch in walking. Finally, a short discussion is given of the evidence for the order of evolution of the series—muscle, sense-organ, central nervous system, and some general considerations thereon.

" The *Annelida*—segmented animals with three layers of cells—ectoderm, endoderm, mesoderm—are represented in our course by *Nereis*, of which only the external features are studied, and *Arenicola*, in which the principal internal organs are examined by dissection, these organs being large and easily seen. An account is given of the formation and functions of the body-cavity (cœlom), mesenteries, excretory organs, the alimentary canal (with its simple digestive glands), the process of digestion and absorption (in *Arenicola* the network of blood-vessels in the wall of the absorptive region of the intestine is easily seen by every student in the laboratory). This brings one to the function of blood as a carrier of nutrient material. The presence of gills leads to a consideration of blood as a carrier of oxygen. In considering the relatively simple central nervous system attention is directed to the fundamental constitution of this system with its sensory and motor neurones and the intermediary neurones. The great development of these last in the vertebrate nervous system is pointed out. Special care is taken to show what a great step in advance is brought about by the coming-in of the mesoderm, the following points being discussed :—segmentation of the body, bilateral symmetry, separate muscle layers for the gut-wall (for peristalsis) and for the body-wall (for locomotion), separation of gut-cavity and body-cavity (in contrast to Hydra), the appearance of excretory organs, blood-system, central nervous system, the evolution of an anterior end, the

parallel advance in development of the powers of locomotion and of sense-organs, and " cephalization."

" I feel certain that the course appeals strongly to the thoughtful student, for he realizes the direct bearing of the principles on his future work. The syllabus of my lectures is as follows :—

PROTOZOA.—*Amoeba* ; functions of the various parts, studied in simple fashion. A short account of *Entamoeba histolytica* and its life-history. A notion of what is a parasite. Relations of parasite and host in this instance. In many cases the destruction caused by the parasite is balanced by the regenerative powers of the host ; this leads to a brief study of the " carrier " question.

Entamoeba coli, briefly treated ; a commensal. Difference between parasite and commensal.

Paramaecium, higher differentiation as compared with *Amoeba.* Significance of conjugation. Woodruff's culture carried to more than 7,000 generations without conjugation—the enormous potential of reproduction of the living cell in such a case.

Euglena—a very short account ; its nutrition ; no sharp line of demarcation between plants and animals. A short account of a *Trypanosome* and of the role of tsetse-flies.

Malaria, asexual cycle in man ; explain " incubation period." Rôle of mosquito.

Hydra, Nereis and *Arenicola* (dealt with above).

Crayfish, used for study of external features and nervous system. General points are dwelt upon (and there is no detailed description of structure), for instance, division of labour among the appendages, correlation of form and function, the value of certain structures (*e.g.,* nervous system) as evidence of relationship to *Annelids,* the advances (as compared with an Annelid) illustrating further differentiation, grouping of segments, fusion of ganglia to form a " nerve centre."

Insecta. An elementary account of a mosquito, dealing with external features, alimentary canal, breathing apparatus, life-history and biology. (No details of structure of other systems of organs). The general methods of attack upon mosquitoes.

Parasitic Worms.—A few carefully selected examples treated from the point of view of their biology and life-history, as showing the mode of infection of man and as indicating preventive measures. As little as possible description of structure is given—generally only the external features and reproductive organs, and sometimes the alimentary canal. The following are considered :—

NEMATODA.—*Ascaris, Oxyuris* (very briefly), *Ancylostoma.*

TREMATODA.—Liver fluke of sheep. Brief reference to flukes in man. *Bilharzia.*

CESTODA.—*Taenia solium, saginata, echinococcus.*"

30. One further point remains. At a subsequent stage of the curriculum it is desirable to give the student careful instruction and guidance as to the direct applications of Biology to Medicine. It is open to argument whether this work should be undertaken in a special *ad hoc* course later in the curriculum, when the medical issues may be better appreciated by the student ; or whether it should form an integral part of the biological course in the first year, which is thus enlivened by the applications of biology to

practical medicine. At Edinburgh the plan suggested by Professor Ashworth is a special short Course in the third year on Medical Entomology and Parasitology to deal with the medical questions raised by mosquitoes, flies, ticks, entamœbæ, trypanosomes, malarial parasites and helminth. Professor Graham Kerr's method of illustrating his ordinary course at Glasgow by such application is, however, usually followed in England.

Chemistry and Physics.

31. The teaching of Chemistry in the English Medical Schools has in recent years undergone little or no change. On the one hand the amount of detail imposed upon the student in didactic lectures is still perhaps too great ; on the other there is an inclination towards early specialism. Thus the amount of routine inorganic Chemistry expected from a medical student is too much and his understanding of the principles of the Science too little. What he needs is a sound introduction to the chemistry of physiology, pharmacology and pathology, and an ability to use chemical treatises and methods should occasion arise. Two things are clear: first, much of the groundwork can now be done in the Secondary School, and to it should be relegated that part ; secondly, no attempt should be made to teach the applications of chemistry at the Secondary School, but these should be dealt with, in more direct fashion than hitherto, in the Medical School. These two new steps are finding expression in different ways. As the students entering the Medical Schools are better equipped in the Science of Chemistry, the various Chemical Courses hitherto held may be modified. They will become more applied, more medical, and that is as it should be. They will deal with organic chemistry, with physiological and pharmaceutical illustrations ; the chemical constitution of fats, carbohydrates and proteins leading up to the chemistry of digestion ; urea, and the methods of estimating it ; the chemical nature of alkaloids ; applications of inorganic chemistry to medicine, etc. The kind of arrangements necessary have already been provided at Edinburgh and some other Schools. Here is the position, in general terms, at Edinburgh, where Professor Barger occupies the Chair.

32. Beginning in October, 1921, students of Medicine are required to pass an Entrance Examination in Chemistry, of which the following is the syllabus :—

> Elements and compounds—The Chemistry of air and water—Combustion, flame—Oxidation and reduction—Acids, bases, salts—Elementary Chemistry of the commoner elements, including hydrogen, oxygen, nitrogen, carbon, sulphur, chlorine, sodium, calcium, copper, lead, zinc, iron—Laws of Boyle, Charles, Gay, Lussac, Avogadro—Equivalent, Molecular and atomic weights, valency—A working knowledge of symbols, formulæ, and equations—Empirical and molecular formulæ—Simple chemical calculations involving weights of materials and volumes of gases.

33. For Scottish students this is normally the course for the Higher Leaving Certificate in Science, for English ones some other examination such as the Cambridge Senior Local Examination. The Entrance Examination consists of a two hours' written paper without practical work and is held three times a year. In 1923 it is proposed to add to the Syllabus " the principles of volumetric analysis as illustrated by Acidimetry and Alkalimetry."

34. Professor Barger's Course of Medical Chemistry for the First Professional student at Edinburgh consists of 100 Lectures and forty meetings of two hours each of practical work, and is attended by medical students only. A beginning is at once made with organic chemistry, and later the study of organic chemistry is continued along with a rapid revision of the subject-matter of the syllabus, together with an extension to other elements, particularly metals, and to a few principles of general chemistry, such as catalysis, reversibility of reaction, freezing point of solutions, electrolytes, osmotic pressure, strength of acids and bases, indicators, colloids, etc. The guiding idea in the choice of subject-matter is that this course of Chemistry should be a preparation for a subsequent course, in the second year, of *physiological* chemistry.

The properties and constitution of drugs, particularly organic ones, are considered to be of less importance at this stage. In organic chemistry a very large part of the work consists therefore in giving the students some elementary idea of the chemical constitution of fats, carbohydrates and proteins, so that he should, for instance, clearly recognise that the essential processes of digestion consist in a hydrolysis of the food to its constituent " bricks." Particularly as regards the proteins this is done in an elementary fashion, and only three or four amino-acids are mentioned. But, on the other hand, the student is expected to know how these may be combined as typifying the constitution of protein.

By far the larger part of organic chemistry is concerned with the aliphatic division, and the chemistry of compounds is chiefly illustrated by means of substances of medical importance, for instance, phenols, salicylic acid, etc. The illustrations for inorganic chemistry are largely medical. Technical processes are entirely disregarded, except for one example of metallurgy—the preparation of iron and steel. This latter illustrates a quite subsidiary aspect of the course, that the student should know something about the most important economic aspects of chemistry. A few other non-medical aspects of the course might be described as general and biological; for instance, the carbon and nitrogen cycle in nature.

35. The small amount of general chemistry which has so far been included is used by Professor Barger to connect the facts of inorganic and organic chemistry, and is again primarily designed as a preparation for the physiological chemistry of the second year, in order that a student may, for instance, understand what is meant by isotonic solution or by hydrogen-ion concentration. As this is rather a large programme for a course of 100 lectures, it is clear that only the important facts can be selected, and that these must be presented in elementary fashion.

36. The practical work of this course consists of volumetric

analysis (acids, alkalies, chlorides, permanganate) and of qualitative analysis, mainly inorganic. The "test tubing" has been imposed in the past by the very limited laboratory accommodation, but it is now proposed to restrict this to a few of the most essential reactions and to substitute for it some organic preparative work and experiments such as the distillation of dilute alcohol, Nesslerising, etc. It is further proposed to judge the practical work of the student less by his performance in the practical examination and more by his performance in the laboratory course, as attested by his notebooks. This will help to eliminate an undesirable element of chance. Such a course should prove valuable to the student as preparatory to physiological and clinical chemistry.

37. In Edinburgh the relation of preliminary Science to the whole medical curriculum has recently been carefully considered and reorganized, and these two examples by Professor Ashworth in Zoology and Professor Barger in Chemistry afford valuable illustration of the way in which applied Science should be interpreted for the student of Medicine. The teaching of Physics, which was dealt with in the previous Memorandum, should, as Sir Ernest Rutherford suggested, follow similar lines. The fundamental approach is the same in these three subjects, namely, an introduction to the elements and principles in the Secondary School and the exposition of the medical aspects, meaning and purpose in the University. When the student enters upon the professional part of his course these subjects must be deeply integrated into physiology, pharmacology, and pathology, and practically applied in his clinical studies.

III.

ANATOMY.

38. Anatomy is the foundation of the Science and Art of Medicine, and it has formed the basis of all the great Schools of Medicine. Alcmaeon of Croton, 450 B.C., is the first of the Greeks of whom it is recorded that he studied Anatomy. A hundred years later Diocles wrote on the subject, and one of his disciples, Chrysippus, carried his teaching to Egypt, thus colonizing Greek Anatomy in the Alexandrian School, where it flourished under the Ptolemies. Galen, a Greek, practised in Rome, and although not pre-eminent as an anatomist his dissertations remained the written word for 1,200 years until the publication of the *Anathomia* of Mundinus at Padua in 1478. In 1537 Vesalius became Professor at Padua and the renaissance began. From Padua the new teaching was taken to London by John Caius, though it did not flourish there until the Hunters established their school in Windmill Street. It was taken to Leyden, whence it passed through Boerhaave to Edinburgh under the Monroes, and thus to the great Medical Schools of the New World—to Philadelphia, Columbia and Harvard. Thus was Anatomy the basis of the Medical Schools in turn—the Schools of Greece, Alexandria, Rome, Salerno, Padua, London, Leyden, Edinburgh, and over the sea in America.

39. The teaching of Anatomy, though it did not return to medievalism, became, however, in course of time, a subject of restricted study in the dissecting-room and the lecture theatre. It was actively neither biological in setting nor physiological in purpose. It served its immediate end only. The student acquired a detailed knowledge of the macroscopic features of the dead body, but he was able to use little of this knowledge when he came to physiology and pathology and still less in the hospital ward. His teachers and examiners were dismayed at his lack of apprehension and utilitarian application, and he himself was disappointed and discouraged. But the fact was that he had been badly taught. He was overburdened with a multiplicity of detail, wearied with bone-classes and a hundred systematic lectures, and harassed by meticulous examinations for which he was driven to prepare himself by "cramming." Nor did the fault lie wholly with his teachers. It was not the pedagogy only that was wrong, though that was too didactic and left much to be desired, for good anatomists were not always good educationalists. (*a*) The gravamen was this, the orientation of the whole subject of Anatomy itself had gone askew. The anatomy was that of the dead-house—wooden, archaic, static, cadaverous; whilst what the student requires is the form, position and relation of the different parts of the *living* body.

We do not sufficiently appreciate that the anatomy of the dissecting room, the post-mortem room, and the ward are all three *different* one from another and from that of the normal healthy man. The Greeks learned their Anatomy from their constant familiarity with nature, and with the naked body of man in action, either during athletic contests or in the palaestra, but the pendulum swung so far in the other direction that in many medical schools of our own day the student was put to learn Anatomy by the dissection of a preserved body, wasted by age and disease. Dissection is necessary; it is the only certain method of finding one's way about the body, but it is not enough in itself. Nor is it made sufficient or more attractive by adding on a large number of doctrinal lectures. (*b*) A second defect in much of the anatomical teaching of the past has been its divorce from Biology on the one hand and clinical study on the other. The early anatomists and all the great masters were biologists and comparative anatomists. When human bodies were hard to come by, recourse was necessary to the bodies of animals, and whatever its disadvantages this introduced a biological trend. Probably Galen learned most of his Anatomy from the study of other animals than man. We know that Harvey was a biologist, and the same is to be said of Malpighi, Morgagni, the Hunters and Bichat. After Darwin, Owen and Huxley, there was a renaissance of Biology among the anatomists. But as Biology and Physiology became separated and more specialized, Anatomy tended to lose something of its original setting. The same sort of thing happened on the clinical side. John Hunter was both anatomist and surgeon, and the Monroes in Edinburgh held the joint chairs of Anatomy and Surgery in that University for fifty-four years. As morbid anatomy and surgery in their turn became specialized they broke away from Anatomy, which was thus deprived on the clinical side as on the biological. This specialization was no doubt necessary, for the collateral subjects were growing and expanding, but it was a mutual deprivation, and to secure full value on both sides it calls for mutual compensation. (*c*) Thirdly, there has been an insufficient supply and an unequal distribution of bodies to make anatomical examination educative and adequate.* (*d*) Lastly, there has been in many cases insufficient explanation and application of the principles of Anatomy, and hence the meaning and purpose of its study have been lost. It has been robbed of its heritage and reduced to the routine and detailed analysis of a scrapped machine, and the only goal has all too frequently been the Examination test. It should be taught not only as a part of

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* This problem has been in a large degree solved in England by the Ministry of Health. Dr. Addison, the first Minister of Health in 1919, was himself an anatomist, and appreciating this serious defect in Medical Education he deputed to a Medical Officer under the Anatomy Acts the re-organization of the matter in co-operation with the responsible local authorities.

Biology, but also as an applied Science, which the practitioner is to use.

40. What, then, is the remedy ? The answer to that question is easy, but its fulfilment difficult. The remedy is a fuller appreciation on the part of all concerned—the examiner, the teacher, the student—of the real meaning and purpose of Anatomy to the medical practitioner and its place in and relation to the curriculum. In my previous Report (pp. 38–42) I have set out the Content of Anatomy, the methods which should be applied in its study and the correlation which is essential with the other subjects of the curriculum. Here it is only necessary to add that the purpose and meaning of Anatomy can only be learned *at the same time* as its structure. The results of analysis must then and there be reconstructed by a synthesis. New medical and surgical knowledge should be reflected in it—bone and joint surgery, the conquests of the brain and the abdomen, endocrinology, orthopædics, the advance of gynæcology, tropical medicine, the re-education of the disabled—all these should find a place promptly in the current interpretation of Anatomy. In one generation the Edinburgh School of Obstetrics enlightened Anatomy by means of the study in frozen sections of the relationship of the organs of the body—Hart on the pelvis, Barbour on the mechanism of labour, Ballantyne on the structure of the human fœtus, Symington on the anatomy of the child, Webster on ectopic gestation, and Eden on the placenta. The surgical advances recently made in bone and muscle grafting and tenotomy illustrate also how Anatomy has come back into its inheritance. The anatomical principles of John Hunter and the methods of Owen Thomas were adapted and re-applied by Sir Robert Jones and his colleagues to the benefit of tens of thousands of wounded soldiers. All this learning and these conquests should return to the dissecting room and be re-taught to the generations following. Its own new paths of research, the wider vision set before it by Professor Elliot Smith, and the splendid triumphs of Physiology and Pathology must also come back to vitalize the teaching of Anatomy. For that unquestionably is the issue before us—the revitalization of Anatomy—first, by showing the purpose of the structure, and the biological history of how it has come to be evolved through embryology ; secondly, by studying the histology of the organs and tissues alongside their macroscopic Anatomy ; thirdly, by comparing the morbid with the normal ; and, lastly, by teaching the clinical applications of Anatomy in all departments of Medicine and Surgery.*

The Anatomy of the Functioning Body.

41. In his Christmas lectures at the Royal Institution Sir Arthur Keith, the President of the Anatomical Society of Great

* Applied anatomy is now made a compulsory course for fourth-year students.

Britain and Ireland, has furnished us with a delightful picture of the Human Body in Action.* He has compared it with selected examples from the engineer's workshop, and has given us a wonderful model of the complete, living and moving machine of the human body. There are, as in other text-books, the main facts of Anatomy as demonstrated by the anatomist, but in place of a dissected corpse there is a living man—the countless vital units of the body are linked together to form the human machine, all its parts co-ordinated and turned to their specific uses. We see the muscle as before, but now we see also the load which has to be lifted, the muscle engines which move it, the fulcrum on which the lever works. We see as before the ribs of the thorax, but now we find a new interest in the seventh and eighth, we find that the anatomy of respiration is a larger affair than we understood in the dissecting room, and is fraught with far-reaching effect on health and disease.

" Thus in every breath we take twelve pairs of bony levers are set in motion ; they are raised by one set of engines arranged as a complicated sheet—the external intercostal sheet of musculature. That sheet has its fixed base in the backbone ; it cannot act unless the muscles which fix and regulate the vertebræ are also in action. The twelve pairs of levers are lowered by another elaborate set of engines—the internal intercostal sheet, which obtains its chief basis from which to pull in the framework of the pelvis. The great muscular sheets which ascend in the belly-wall from the pelvis to the ribs not only take a part in lowering the ribs and compressing and emptying the thorax, but have also, when we are standing up, to support the weight of the viscera which are contained in the abdomen. When we see how great is the number of structures set in motion with each breath we take—levers, muscular engines, joints and nerve centres—we are astonished that so complex a mechanism can be carried on with so little effort on our part . . .

" This, then, is the story of how Nature has constructed the moving walls of the respiratory bellows, which she has fitted to the human machine. She has used the backbone as the upright or standard for a support; the side and front wall she has built out of levers and engines, so that when one set of engines are set in motion the side and front walls move outwards as well as upwards ; at the same time a piston packed with viscera and coated with muscular engines moves downwards and forwards. In this manner are the bellows enlarged in every direction, and air is thus drawn into the lungs. Then by setting another elaborate group of engines at work the movements of the levers and pistons are reversed, and the air is gently expelled from the respiratory chambers. Man has not yet conceived a design which can rival or approach the respiratory bellows ."†

42. We read, again, of a factory, the alimentary canal, threatened with decay. There are all the old anatomical landmarks, but they become parts of a vast laboratory, with a telephone system, a postal system, units, team work, mass movements, and a vital output—and thus while the human body is a mechanism it has been given the organization of a workshop or an army, a living organism. There is nothing new in all this—though the writer has woven into his report the latest advances of knowledge—

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* *The Engines of the Human Body*, by Sir Arthur Keith, M.D., F.R.S. (Williams and Norgate, 14, Henrietta Street, London), 1919.

† *Ibid.*, pp. 129–132.

what is new is the seeing eye, the interpretation, the synthetic attitude. Thus the anatomy of the body has been presented as a living and moving thing, complete, co-ordinated, purposive, and above all integrated into Medicine.

43. From this stimulating text-book, which every medical student would be wise to read, I turn to an illuminating discourse delivered in London in the Spring of 1920. It is entitled *The Influence which our Surroundings exert upon us*, a paper read before " Ye Sette of Odd Volumes," by Sir W. Arbuthnot Lane, Consulting Surgeon to Guy's Hospital. And this is the theme of his post-prandial philosophy :—

" Many years ago, being much dissatisfied with the description of the functions of the skeleton, and of the joints as contained in works of Anatomy, I endeavoured to arrive at a correct knowledge of their mechanics by studying the extremes of function of the several parts in a manner which was quite novel, since it was not recognized at that time that the skeleton was influenced in any way by the surroundings. Any coarse change observed in it was regarded as evidence of the presence of a disease.

" The results have been very far reaching and their importance considerably exceeded my expectations. Not only have they helped to show that the skeleton and its joints undergo very marked and definite changes when exposed to abnormal conditions, and in so doing have demonstrated in the clearest way the mechanics of its component parts, but they have also indicated the manner in which evolution takes place by its being telescoped into a portion of the life-time of the individual. Even beyond this these researches have thrown a very clear light upon the factors that produce many diseases and upon the mode of their prevention and cure."

44. Sir Arbuthnot Lane sees, what others have also seen, that in every part of the body, as well as in the body as a whole, a period of activity alternates with one of repose. " Its anatomy," he says, " only remains normal in structure if subjected to proper association of activity and of rest." Each attitude, exclusive of the others, produces its effects on the skeleton and muscles. So he studied a series of bodies—a coalheaver, a brewer's drayman, a coaltrimmer, a shoemaker, a dealporter, a feeble old woman—and to him they represented some simple laws : (*a*) that the skeleton represents the crystallization of lines of force ; (*b*) that pressure and strain produce respective change ; (*c*) that without pressure or strain a new mechanical condition may develop, or an old one may be modified in a manner advantageous to the individual in his special relationship to his surroundings. The soft parts are also affected and gravity and constipation produce profound changes in the gastro-intestinal tract, which, though Nature attempts to remedy by the formation of membranes or accessory ligaments, may degenerate into dilatation, ulceration and even malignant disease. Yet these results were preventable had their causes been known and understood. " Education is a thing," he concludes, " that will have to be undertaken much more seriously than it is at present, not by so-called educationalists whose knowledge of the body

and its functions is superficial, but by scientific men specially trained for the purpose."

The Vision of John Hunter.

45. Here then we have two Lay Sermons by two anatomists. They might well have been entitled *Lessons in the Teaching of Anatomy*. They disclose the anatomy of the living body and the effects of use on the human framework. They bring the every-day life of the industrial worker, the life of the factory, into touch with medical study and practice. They leave the merely academic side of Anatomy high, dry and remote, and they make manifest, almost as by unveiling, the relation of growth and differentiation to the living body and to the practice of Medicine. It is the supreme method of John Hunter.

46. We have seen that the aim of anatomical teaching is the study of the living man. " But its foundations," says Professor Berry, of Melbourne, " are to be sought *in the study of all vital phenomena*. The fields of heredity, morphology and physical anthropology offer great and unrestricted possibilities to the anatomist of the living. The human cadaver offers few such fields." The radical way of making Anatomy the study of the living is to give it the setting of anthropology, comparative anatomy and embryology, of biology in the broadest sense. As basis we need to use the study of the dead body as a *method* rather than an end in itself. The end is a knowledge of man in the animal kingdom, his origin, his history, his position there, his relation to other animals, his form and framework, how it came to be and its purpose. For these things give the student not only a conception of the unity of nature but the reasons and explanations of the structural characters of the body of man, which each discovers for himself by dissection. To see this is the vision of John Hunter. He thought biologically, his surgical conceptions were those of the comparative anatomist, and to him rational treatment was reliance on the forces of nature. His study of Anatomy made him a biologist, a student of the living and not the dead. He did not work at Anatomy, as is usually done, for a few hours in the day, but was employed in it from the rising to the setting of the sun. With his brother William, and subsequently on his own account, he spent the early years of his life in London at dissection, and the superb Hunterian collection is one of the results. He applied his work to practical and ultimate issues. " All this time," says Mr. Stephen Paget, " he was only laying the foundations of the vast extent of his real work that was yet to come. Human Anatomy was taking its place in his mind as but a part of all Anatomy ; he must know the whole animal world, every living structure in it ; must dissect everything, noting all different forms and arrangements of the organs, each method of nature to adapt them to the necessities of life." As Sir Everard Home said, " it was not his intention to make dissections of particular animals, but to institute an inquiry into *the various*

organizations by which the functions of life are performed."* Hence the *content* of Human Anatomy must be widened if we would make it living. The centre must still be the body of man, but the setting and illustration of it will be biological, anthropological, teratological, and in the result it will be clinical. Dr. Johnson Symington, thirty-five years ago, was accustomed to give his class at Edinburgh a demonstration on the anatomy of the embryo, the fœtus and the child, and in many English Schools the example of Sir William Turner is followed, and the subject is interpreted in terms of racial anatomy and anthropology, illustrative of the normal growth of different tissues and organs and the evolution of man's body as a whole. " Anatomy should be taught as a Science," writes Principal Mackay, of Dundee, " an end in itself ; not as a clinical study, but as a preparation for actual clinical study."

Methods of Anatomical Teaching.

47. In addition to giving Anatomy a vital setting there are various ways in which the student may be trained in Anatomy from the " life " point of view, and so may be obviated what one of the London Schools reported as " the complete separation that at present (1919) exists between the scientific and clinical teaching." (*a*) The use of living models for special instruction in surface anatomy ; (*b*) the study of muscle movement by action exercises, by the observation of gymnastics, X-ray skiagrams, cinema films, etc. ; (*c*) the inclusion of one or two clinicians on the anatomical teaching staff ; visits by the anatomist to the wards ; (*d*) the introduction of suitable clinical cases to the anatomical department or visits to the out-patient room or the hospital to study cases illustrating Anatomy ; (*e*) applied Anatomy, both medical and surgical ; and (*f*) facilities for clinical students to return to the anatomical department—all these are means which have been adopted in English Medical Schools. At the Middlesex Hospital there is a laboratory of applied Anatomy and Physiology ; at St. Thomas's a special orthopædic department ; at Leeds and other schools the professor of Anatomy goes into the ward ; at Oxford, since 1886, students have specially studied upon the living subject the exact anatomical position of the principal viscera and other structural features ; and at

* Professor Wood Jones, of Adelaide, has set out something of the general and particular of this argument in his two books, " Arboreal Man," and the " Principles of Anatomy as seen in the Hand." He epitomizes his case when he speaks of " the emancipation of the fore limb," and when he declares that " the power of the hand grasp has made possible the forerunners of the Primates, has perfected the evolution of the Primates, and has paved the way for the development of man." Thus he leads his student to the origin of the body, every part of which is to illustrate the principles of Biology and of Anatomy, every lesson of which is to be something directly edifying to the practitioner of medicine, and to the educationalist.

nearly all schools the X-ray is used. By this means Dr. Morison at Manchester demonstrates to the student of Anatomy the epiphyses of the bones, the movements of the joints, the thorax and diaphragm, the alimentary canal (by bismuth meals), peristalsis, the kidneys and the injected blood vessels of the cadaver; and the student learns, beside anatomical structure, observation diagnosis, the application of radiology, living Anatomy and Physiology and the beginnings of research.

48. Finally, the teaching and examinations in Anatomy must have regard to the needs of the medical practitioner. He uses Anatomy every day, but it is not the Anatomy of the examination paper. The sort of thing that is of no value to him is the minute detail of all muscles and their attachment, of arterial and nerve plexuses or of the folds of the peritoneum. Like John Hunter he needs the biological principles of Anatomy; like John Hilton he seeks for its explanations, for the uses and relativity of its various parts, for its actual working and application. When Sir John Bland Sutton said the other day in the Hunterian Oration that "morphology has become the soul of anatomy," he meant that the study of morphology had profound lessons to teach as to the relation of Anatomy to the whole being of the human body, not only as a machine, but to its maintenance and reproduction, to its growth and development. This significant lesson is to be brought to the student by getting him, as Morgagni used to say, to "think anatomically." Let him carry his Anatomy on after his intermediate examination into his clinical years, aided by courses of applied anatomy taught by the clinician, and coming back when needful to the anatomical laboratory to verify or to refresh his mind. The General Medical Council suggests that questions should be included in the final examination on the applications of Anatomy and Physiology to practical medicine. For some years past, clinical Anatomy has been taught to fifth-year students in the more enlightened schools, and the plan has been of great advantage in the development of co-ordination between Anatomy and Medicine. The anatomist and the clinicians must break new ground by conference, co-operation and joint teaching.

In achieving this wider synthesis of anatomical teaching, we must not neglect one element of the older method of instruction which was of great value, its insistence upon *accurate* knowledge. With all its faults, all its exaggerated demands upon the memory of the student, the older anatomy did make clear the distinction between "there" and "thereabouts." We must encourage the student to take broad views, but not vague views. We must still insist upon an accurate knowledge of topography, although we may reduce the elements of the landscape which should be known.

IV.

PHYSIOLOGY.

49. It has been customary to consider in this country that the subject of Physiology for the medical student comprised histology and general, experimental and chemical physiology, and its study in most Medical Schools has been carried on by a comprehensive series of systematic lectures, by practical work in the laboratory, and by demonstrations. The departments and teachers have been well equipped in accordance with the standards of the day, and the position of the subject and its teaching have compared favourably with that obtaining in other countries. For some years previous to 1914 substantial changes were proceeding which, since the War, have been expedited and expanded. Every year Physiology becomes more intricate and the search for ultimate causes, factors, and inter-relations more complex. There is growth at the outposts; inherent relationships with collateral subjects become manifest; the applications to Medicine are developed and new ones are introduced; and, above all, the solid advances of Physiology itself make it more and more an independent Science, like Chemistry and Physics, with which it should be in close association. Happily it has already shown signs of this fraternity, and in recent years the whole question of the co-ordination, integration and organic regulation of the normal human body has opened a new chapter in Physiology—a chapter which contains substantial and fundamental sections of Physics and Chemistry. Haldane's claims for organic regulation and Sherrington's for nervous integration are illustrations in point. But much else has happened. The experiences of the War brought into focus new factors in nutrition, in respiration, in fatigue, in neurology, and in vital capacity. And there is the new knowledge regarding chemical synthesis and the function and place in the bodily autonomy of internal secretions.

The Modern Expansion of Physiology.

50. In the light of these facts Physiology in the Medical Schools has been expanding in substance and in outlook more, I think, than any other subject of the curriculum, and its long foretold conquest of English Medicine is at hand. The teaching of the subject now includes Systematic Physiology, Experimental Physiology, Bio-chemistry (Physiological Chemistry and Metabolism) and Human Physiology. To these, in the best Schools, are added Neurology, Psychology and applied or clinical Physiology—with sometimes special departments for electro-physiology and bio-mechanics. Professor Graham Brown, of the

University of Wales, believes that an effective physiological institute in a Medical School should contain eight subdivisions of research and instruction—(1) Behaviour or total Physiology, including physiology of the nervous system ; (2) bio-physics and electro-physiology ; (3) physiological chemistry ; (4) micro-physiology ; (5) bio-mechanics ; (6) metabolism and endo-crinology ; (7) special sense physiology and psychology, and (8) applied physiology. He would, it will be seen, rightly include histology, " for its more important part is truly functional," though this subject is now, in some measure, also included under Anatomy. Metabolism and endocrinology might well be incorporated with bio-chemistry, but otherwise it is difficult to suggest much curtailment, though it is imperative that excessive elaboration should be avoided. However the sub-divisions be arranged, and this will vary in different schools, their substance is essential to sound teaching. For in Physiology we have three desiderata to meet on behalf of the student :—

(*a*) A knowledge of the normal functioning of the healthy body and the extent and limitation of its variations ; with the methods of studying and investigating its activities ;

(*b*) A knowledge of the factors which disturb the normal, and the methods of investigating them ;

(*c*) The application of the principles of Physiology to Medicine.

Professor Graham Brown's plan of teaching continues during two years, and he proceeds as follows :—

" I would suggest that the student be first of all given a short series of lectures in which the subject would be presented as a whole. If these were given with sufficient vividness he would have, as it were, a map which was marked with the main features of the country into which he was about to enter. This map would remain with him, and into it he would later be able to fill the detail as he explored different parts of the territory. This course of lectures might be called the Physiology of Behaviour. It would probably be that part of the teaching which was the most difficult to give.

" Starting at the same time, and continuing for the remainder of his first year of Physiology, the student would have practical courses in Bio-physics, Physiological Chemistry and Micro-Physiology. In other words, he would study the cell and its functions from the physical and chemical aspects. He would here obtain his knowledge of the fundamental physiological processes.

" In the second year of Physiology the student would come into contact with the applications of these fundamental processes to the mass functions of the organs and systems of organs. The metabolic interchanges of digestion and respiration, the mechanisms of circulation, respiration, digestion, and general movement would all be taught."

The lecture system has no doubt been overdone, but it has its value in presenting the subject as a whole, in providing explanations and in drawing attention to the latest advances in

knowledge. Professor Noël Paton, of Glasgow, conducts his Physiology Course by taking the practical work first, to be followed by reading and demonstrations, and subsequently attendance at Lectures. There can be little doubt of the rightness of this order, provided a few preliminary lectures are given to map out the course and its purposes in the student's mind. In most English Medical Schools the number of general systematic lectures has now been substantially reduced, and the practical work and applied Physiology increased and differentiated.

51. The scope of Physiology is the study of the activities of all living things and its great end is to answer the question, "What is life?" It is, as we have seen, a part of Biology, and if the student has been wisely grounded in Biology, in Physics and in Chemistry, he will find himself provided with firm foundations for Physiology. For he will apply these subjects to the living body. He will learn the elements of bio-physics, of bio-chemistry, of metabolism, of muscle and nerve function, of respiration, digestion and organic regulation. But even so, his immediate business is the application of Physiology to Medicine. First, he must pass from animal physiology to mammalian physiology; then more narrowly he must know the physiology of man; and, finally, he must apprehend the applications of its principles and methods to health and disease. In these three directions great progress has recently been made in this country.

(i) *The Application to Mammalian Physiology.*

52. As I pointed out in my previous memorandum (1918), the best example of the practical teaching of mammalian physiology is to be found at Oxford. Sir Charles Sherrington has reorganized his course and has published an illustrated text-book covering its scope and recommending the kind and order of exercises, with annotations concerning the source and bearings of the more salient observations and the necessary equipment and methods adopted. The following is Professor Sherrington's revised arrangement of exercises:—

Syllabus of Arrangement of Courses.

EXERCISE I.—Rhythmic movement and tone of intestine; influence of adrenal extract on intestine, spleen, and arterial wall.

EXERCISE II.—Revival of beat of the excised mammalian heart; influence of temperature thereon.

EXERCISE III.—Adrenal extract and chloroform on the isolated mammalian heart under coronary perfusion.

EXERCISE IV.—Inspection of the lungs and beating heart *in situ*: influence of intra-pericardial pressure and of faradization of the vagus nerve. The capillary circulation viewed by the microscope.

EXERCISE V.—Graphic of arterial pressure, influence of vagus, of atropine, and of faradization of the spinal cord. Antidrome conduction in dorsal columns of spinal cord.

EXERCISE VI.—Arterial pressure record; influence of adrenal extract; of asphyxia; and of amyl nitrite; measurement of venous pressure; occlusion of coronary vessels.

EXERCISE VII.—Arterial pressure, splanchnic nerve and adrenal gland; pituitary extract; vasoconstriction in kidney and gut; chromaffine reaction; chyle; pulmonary circulation-time.

EXERCISE VIII.—Arterial pressure and pulse; the effects of aortic stenosis and of aortic incompetence. Reduction power of the tissues as indicated by methylene-blue.

EXERCISE IX.—Nervi accelerantes; gravity and arterial pressure; recurrent laryngeal and the vocal cord.

EXERCISE X.—Diuresis.

EXERCISE XI.—Specific gravity of blood; perfusion of renal vessels with Ringer-Locke; influence of adrenal extract and amyl nitrite; haemolysis.

EXERCISE XII.—Salivary secretion; air embolism; expansion of lungs by aspiration.

EXERCISE XIII.—Reflexes of pharynx and larynx. Graphic of respiratory movement of chest and abdomen; influence of deglutition upon them. Influence of severance and of stimulation of the vagus on respiratory rhythm.

EXERCISE XIV.—Vaso-depressor and cardio-inhibitory reflexes; their dissociation by atropine. Vaso-pressor reflex from afferent limb-nerve.

EXERCISE XV.—Knee-jerk; Magendie's law of the spinal roots.

EXERCISE XVI.—Tonic knee-jerk; law of conduction of the spinal nerve-roots tested by pinna reflex.

EXERCISE XVII.—Influence of cervical sympathetic on blood-vessels of the pinna. Hæmorrhage and arterial pressure; restorative effect of gum-saline injection (Bayliss). Clotting of blood; fibrinogen.

EXERCISE XVIII.—Spinal reflex action in a flexor muscle (tibialis anticus). Proprioceptive reflex. Comparison between reflex and peripheral contraction.

EXERCISE XIX.—Reflex action in an extensor muscle (vastocrureus); postural reflexes and reflex inhibition of the crossed extension reflex.

EXERCISE XX.—Pancreatic secretion and the preparation and action of secretin; bladder-bile.

EXERCISE XXI.—Phagocytosis and estimation of opsonic index.

This practical course has taken shape gradually under experience and during the endeavour to devise the kind of teaching which is needed. Each of the twenty-one lessons consists of some three hours' work, and the experiments included are such as experience proves the student will be able, with ordinary care on his part and some supervision by the teacher, to accomplish successfully. It will be seen that this study of mammalia deals with heart beat, blood pressure, renal and salivary secretion, respiration reflexes, pancreatic secretion, phagocytosis and opsonic power. The sequence of arrangement has been found appropriate, but it is obviously open to wide modification and is used in part or whole in a number of Medical Schools. As arranged, the exercises on organs isolated from the body in a surviving state are taken first; then those on the circulation, commencing with the Harvey observations by inspection, *i.e.*, the simplest method; then those on respiration and secretion;

then those on the central nervous system; and, finally, the experiment on phagocytosis and the opsonic action of serum. The experiment on the pancreas and secretin is placed late, because exposure of the pancreatic duct makes some demand on skill the student will have acquired. On the other hand, the exercises on phagocytosis and opsonins, and that illustrating the treatment of hæmorrhage by transfusion of gum-saline, build a bridge toward Pathology, a subject which the student will pursue next after his Physiological Course is finished. At Oxford this course is taken by "honours" men, who constitute some 80 or 90 per cent. of the students of medicine. Their practical work also includes (*a*) histology, (*b*) physiological chemistry, (*c*) frog-physiology, and (*d*) clinical physiology. The advantages of such a scheme are obvious. It provides an ascending scale of experience in technique; it leads the student's mind from work on the frog (which has perhaps been a little overdone both in time and character) to that on the higher types; it extends the scope of animal physiology towards man; it interprets, without protracted study, the meaning of the fundamental experiments of the pioneers of Physiology; and it prepares the student for Human Physiology and clinical work.

(ii) *Application to Human Physiology.*

53. Significant progress has been made in the practical study of Human Physiology, which cannot fail immensely to improve the equipment of the student for clinical practice. The old-fashioned practical class of static histology has disappeared, and its place has been taken by a valuable scheme of practical work which includes chemical Physiology and direct observational work on the living body (histology being now usually transferred to the anatomists). In some Schools the suggestions I ventured to make in 1918 have been adopted, with or without modification; in others more attention has also been given to the cytology of blood, estimation of hæmoglobin, urea and glucose, viscosity, specific gravity, corpuscular resistance, agglutination, and so forth; testing the functional integrity of various organs of the body, bismuth and barium meals, acidosis, etc.; and in yet other Schools substantial advance has been made in teaching the physiology of normal function.

In 1919, the General Medical Council called the attention of Schools to the desirability of taking definite steps to provide fuller instruction in such function as illustrated in the physiology of breathing, eating, drinking, exercise, rest, normal childhood, adult life and old age, and much development has taken place in this direction. Such subjects had been dealt with already at Dublin, Birmingham, Aberdeen, and Leeds; at Sheffield applied Physiology is continued over the clinical years; at the Middlesex Hospital a laboratory is devoted to such applications, and they are commended in preference to abstruse experimental work; at Oxford there is, as we have seen, a special course in

clinical Physiology; at Belfast the work has been reorganized to provide for more instruction in normal Physiology; and at Manchester, under Professor Hill and Dr. Lamb, a valuable practical class on Human Physiology is in being. Professor Noël Paton has revised his practical course at Glasgow, and now begins it with the study of the Special Senses as "the instruments of knowledge," partly because of the importance of the student learning at an early stage the limitations of these senses, partly because their investigation affords an introduction to the use of the more difficult methods employed in the study of respiration and circulation.

54. An aspect of normal Human Physiology which is of utmost importance is that of the total efficiency and Vital Capacity of Man. As a result of war experience, both in the Army and Air Force and in civil industry, this subject has received special attention from Cathcart, Greenwood, Hill, Dreyer and Flack, and measurements of physiological output and tests of capacity have been introduced. The ability of the normal body to withstand strain and pressure, its powers of compensation and the factors by which it is able to yield its maximum efficiency, are matters of the highest physiological and national importance. Attention was called to this subject by the Health of Munition Workers Committee during the War,* and since then it has been explored by physiologists and others and valuable tests introduced, the wide application of which may be anticipated. Clearly, it is a subject which should be fully dealt with in every systematic course of Physiology. Its study is invaluable to the student, both as method and practice. From it he obtains a conception of the effort syndrome, of the far reach of the normal, of the co-ordination of the body, of organic and nervous regulation, and of the intimate relation of nutrition to physiological function.

55. The increased attention devoted to practical work in Human Physiology has given the subject new impetus, and English medical students will reap therefrom two substantial advantages. First, the student will learn to apply his general physiological knowledge directly to man. He will understand something of the wide variations which occur within the normal compass and amplitude of the body functions. Hitherto, many quite healthy "signs" and "symptoms" have been accepted as indications of disease and the abnormal, whereas, in fact, they lie within the physiological normal. Secondly, by studying Physiology on the body itself the student passes to more difficult enquiry than when he deals with the frog or cat, and he learns sound methods of clinical investigation and the elements of research. As Sir Thomas Lewis has pointed out, the transition from laboratory Physiology and its elaborate apparatus on the one hand, to clinical Physiology and the simpler methods of the practitioner on the other, is at present too abrupt, and the

* *Industrial Health and Efficiency*, 1918, Cd. 9065.

student seeking to apply laboratory knowledge and methods to the patient before him loses his way. He fails to differentiate between the special investigations by which knowledge is advanced and the daily routine by which it is practised. He must learn to dispense with special methods and elaborate apparatus, and to depend upon simple devices, the signs and symptoms of the body, the use of his own senses of hearing and touch—above all, clinical experience. Polygraphy, electrocardiography, the instruments and tests of the laboratory, the methods of mammalian investigation, even hospital equipment—these lie outside the scope and opportunity of the ordinary practitioner. He must find his way without them. They are preparatory, scaffolding, methods of research, means to an end. "Medical practice will grow more scientific," says Sir Thomas Lewis, "as it becomes more and more simple—as the practitioner grasps great and fundamental truths in their relation to common diseases; it will not grow scientific in proportion to the mass of detail—impressive enough, may be—which he is able to pack into the compass of his brains. The place of these refined methods is the laboratory and the teaching hospital. In the teaching hospital they are there so that the student may learn how *knowledge is acquired.*"* Now the way, and the only way, to avoid artificial and fallacious instruction in this regard is to train the student by habit and practice to verify and standardize his physiological knowledge by the study and observation of man's living body—himself, a fellow-student, a patient or a model; and, as I emphasised in 1918, dependance should, as far as possible, be placed on eye, ear and tactile sense and not on instrument or apparatus. The importance of this method can hardly be exaggerated. The aim is to make competent and reliable medical practitioners. If this depends upon an understanding of one subject more than others, that subject is Physiology, and in particular *Human* Physiology—not a book-learning alone, not a highly technical and abstruse conception of the vast field now opened to us, but a simple, bed-rock, practical comprehension of the character and scope of the normal functions of the body. The order of sequence is thus adequate instruction in Chemistry, Physics and Biology, then in General Physiology, then in Human Physiology, and thus to its relation to ordinary life and clinical practice.

(iii) *Application to Clinical Practice.*

56. "I am afraid," writes Professor Halliburton,† "that too frequently Physiology is studied by the student not as a preparation for the after-study of disease, but as a means of passing a certain examination. Too frequently the teacher fails to keep before himself and his students why they are studying

* *Relation of Physiology to Medicine.* Brit. Med. Journal, 1920, ii, 461.

† *Physiology and National Needs.* Edited by W. D. Halliburton, M.D., F.R.S., 1919, pp. 80–81.

Physiology, with the result that, when the student comes to the bedside, he does not bring with him that training which is all-important in his practical work. . .

" But I venture to think," he adds, " that not infrequently the fault lies not with the physiological teacher, but with the hospital physician under whom the student finds himself. The physician, after an inadequate study of the science of Physiology in the remote past, may have lost all touch and all sympathy with the science of to-day, may have sunk into an easy empiricism, and may be content to cloak his ignorance by sneers at the application of scientific methods to practice . . .

" Reform is needed in the physiological teacher on the one hand, and in the hospital physician on the other. The one must keep the object of his training of medical students constantly before him ; the other must keep in touch with the growing science of Physiology, and must welcome all applications of physiological methods to his work."

Here we have the practical issue in clear terms, and it is satisfactory to be able to report that the issue is now being met, and in two directions, namely, in the Medical School and in the Hospital.

57. In the first place, Human Physiology is now being taught more adequately than formerly—on the lines already indicated—particularly in relation to the later subjects of the curriculum. Students are learning to think of disease as disordered Physiology ; they are engaged in the study of applied Physiology ; and clinical physiological methods are being demonstrated in the laboratory. Further, the teaching of Physiology is being continued throughout the later period of the curriculum, is synchronized with clinical instruction. At Manchester, for example, though, as in all other Schools, Physiology is taken in the second year, the student is also expected to take advanced courses, for in the third year Professor Hill has an advanced course in physiological method as applied to the study of morbid conditions ; in the fourth year there is a course by the Professor of Psychology in the psychology of normal human behaviour ; and in the fifth year a course in Abnormal Psychology parallel with the class in Mental Diseases. There are also advanced courses in chemical and experimental Physiology for which students return to the physiological laboratory. This is a practice of other Medical Schools, and the Scottish Branch (Curriculum) Sub-committee of the General Medical Council has tentatively suggested that this later teaching in Physiology might include :—

1. *Circulation.*—Cardiac Irregularities. The Electrocardiogram and the clinical phenomena associated with its varieties. The Pulse. The circulation in different parts of the body, its regulation and the clinical significance of its variations. Heart failure, the effect of toxins and drugs.

2. *Respiration.*—The Analysis of Air and of the Blood Gases. The effects of Anoxaemia and of variations of the CO_2 content. Vital Capacity and its changes in Clinical Conditions. Indications for the use of Oxygen. The Alkali Reserve of the Blood and its Maintenance, with the Clinical Conditions that affect it.

3. *Digestion.*—The Influence of the Nervous System on Digestive processes. The Test Meal and its fallacies. The Digestive Secretions.

The normal picture revealed by X-rays after a Bismuth Meal. The Physiology of various operations upon the digestive tract. The results of Gastro-enterostomy, and of adhesions of various structures. Intestinal Stasis, Abdominal Pain, its causes and localization.

4. *The Nervous System.*—The Physiology of the Disturbance of Sensations in the early stages of Disease. The importance of Reflexes. The Postural Reflex, and its Relation to the production of structural deformities. Pain, Exhaustion, Malaise and Breathlessness, their significance and diagnostic value, as also those of vomiting and Vasomotor Disturbances. Brain and Nerve Centres.

5. *Metabolism.*—Dietetic Requirements. Vitamins and their Influence. Basal Metabolism and its Clinical Applications. Carbohydrate Tolerance, blood sugar, Diabetes, and Acidosis. Renal Insufficiency. Fever and the Mechanism of its production.

6. *The Endocrine Organs.*—Their action upon Growth and Metabolism. The Therapeutic action of extracts and the effects of diminished secretion and of complete removal.

7. *Reproduction, Development and the Physiology of Childhood.*—A Clinical Application of the Salient Facts of the Physiology of these Conditions, more especially in its bearing upon the health of the Mother and Child.*

These are valuable suggestions, and in practical ways and at appropriate times such subjects should form part of the study of Human Physiology in its relation to clinical practice.

58. In the second place, changes are taking place at the teaching hospitals by which the student is enabled to apply physiological methods in his clinical work. All teaching hospitals now have clinical laboratories available for Ward work, and in several Schools physiologists have been attached to the hospital as liaison officers between the physiological department and the Ward. The work of these laboratories has brought physiological life, stimulus and method into the hospital—the practice of therapeutics and the patient have gained substantially, but so also has Physiology, for practical human problems have invigorated the physiological work. More far-reaching as an educational measure is the new plan of bringing the physiological student in his second year to the hospital, periodically, for the study of cases which illustrate physiological principles or methods, and still more radical and effective appears to be the whole-time appointment of the Professors of Medicine and Surgery or their Assistants in Clinical Units or otherwise. For it is the business of such whole-time teachers, as "applied physiologists," to integrate the preliminary and intermediate subjects with their clinical teaching. That is perhaps one of the principal reasons for their appointment, as it is also one of the principal effects. As the prospective Surgeon returns to Anatomy, why should not the prospective Physician return to his Physiology ?

Conclusion.

59. Physiology is steadily moving into the front rank of biological science. Its application to Medicine is but a part of

* Minutes of General Medical Council, 1922, vol. lix, p. 223.

its sphere, yet that application lies near the foundation of Medicine itself. The enormous advances in our knowledge of nutrition, secretion and nervous control are among the triumphs of the age in which we live and are profoundly affecting the whole realm of Medicine. An all-round equipment in Physiology is perhaps the greatest single need of the medical student.

60. While we may admit that English Physiology is one of the strongest parts of English Medicine, it behoves us to watch always with vigilant and critical eye the form and content of its teaching. In any case the main part of that teaching must be practical, and we must safeguard ourselves against some particular dangers. (1) At present there is still too great a tendency to work in watertight compartments, yet the relationship of structure and chemical property with function and life is obvious. The essential requirement is the emergence of function and life. Physiology cannot wisely be taught as a series of disconnected events, as if we were describing the workings of separate parts of a machine. Life must be measured, as Lord Haldane has pointed out, in terms of life.* The structure, the chemistry, and the nervous control of a living organism are mutually inter-dependent and inter-related as a single organic unity. There can be no true understanding of the parts without the whole, and that is one of the extreme difficulties in the presentation of the subject to the student's mind. The several parts of the practical course must be held in due proportion, emphasis being laid less upon traditional muscle-nerve preparation and experiment and more upon the physiology of the heart and circulation, of secretion, of digestion, and above all of organic metabolism and regulation. Function is something much more complex than mechanics. It involves not only the performance of a duty by specialized cells, tissues or organs, but an organic control of structure and office, and of one system by another. The function of respiration implies not only respiratory mechanism but chemical change also, and both fall under the control of the nervous system. It is idle to talk to the student of respiration, digestion or secretion without a full recognition of this axiom. (2) In the second place, the student should apply his observations and experiments on the frog to mammals, and where practicable to man himself or his fellow-students, making his work bear as directly as possible on the living body. There is a tendency to over-elaboration of isolated aspects of Physiology instead of teaching the student to comprehend their simplest application to normal life and hygiene, and to maximum efficiency. (3) Much is lost by the practical divorce of physiological teaching from pathology and clinical medicine and surgery, partly owing to the student discarding his Physiology when he has passed his intermediate examination. Arrangements are now made in the curriculum for a much closer association of the Physiological department in the University with the pharmacological and pathological

* *The Philosophy of Humanism.* 1922. Chap. VII.

laboratories, and with the surgical work of the hospital. (4) Lastly, not only should the practical course in Physiology be concurrent with the systematic teaching of the subject, but it should depend upon the personal work of each student, his own observation and his own experiment; for thus only can we introduce the true practice of research, of which alone the living spirit of Physiology is born. The clinician must be ever a physiologist, the physiologist always a researcher.

61. It is obvious that to carry out these ideals in practice means some re-arrangement in many Medical Schools. It means more equipment, better teaching, and a new relation of the teaching of this subject to pathology and anatomy on the one hand, and to clinical work on the other. And all this means expense, but it is expenditure which should be incurred. The immediate necessities in regard to this subject in the Medical Schools are (*a*) a reduction of systematic lectures and a larger understanding of the methods and purposes of practical work; (*b*) more thorough guidance as to the relative importance of the issues raised in the practical class; and (*c*) a closer association of Physiology with the other intermediate subjects and with clinical work, in both medicine and surgery.

V.

PHARMACOLOGY AND THERAPEUTICS.

62. " To state that the future of Medicine lies in pharmacology may sound fanciful," writes Professor W. E. Dixon, of Cambridge, " but it is certain that the most hopeful of all signs of the progress of Medicine of to-day is to be found in the progress of the science of treatment." Speaking in general terms the *science* of treatment is Pharmacology and Therapeutics, its *art* is to apply the science to the anatomy, physiology and pathology of the human body. Though it is even yet an incomplete science, little more than a collection of data, its history is the most ancient of all branches of Medicine. Hundreds of years before the fifth century of Greece, men gathered simples on the Ægean shores and applied them internally or externally to the signs and symptoms of their bodies when sick. A list of such simples and drugs formed the earliest pharmacopœia. In the Middle Ages the naturalist-physicians wrote herbals which set out the botanical characters, external appearance and origin of medicinal plants and their values. In the course of time new drugs or new combinations of old drugs were used, and so a lengthy and elaborate pharmacopœia came into existence. The advance of chemistry led to the analysis, and that of toxicology and clinical medicine to a study of the effects, of these drugs. Hence by the middle of the nineteenth century there came to be a body of knowledge respecting materia medica, the memorization of which burdened the student of that time. Now in recent years three or four profound changes have occurred which have altered the whole orientation of the science and the art of Therapeutics.

(i) First, there were experimental observations on the active principles of drugs and their effect on animals, followed by a fuller study of the mechanism of the normal physiology as altered by these effects. The principles of pharmacology were illuminated and made manifest in the investigation of particular and specific drugs. The researches of Magendie on strychnine, Bernard on curare, and Fraser on strophanthus are illustrations in point. Quinine is an excellent example of the growth of our knowledge of drugs. In the sixteenth century cinchona bark was introduced; Fothergill and others extended its use; in 1820 Pelletière and Dumas isolated an alkaloid (quinine); many and varied experiments were made in respect of its application to malaria; Cunningham and others differentiated other alkaloids; and these have been

applied to the treatment of benign and malignant tertian infections.

(ii) In the next place, there came about new relationships between pharmacology and physics and chemistry in regard to the chemical structure of the molecule and the physical processes of absorption, surface tension and solution, and these conditions may prove to be the formative factors in regard to many of the new synthetic drugs of modern times.

(iii) Thirdly, the advance of physiology revealed the importance of internal secretions, which are to all intents and purposes drugs within the bodily economy—indeed, they have been extracted and used as drugs, adrenalin, thyroid, pituitrin. Thus has been opened a wholly new chapter not only in materia medica but in our conception of the creation, storage and distribution of body fluids of vital consequence.

(iv) Lastly, a new relation has been established between pharmacology and pathology, owing to the morbid effects now known to follow an increase or decrease of natural chemical substances in the body and the production in the body itself, and by means of body cells, of protective substances. Long before Jennerian Vaccine it was known that the body possessed its defensive substances, but in the last few years there has been an enormous development in serology and immunology which has revolutionized therapeutics.

63. To understand the present position of Pharmacology in Britain, it is necessary to remember that thirty years ago the subject hardly existed as a part of Medicine : there were few or no pharmacologists in the present sense, physicians holding hospital appointments taught *Materia Medica*, and Therapeutics from an empirical standpoint ; and the examining bodies required no experimental knowledge of the subject. Yet at this time the Pharmacological Laboratories in Germany, Austria and Italy had already become comparable in importance with those of Physiology and Pathology : these laboratories consisted essentially of two parts according to whether the work was of a chemical or a physiological nature, though not infrequently the Professor of Pharmacology had beds also, both for clinical teaching and research. The chemical staff was engaged in bio-chemical study and in the synthesis of new chemical substances. It was clearly impossible for isolated workers in England at that time to do more than attempt one branch of the subject, so that when a Medical School organized its pharmacology (as in Cambridge), it was decided to adopt the physiological side as being more immediately important in view of the general ignorance of the action of drugs, the empiricism of the practitioner, and the open contempt of the average

physician for drugs generally. The present position of Pharmacology in England is largely due to this approach. But the practice of those days was never thought to have attained an ideal, but to be only a first step towards something practical. Pharmacology in its proper use is not merely the physiological action of drugs on normal organisms, but it includes the synthesis of new chemical substances with a view to their use in Medicine and the experimental trial of these drugs on the diseased patient. Synthesis has not been widely undertaken in Great Britain ; and our Pharmacopœia during the last twenty-five years has been supplemented almost entirely from the Continental Laboratories of Pharmacology. It also needs revision in other respects. The reason so much importance is now attached to the Laboratories of Pharmacology in foreign countries is that these Laboratories have in the past given a substantial and quick utilitarian return in new drugs for the money expended (*e.g.*, the new anæsthetics, the hypnotics, urinary disinfectants, tropeines, diuretics, vaso-dilators, antipyretics, synthetic purgatives, organic metallic compounds, and drugs such as the derivatives of trypan-blue). We can ill afford, any longer, either academically or commercially, to leave synthetic Pharmacology as a monopoly of certain Continental laboratories. We need an Institute of Experimental Therapeutics comparable with that of Erhlich, in Frankfurt, comprising all branches of Pharmacology, chemical, experimental and clinical.

With these facts in mind it is clear that Pharmacology is not the dead, static accumulation of dry-as-dust materials which it seemed to be in the student days of Darwin and Huxley, but living and progressive, full to the brim of potentiality and possibility of future discovery. But it must be explored in conjunction with Physiology, with Pathology and, above all, with Therapeutics. The practitioner should know the pharmacological action of the prepared drugs which he uses.

64. The meaning and scope of Therapeutics has recently undergone changes, profound and far-reaching, and it is high time a wider view was taken of this fact in the form and content of Medical Education. *Materia Medica* in the narrow sense no longer covers the ground. Indeed, a generation ago the drug or medicinal scope of Therapeutics had been enlarged by the addition of dietetics, climatology, mineral waters, baths and the therapeutic value of rest. But consider half a dozen further illustrations of the expansion which has occurred, and reflect that these matters are not even yet receiving adequate practical attention in some of our Medical Schools.

(i) *Vaccines and Serology.*

65. In the earlier part of the nineteenth century vaccination of infants (for small-pox) took the place of inoculation, and it

became compulsory under Act of Parliament in 1853.* At the time of the passing of the first Vaccination Act in 1840 the only local authorities that exercised jurisdiction throughout England and Wales were the Poor Law Guardians, and the administration of the Vaccination Law was, therefore, entrusted to them, and thus it remains, subject to the control of the Ministry of Health. The Board of Guardians appoint medical men to act as "public vaccinators" in their districts, and non-medical vaccination officers to keep the vaccination registers and issue the necessary notices with reference to vaccination.

The instructions of the Ministry of Health to public vaccinators direct that, except in so far as any immediate danger of small-pox may require, the public vaccinator must vaccinate only subjects who are in good health.

The public vaccinators (who use calf-lymph specially prepared at the Government Lymph Establishment) are instructed to aim at producing four vesicles or groups of vesicles having a total area of half a square inch on the eighth day after the operation has been performed. By making four small marks separated as widely as possible from one another there is less likelihood of "bad arms" resulting and a maximum efficacy in protection against small-pox is afforded.

The greatest care is taken at each stage in the production of the calf lymph, and every public vaccinator is required to adopt strict aseptic precautions (cleansed arm, sterilized instruments, and proper protection of vaccinated surface) and to report on the result of every tube used by him.†

The percentage of successful vaccinations by this method is 99·4. Every medical student is required to take a course in the Theory and Practice of Vaccination. For various reasons this training has become perfunctory, and steps should be taken forthwith in every Medical School to ensure that satisfactory conditions are complied with.‡

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* Exemption on the ground of conscientious objection was granted in 1898, an arrangement described by Lord Lister in the House of Lords as a "tremendous experiment," and the means of obtaining exemption were further facilitated in 1907. The result has been greatly to increase the exemptions, which have now risen to 60 per cent. of the births.

† For particulars of the administrative arrangements for Vaccination in this country see *Small-Pox and Vaccination* (Ministry of Health Report, No. 8), 1921, price 3*d*.

‡ The Vaccination Act, 1867, Section 4, provides that no person shall be a Public Vaccinator who is not qualified in proficiency of vaccination as required by the Ministry of Health. Whilst some practitioners may not desire to be Public Vaccinators, a large number actually become so, and all should in any case be qualified to become such. The Local Government Board issued a general order in 1898 under the Vaccination Acts, Article 2 of which provides that a Certificate of Proficiency in the practice of vaccination shall be signed only by the teacher of that subject who has been authorized by the Central Authority (now the Ministry of Health).

All Medical Schools have incorporated proficiency of vaccination as a requirement among their conditions for qualification in accordance with the requirements of the Examining Body to which the student proposes to submit himself for examination for qualification in Medicine. The Instructor in this subject should (*a*) be a competent vaccinator; (*b*) have had wide experience of vaccination; (*c*) be thoroughly familiar with the law of vaccination and with its administration; (*d*) be expert

[*See next page.*

66. More important to the medical student than vaccination for variola is the enormous field now opened before him by the progress of our knowledge of immunity. As is well known, immunity may be *natural* to the species or the individual, or *acquired* by the course of an infective disease, which in its turn may be conferred by inoculation of a modified virus or the serum of an immunized animal. Hence has arisen a new and powerful means both of *diagnosis* and of *therapeutics*. For we can now detect a suspected infection by testing the blood for anti-bodies, by agglutinating with a specific anti-serum, or by standardizing the pathogenicity of an isolated micro-organism. Agglutination reactions are now employed in typhoid (Widal), in food poisoning (Gaertner), in dysentery (Shiga, Flexner) and so forth. Similarly, precipitin, bacteriolytic, hæmolytic, complement-deviation and other allied tests have been introduced, and are now in common use in pneumonia, diphtheria (Schick), cerebro-spinal meningitis, cholera, syphilis (Bordet-Wassermann), tuberculosis (Calmette, Von Pirquet, Moro) and other bacterial infections. The complement-deviation reaction has been used along with agglutination for identifying bacteria by means of specific anti-serums in differentiating food poisoning organisms and the coli-typhoid group and for the detection of blood stains.

67. A second result of the new knowledge of immunity has been the preparation of vaccines (vaccine therapy) and anti-toxins (serum therapy) for therapeutic use. Vaccine therapy may be employed in prophylaxis and in treatment. Living but modified virus is used in small-pox and rabies; dead cultures are used in typhoid, pneumonia, plague and cholera. For therapeutic use vaccines may be polyvalent (numerous strains of the supposed causal organism) or autogenous (the strain isolated from the individual patient), and their application is ever widening. (Small-pox, typhoid, cholera and plague

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in handling children and know by experience the signs and symptoms of children's diseases; (*e*) be a clinician with experience of vaccinia and its sequelæ, rashes, complications, etc.; and (*f*) be competent to fulfil the conditions of the post of public vaccinator and of teacher of vaccination, as set out in the Regulations of the Ministry. There are advantages in appointing a Public Vaccinator as a Teacher of Vaccination. As such his work and his teaching come under the inspection of the Ministry of Health, who are thus able to ensure a high standard of work.

An approved course in the Theory and Practice of Vaccination should include several classes of instruction and practical work.—(1) History and Pathology of Vaccination. Inoculation and its Effects. Cow Pox. Vaccinia, variola, varioloid; (2) Prevalence, age, incidence and mortality of Small-Pox, 1700–1800, 1800–1902.; (3) Vaccination in various countries. Results.; (4) Primary Vaccination and Re-vaccination. Area of scar and number of marks. Course; (5) Modification of Small-pox by Vaccination. Rashes, complications, treatment; (6) The Law of Vaccination. The Acts of 1840–1841, 1853, 1867, 1898, 1907. The practical work should include—Preparation of calf-lymph. How to vaccinate. Time, preparation, method, lymph used, protection, after-care. Practice. Observation of previous cases.

stand perhaps in the first rank, but vaccines are now frequently used in acne, coli infections, coryza, influenza, pyorrhœa alveolaris, pneumonia and streptococcal infections). Antitoxins have become part of the established armamentarium of the practitioner in diphtheria, tetanus, dysentery and snake bite. Anti-bacterial serums have been used in dysentery, cerebro-spinal fever, acute pneumonia, and streptococcal infection.

68. While it is obvious that neither the student nor the general practitioner can devote time to, or become skilful in the detailed laboratory technique which lies behind the practice of immunology, it is equally certain that in after life the general practitioner will require a practical working knowledge of its application to disease both in diagnosis and treatment. Much improvement has recently been made in some Medical Schools in the teaching of this subject, dependent upon laboratory equipment, upon the predilections of the bacteriologists, and upon the incidence of disease. The significant triumph of typhoid inoculation during the War served to draw universal medical attention to Sir Almroth Wright's work and methods; similarly the prevalence of small-pox, influenza and syphilis stimulated the study of their immunology. Nevertheless it must be said that many students appear to possess but a rudimentary and rather confused idea of the application of these things to everyday practice. It does not seem too much to require that every Medical Student shall receive elementary instruction in the following points :—

(*a*) The principles of immunity.

(*b*) The methods of preparation of vaccines and serums, and first-hand experience of one or two types, *e.g.*, the making of small-pox or rabies vaccine and of diphtheria antitoxin. He should also know how to collect material for the preparation of autogenous vaccines.

(*c*) The diseases for which practical immunology is available, their differential diagnosis, and the circumstances in each when vaccine or serum should be used.

(*d*) Principles of selection of stock, polyvalent or autogenous vaccines.

(*e*) The time of use, method and site of injection, dose, secondary or repetition doses.

(*f*) Action on blood, local reaction and general effect.

(*g*) Ill-effects and risks. Rashes. Methods of obviating ill-effects, precautions against anaphylaxis.

(*h*) Results of experience of these bodies and the results of their use. The student should know in particular the convincing evidence in regard to small-pox, rabies, diphtheria and typhoid fever.

(*i*) Association of other forms of treatment with vaccine and serum therapy.

(ii) *Organotherapy.*

69. This new form of Therapeutics is chiefly represented by the use of thyroid extract for myxœdema and cretinism, a substitutive rather than a curative form of treatment. It has also proved of service in other conditions. What makes organotherapy important to the medical student is that it is a method of treatment based upon compensating defect by administering the extracts derived from internal secretions. Adrenalin, the hormone of the suprarenal glands, stimulates the sympathetic nervous system, and has been used in exhaustion and shock. Pituitrin from the pituitary body gives tone to the arterial system, restores peristaltic activity to the paretic bowel and contracts the uterus ; and Insulin (extracted from the pancreas) is now being introduced for diabetes. Several other similar extracts are in the experimental stage.

(iii) *Heliotherapy.*

70. Sunlight treatment was practised in the colonnades of the great medical temples at Epidauros and Cos, and after many centuries of neglect has recently been re-introduced and re-applied. Rollier, of Leysin, has for twenty years been its persistent advocate. He claims that its principal effect is on the skin, which forms, of course, not only a protective covering to the body, but is also an organ of circulation, innervation, respiration, nutrition and excretion. " Those important physiological functions can only be accomplished," he says, " if the skin is placed in its natural surroundings, permanent contact with air and light." He begins by exposing only the less sensitive parts of the body to the sun's rays, feet, legs, thighs, then abdomen and thorax, keeping the head covered, and gradually increasing the duration of exposure until the body as a whole is pigmented. To this process he submits all forms of tuberculosis (osseous, cutaneous, pulmonary), adenitis, peritonitis and other conditions. " The best orthopædic and preservative surgery may be practised by means of heliotherapy," and with suitable after-care he has obtained remarkable and convincing results. This method has been followed with success in this country, as elsewhere. At Alton and Hayling Island (Gauvain), at Leasowe (Martin), at Carshalton (Price), even in Glasgow (Taylor), the curative value of heliotherapy has been ensured, especially in tuberculosis in children. Happily also it has been practised, alongside an open-air life, in many sanatoria and open-air schools for twenty years past for various forms of debility, anæmia and tuberculosis, and the great movements in favour of Garden Cities, Smoke Abatement and Daylight Saving have contributed to the common acceptance of the hygienic advantages of sunlight.

For the student to visit such institutions (or those providing ultra-violet rays or carbon arc light) is something of a liberal education in the possibilities of heliotherapy, and enlarges his conception of therapeutics.

(iv) *Electro-therapeutics and Radium.*

71. Here, again, there has been exceptional advance and numerous and varied applications. Galvanic and faradic current, separate or combined, high frequency, radiant heat baths, and static electricity are in daily use for an immense variety of maladies, and there are many institutions or clinics where the student may quickly become familiar with methods and applications; and though as a practitioner he may not be able personally to possess and use such apparatus, he will learn how and when electric treatment should be used. Ionization falls, perhaps, more within the compass of the practitioner, and thus he can introduce into the tissues drugs in ionized form, nascent and active. Radium is also steadily winning its way, as any observer of the work of the Radium Institute knows. From merely external application and the insertion of radium tubes, methods of embedding were developed, and now radium is used in conjunction with major operations, with diathermy, with X-rays, and with "intensive" X-ray treatment. Great progress has been made since the War in Europe and America in all these four new applications, and Mr. Hayward Pinch's records indicate the variety of diseases, now ameliorated and arrested, and even cured, by their means. With X-rays the student is more familiar, and in every Medical School in this country radiology is now taught. In some, however, it is too casual and incidental, and the General Medical Council had good ground for recommending that in future it should be dealt with separately and systematically. Such a course should include not only (*a*) means of production and (*b*) application both to diagnosis and treatment, but detailed instruction as to (*c*) methods of radiographic examination, now more finely adjusted, exact, and safeguarded, (*d*) relation of X-rays to other forms of examination and treatment, and (*e*) the correct and differential reading of radiograms. The last-named point is more comprehensive than at first sight appears, for it raises many questions of anatomy, physiology and pathology, as well as the physics and mechanics of radiography. For instance, the interpretation of radiograms of the skeletal system of children requires accurate knowledge of the process and timing of ossification and epiphyseal change; of the heart, a knowledge of its normal variation in shape and size; of the lungs, the effect of inspiration, expiration and diaphragmatic movement; of aortic aneurysm or cystic calculus, the respective differential diagnosis. All this means that to be reliable X-ray work depends upon an accuracy of

knowledge of the body less immediately necessary than in, say, the use of radiant heat baths or heliotherapy. This is part of the value of its study to the medical student.

(v) *Mechano-therapeutics.*

72. Massage (passive) and remedial exercises (active) as forms of physico-therapeutics have been steadily reintroduced, and since the War have become widely recognized. Their practice, like nursing, is sufficiently specialized to call for particular training and experience, which lies outside medical education. Yet the medical practitioner should know the methods adopted and their value in the treatment of morbid conditions. He himself indeed should be in a position to ensure for his patient the kind of treatment needed, and should know its possibilities and limitations. The various forms of massage (stroking, kneading, friction, *tapotement,* vibration) and remedial Swedish exercises (including graduated, breathing and resistant exercises) are not merely corrective and preventive of stiffness, adhesions and other morbid conditions of muscles and joints. They exert also direct and indirect effect on nutrition and metabolism, on the respiratory, lymphatic and circulatory systems, and constitute an essential part of the modern treatment of injured joints, bone repair, spinal curvature, talipes, chronic constipation and intestinal stasis, and many nervous conditions. Breathing exercises are necessary after certain nasal and pharyngeal operations, and form a constituent part of the hygienic training of school children; massage is now used after many surgical operations as a matter of course; and both massage and remedial exercises have been extensively applied in the vast undertaking of re-education of the maimed soldier. Many forms of manual instruction and occupation are their modern expression, and are applicable to the re-education of every patient whose injury or disease has thrown his manipulative or nervous organization out of gear. A last point may be mentioned. Since the introduction of the School Medical Service, all the children in the Public Elementary Schools pass through a system of Swedish physical exercises from the ages of five to fourteen years, and its modification to remedial purposes is thus facilitated, if and when their invalidity demands such treatment. Indeed, the graded table of Swedish exercise in the official syllabus taught in the elementary schools is, with slight modification, available for health and therapeutic purposes.

(vi) *Anæsthetics.*

73. The General Medical Council has recommended that every student seeking medical and surgical qualification shall take a course of instruction in the administration of anæsthetics and be certified as having himself administered anæsthetics on at

least ten occasions. A generation ago such a recommendation would not have been without its embarrassments. The student then took his turn alongside the anæsthetist and picked up what he could, trying his "'prentice hand" under a vigilant eye. But that is changed and in all Medical Schools special instruction is now given, though it is in some need of systematization. The following points in particular call for attention in providing this instruction : (*a*) the nature of the operation ; (*b*) the selection of local or general anæsthesia ; (*c*) the condition and preparation of the patient ; (*d*) the anæsthetic to be used (nitrous oxide, ethyl chloride, chloroform or the narcotics) or combinations of them (general), cocaine, eucaine, novocain (local) ; (*e*) selection of the method of administration ; (*f*) the stages of anæsthesia and their development and phenomena ; (*g*) complications ; (*h*) risks, precautions and the treatment of dangerous symptoms ; (*i*) after treatment ; (*j*) spinal anæsthesia. Great accuracy and thoroughness are obviously necessary in this instruction, which should be systematic as well as practical. To give an anæsthetic promptly and safely is an emergency task which may fall to any practitioner without notice, and like other surgical emergencies brooks no delay or incompetence. The practical use of opium and other narcotics is a subject insufficiently taught in some Medical Schools.

(vii) *Psycho-therapy.*

74. In recent years some forms of treatment of mental disease have overflowed their boundaries and invaded the realm of internal medicine, and thus there has sprung up an application of psycho-therapy to various disorders in which mental factors have been causative, or even to physical disorders in which the mentality of the patient is playing a dominant part. Every individual possesses volition and certain elemental instincts and emotions, has passed through a certain experience and upbringing, and has contracted habits, and these factors undoubtedly may play a part in disease and its treatment. In hysteria, neurasthenia, psychoneuroses and other functional nervous disorders, in some of the insanities, and even in non-mental disease, psychotherapy may be of service. Its methods are analysis, suggestion, persuasion or reinstatement of disordered function, and these methods may be associated with various physical agencies. There is not yet a science here, nor even a uniform practice. Much depends on the "personality" of the patient and the physician, but that psychological methods may, and should, play a part in therapeutics no sensible man denies, for to deny it would be to assume that the patient or physician is unaffected by the powers of the mind. There is great need for the medical student to receive instruction and guidance in elementary psychology, which, as is suggested elsewhere, may well form a part of physiology.

Practical Methods of Teaching.

75. The scope of the work in this department of Medical Education is therefore twofold, pharmacology, or the scientific study of drugs, on the one hand, and therapeutics, or the art of treatment, on the other. The arrangements made in Medical Schools in this country for fulfilling this dual necessity are various. One feature, however, is common to them all; the old system of putting the student through a course of practical pharmacy and of learning the subject of pharmacology and therapeutics by dissertations on the British Pharmacopœia has practically vanished. In most Schools the work is accomplished by systematic lectures, demonstrations and practical classes, associated with a more or less systematic study of therapeutics in the Hospital ward.

76. Substantial reforms have been undertaken in regard to the arrangements made at Edinburgh. The Professor of Pharmacology (Dr. Cushny) undertakes the pharmacological work in laboratories in the University and is relieved of all clinical work in the Hospital, which in its turn is undertaken by the Professor of Therapeutics (Dr. Meakins), who is also physician to the Infirmary (with forty-five beds). The two Professors work in close conjunction, and the two aspects of the subject are comprehensively dealt with. The scheme is probably the most complete in this country. Both professors are "whole-time," and the Professor of Therapeutics is also Professor of Clinical Medicine. The clinical lectures and daily ward visits bear upon therapeutics, and there are sixteen special lectures on the latter subject. Attached to the wards is a therapeutic laboratory with accommodation for ten workers in chemistry and physiology, and the Professor of Therapeutics has also two whole-time assistants in the University for research work. At Sheffield, Professor Mellanby is Professor of Pharmacology and teaches all students by means of a course of lectures and experimental work in pharmacology in their third summer, and in the following winter the same Professor demonstrates clinically in the Hospital ward the principles which he has taught in the previous winter. Here, therefore, pharmacology and therapeutics are in the hands of one teacher, and it is obvious that this arrangement has many advantages, particularly when the Professor is also engaged in research work on both aspects of the subject. At Oxford, Professor Gunn lectures three times a week for two terms on practical and experimental pharmacology, the student concurrently learning practical pharmacy either at the same laboratories or at the Hospital Dispensary. Professor Gunn is also Consulting Pharmacologist to the Radcliffe Infirmary and is therefore able to undertake practical therapeutics in the ward. At Cambridge, Professor Dixon's work is well known, and this School has exerted a wide influence on pharmacological teaching.

77. The practical courses in the best Schools follow much the same lines, and consist of the examination of the physical

and chemical character and pharmacological effects of a selected group of the principal drugs, and provision is made for experimental pharmacology and research work for senior students. Professor Gunn believes strongly in the practical work being of such a nature as to bring the subject of pharmacology into relation with general medicine whenever possible. The student undertakes experiments of perfusing frog blood vessels (action of nitrites, adrenalin, guanidine, caffeine, digitalis, etc.), as such work provides sound training in technique. The student learns to apply to mammals similar experimental work, on the isolated rabbit's heart or intestine, or the guinea-pig's uterus; he also studies hæmolysis of rabbits' corpuscles; the action of drugs on protozoa; and measurements of blood pressure, diuresis and intrapleural pressure are made on the decerebrated cat.

78. In most of the Medical Schools during the last two or three years arrangements have been made for the systematic study of non-medicinal therapeutics. At Aberdeen this work forms part of the Course of Pharmacology, where an additional series of ten lectures is given on some of the methods of treatment which I have named above (for example, massage, remedial exercises and psychotherapy). In other Schools the student is taught vaccination, serum-therapy, radiology and mechano-therapeutics in the several Departments of the School or Hospital where these methods are practised. *Therapeutic clinics*, to which I referred in my previous Report, have been established in several centres, but there is still abundant opportunity of expansion in this direction. Since the War many special hospitals have applied the newer methods of therapeutics to ex-soldiers and also to children, and much might be done by arranging for students at Medical Schools to visit such centres of special treatment from time to time in order to become familiar with the newer applications of therapeutics. Substantial advance has similarly taken place, particularly in the Scottish Universities, in the practical instruction of the student in prescribing and in what may be described as preventive therapeutics. Professor Marshall, of Aberdeen, deals with the principles of therapeutics, the conditions modifying the actions of drugs, their use in the different systems of the body and in the prevention of disease. At Edinburgh similarly therapeutics are not only taught, but form a constituent part of the final examination in Medicine. In his clinical examination of his "long" or commentary case the student is expected not only to make all necessary tests and to ask the results of tests that he could not in the time make for himself, but under the head of treatment he must write a formal prescription, giving the pharmacological, pharmaceutical and therapeutic reasons for his advice, and for the use of the active ingredients included in his prescription. It would seem desirable that this plan of calling out the reasoning faculty of the student and of the candidate should become a universal practice, and accompanying it there might

well be an opportunity for both instruction and examination in regard to prevention and prognosis.

Clearly, the aim to be borne in mind is to escape from the old-fashioned tradition by which the student of pharmacology was expected to memorize details of a large number of drugs, and to substitute for it a fuller and simpler apprehension of the character and utility of a few selected drugs of daily use, and the still wider field of practical therapeutics which are rapidly coming into vogue in general practice. In truth, we should aim at producing not pharmacologists in the narrow sense of the term, but practical therapeutists, who appreciate that both the science and art of the subject are rapidly expanding and marching always on the confines of unexplored country in which there is much hidden treasure. Learning is needed, but more important than detached knowledge is an open mind, an alert reasoning faculty and an always enlarging application of treatment, both medicinal and non-medicinal.

VI.

PATHOLOGY AND ELEMENTARY BACTERIOLOGY.

79. In order to understand the present position of Pathology in the Medical Schools of this country it is necessary to remember the process of evolution through which it has passed. Pathology is the scientific study of disease, and at first it was pursued with the object of throwing light on the medical treatment of the patient. By the advance of our knowledge of morbid changes in cells, tissues, organs and the body as a whole, the subject has slowly but steadily developed until it has become something of an independent science, rightly pursued for its own sake. The result has been a substantial development in Pathology as such, and in the various laboratory methods and forms of technique by which its problems have been investigated. Further, its ramifications have passed into all branches of Medicine and Surgery, and have become integral parts of such branches. So much has this been the case that it is almost true to say that practical Medicine now consists of diagnosis, pathology and treatment, and practical Surgery of diagnosis, pathology and the application of the mechanical arts. Hence, whilst Pathology remains in some degree a separate science, it has become largely absorbed as an essential part of the practice of Medicine. When, therefore, the criticism is made that great advances have not been made in English Pathology in recent years the explanation is not that there has been lack of progress or research, but that the integration has been so intimate that the science has become woven into the warp and woof of the whole texture of medical practice. Thus its advance as a pure science has become obscured.

80. Speaking broadly, there have been four stages of growth in English Pathology :—

(*a*) It began as *Morbid Anatomy*. Its study consisted of the examination of the end-results of disease in the dead-house. The lectures on Pathology of two generations ago were almost entirely lectures on Morbid Anatomy. Its laboratory was the post-mortem room, the purpose of which was less the study and teaching of Pathology than the determination of diagnosis and the clearing up of the issue at the autopsy.

(*b*) The second stage occurred in the rise of *Morbid Histology*, dating from Virchow, who taught that though disease was a process it had a local focus and a local origin in the cell. Pathology therefore became cellular

Pathology, and Morbid Anatomy could only be made manifest to the student by the study of changes in the cell. It was not long before it became clear that these changes were two-fold ; there was a change in the morphology of the cell and in its chemical contents, reactions and secretion. Thus Pathology became the study of the disease process which involved histology and chemistry, and, in order to demonstrate these changes, particular methods of section cutting, mounting and staining were devised, and chemical tests were applied. Hence arose the newer methods of pathological technique, a subject which has advanced rapidly.

(*c*) The third stage was marked by the advent of the subsidiary science of *Bacteriology*. From 1849 onwards, and particularly between 1880 and 1900, many specific micro-organisms were discovered in relation to disease. The growth of Bacteriology was so swift and extensive that it quickly became almost a separate subject, the separation being detrimental alike to itself and to Pathology. The main facts in Bacteriology as worked out in the laboratory are now in routine employment by the pathologist and the clinician. Every year witnesses advance in the application of both Bacteriology and Pathology, and the student has thus been led into a whole new field of immunology. Here, again, the advantage to clinical work has become predominant in his mind, the subject has become daily more intimately associated with medical practice, and thus has lost something of its individuality. Hence the bacteriological investigation of morbid fluids and substances, methods of blood culture, agglutination, etc., have become, like blood counts and the examination of urine, everyday activities. Yet these examinations belong, from the medical point of view, to pure Pathology. Pathology appears to have surrendered them, but the loss is only apparent, for they have proved themselves to be valuable pathological methods in medical diagnosis.

(*d*) Lastly, the prophecy of Virchow has come true, and the pathological anatomist has become a *pathological physiologist*. The whole subject of Pathology has widened out to become a study of disease in the living cells rather than the dead, of function rather than of structure. Attention is being directed less to the end-result and the cadaver, and more to the living patient in whom the disease is actively present.

> Obviously, the study of disease is not less Pathology because the patient is still living. "Pathology, if it is to be the useful reality that it ought to be to the student and the graduate," says Professor Dean, "must be learned in the wards as well as in the post-mortem room and the laboratory. Pathology does not begin when the patient dies." It is this larger conception of Pathology which has brought Virchow's "pathological physiologist" into alliance with the physician in studying and measuring morbid conditions, expiratory exchange, hydrogen-ion concentration of blood, and so forth. Such pathological-physiology is a rapidly growing subject; some judge it to be clinical medicine, others physiology; but, in truth, it is an aspect of Pathology, a living, vital, clinical aspect of everyday practice. When, therefore, we consider Pathology in its modern sense, we have to think, not of the dead-house alone, nor yet of clinical Pathology in the laboratory alone, the examination of tissues or discharges; we must think of the organic integration of the Pathology of function in the whole practice of Medicine.

81. There is even yet another aspect in which this wider conception of Pathology must be interpreted. We have seen that the subject is no longer Morbid Anatomy or Morbid Histology or even Bacteriology alone, but *the science of morbid processes*. Such processes have, as we know, an ancestry of causes and a progeny of effects; both these origins and these results should form a part of our consideration of Pathology. They furnish it alike with a history and a purpose; in organic disease of the nervous system, in rheumatism, in auricular fibrillation of the heart, in the metabolism of diabetes or in rickets, we see that there have been predisposing conditions which have set up the morbid process, as there are also far-reaching results. In rickets, for example, it is not sufficient to show the student the thickening of the bone at the epiphysis, the changes in the cartilage, the formation of osteoid tissue, decalcification and the various malformations of the body which result therefrom. We must also set before him *the course of events* which have led to these malformations, a rational account of their development and relationship—social, personal, physical, dietetic, the effect of lack of sunlight and fresh air, of unsuitable diet, and, beyond the present malformations, the ultimate morbid anatomy of the case. We must lead him to envisage the probable sequence of events which these conditions may imply in the future. Let the origin of these diseases be what it may, the student should understand the predisposing conditions which gave them scope and occasion, and the complications of which they may be the precursor; for thus the morbid signs are readily associated with the clinical

conditions, and the sound medical or surgical treatment of the case. Such an approach to Morbid Anatomy gives it a new purpose in the mind of the student and his academic interest in it becomes practical.

The Scope of Pathology

82. The subject of Pathology then should include (i) Elementary Bacteriology; (ii) Morbid Anatomy and Histology; (iii) General and Special Pathology and their chemistry; (iv) Experimental Pathology; and (v) Clinical Pathology. And the whole should have a setting of (vi) Comparative Pathology. Pathology, like Physiology, is much more than a handmaid of Medicine, it is itself a science which the student must study in its comprehensiveness for its own sake. Moreover, these six divisions of the subject should be taught as conjoint parts of a whole and in due relation to the other medical subjects of the curriculum. In the most enlightened Schools of the New World, as well as in the best Schools in this country, experience has shown the importance of spreading the subject over two to three years of the medical curriculum. The course may well begin with Elementary Bacteriology in the second year, concurrently with the teaching of Anatomy and Physiology, and with such a course the technique and methods of pathological Chemistry should also be acquired. Then in the second or third year will come general Pathology, Morbid Anatomy and Histology; in the fourth year there will be special Pathology, autopsies and the clinical application of Pathology, and up to the end of the student's curriculum he will be in a position to derive advantage from the bacteriological, histological and chemical results of the post-mortem examination. He is to be taught not the characteristics of end-results only but the nature of morbid processes; he is to find the relationship between organic changes and clinical features; his beginning is Chemistry, Anatomy and Physiology, and his end is clinical practice and a pathological apprehension, and this will comprise a wide range of comparative study.

83. In regard to this scheme of Pathology two things must be said. It should begin with Elementary Bacteriology and Pathological Chemistry, and it should be organized to give the student a complete practical training in the correlation of Pathology with the clinical study of disease. The course in *Elementary Bacteriology* should first include an account of its rise in the nineteenth century and its association with Biology and Chemistry. The work of Pasteur forms an excellent introduction. Subsequently the student should be instructed in the principles and elements of Bacteriology and learn to understand the methods of their application.

Such a course will include microscopical preparation; staining and examination; media-making; the cultivation of organisms and their isolation and identification; sterilization, the use of bacteriological

apparatus and the collection of material; the methods of examination of water, milk, air, pus, sputum, urine, etc., general nature and types of organisms; Staphylococci, streptococci, B. coli and the principal pathogenic organisms; anaërobes and soil organisms; serological methods in general diagnostic use.

84. In order to teach the undergraduate the correlation of Pathology with clinical study, some necessary administrative arrangements must be made: (i) First, the Professor of Pathology in the University should be Pathologist to the Hospital connected with the Medical School, with full opportunity of coming into its wards. (ii) Secondly, the Pathological Institute,* which should bring together in one Institution all branches of pathological work, should be either in the Hospital or closely associated therewith (iii) Thirdly, each student should have a course in Clinical Pathology—the collection of hospital material and the technique of the principal pathological examinations (for urine, sputum, blood, excreta, diphtheria swabs, examination of tissues, Bordet-Wasserman, Widal and other tests). (iv) Fourthly, post-mortem examination of the dead body should be undertaken by each student in turn, as "clerk" or otherwise. Several autopsies should fall to the lot of each, and in all cases the findings should be carefully and closely correlated with the clinical phenomena of the case, the signs and symptoms of which should be explained as far as practicable by the autopsy findings. (v) Lastly, there is much to be said for the method of pathological conference as practised by Professor MacCallum of Johns Hopkins University, Baltimore. At this Medical School, which represents some of the best teaching of Pathology in the American Continent, the subject is learned by the student carrying out in the laboratory and the hospital the examination of the blood, urine, sputum, excreta or parasites of the patient in his charge; any tissues or discharges removed are examined in the Hospital laboratory or, if necessary, in the Institute of Pathology; if the patient succumbs, the body, passing to the pathologist, is examined by schedule, and such organs and tissues as may be found necessary are collected together for the student to have before him for consideration with the clinical features of the case. Such arrangements provide the material for the "pathological conference." At these departmental conferences, a survey is made by the Professor of the pathological syndrome for teaching purposes, for correcting the records, for research inspiration, for training in method and technique, for dealing with pathological signs by inductive reconstruction of the actual case, and for training the staff of the

* A Pathological Institute should incorporate adequate post-mortem rooms with cold storage plant (refrigerators and brine circulation), Lecture Rooms and the Pathological Museum constructed on the case-method basis. There should be ample accommodation for the Hospital Pathologist, and for routine examinations of morbid histology and bacteriology; suitable laboratories for the Professor and his assistants, as well as a departmental library and laboratories for research; class rooms for systematic instruction in pathological Chemistry and special balance, polarimeter, combustion and experimental rooms.

Department. There is here also the correlation of the clinical phenomena with the post-mortem findings. It is along these lines of the " case-method " that Pathology is developing at the present time in the British Medical Schools. Systematic lectures are being reduced in number and practical work is taking their place. In most Schools pathological clerkships have been introduced, the teaching museum is being co-ordinated with current instruction instead of being merely a collection of isolated specimens, and the student is becoming an interested investigator of the relation of the morbid process of disease to the signs, symptoms, and clinical features which he has noted in the Ward. " The road to medical education," said Sir William Gull, " is through the Hunterian Museum and not through an apothecary's shop."

Need for a School of Pathology.

85. One of the defects in the teaching of this subject is its disjointedness and lack of system. In some schools only parts of the subject are dealt with, and the authorities appear to be satisfied if the student obtains a superficial knowledge of general and clinical Pathology ; in others the subject is fragmentary and incoherent in presentation, one teacher undertaking Morbid Anatomy and the autopsies, another bacteriology, a third clinical Pathology—each going his own way. It is necessary that Pathology should first be taught as a pure science, as Physiology has been taught in the honours schools of Universities, and then by experimental method as an applied science. Each Medical School should have a complete organization within its own walls for the teaching of Pathology. In such an organization all the six branches of Pathology would receive attention and be effectively co-ordinated in one general scheme. There should be unity of conception and the necessary facilities—the class-room, the museum, the post-mortem room, the experimental laboratory, the ward laboratory and the ward—all organized to one end. That end is the establishment of a correlation between Physiology and Pathology, between the several branches of Pathology, and between Pathology and clinical study. Pathology, like Anatomy, runs the risk of routine and static interpretation, dissociated from the living, and uncorrelated with its companion sciences. It is necessary, therefore, to make all possible graphic use of post-mortem findings, of current and museum pathological specimens and of clinical Pathology in its widest sense. This implies co-operation and joint action between the physiologist, the pathologist, the bacteriologist and the clinician, and it is this co-operation which is the true foundation of the teaching of Pathology within the University.

86. Finally, if we are to secure sound progress and thorough workmanship in the science and practice of Pathology something

more is needed, something in the nature of a general School of Comparative Pathology—vegetable, animal, human—a well-equipped centre for research, for advanced teaching, and for the training of pathologists. Only thus can we secure a worthy succession of younger men properly trained for pathological work. With a School of Pathology thus developed should be connected hospital wards as in the Rockefeller Institute in New York, and associated with it or contiguous to it should be laboratories for animal and human pathology, bio-chemistry and parasitology. "One should be a help to the other," as Pasteur said when the width and variety of his studies were criticized.

VII.

THE CLINICAL STUDY OF MEDICINE AND SURGERY.

87. The purpose of the Medical Curriculum is the training not of specialists but of general medical practitioners. It is designed to produce *a practical result.* Each branch of it is based upon a larger or smaller but always growing body of Science, and its constituent subjects converge to a focus in practical medicine. The desired product is a well-equipped medical practitioner. It is obvious, however, that he cannot acquire in five years a complete knowledge of the science and art of Medicine and all its branches. He can only be partially equipped. In a word, he can only be provided with the scientific outlook, a method and tools, associated with a general knowledge of the art of Medicine and Surgery and a particular knowledge of the immediate work of a medical practitioner. This is the real issue before us. To assume that into the student's head is to be crammed in forty-five or fifty months a deep knowledge of Medicine is to overload the curriculum and overburden the student. There is a natural and wholesome tendency of the teachers and examiners of each of the twelve great subjects to seek to furnish the student adequately with the subject for which they are responsible and in which they are expert. Knowledge grows and the subjects expand ; and the imposition of the curriculum tends to gravitate into the hands of the teachers and examiners. The inevitable result is that the curriculum becomes too heavy and the student is overfed for his size. Yet in the basic sciences and in the clinical subjects the real and crucial business of the Medical School is to establish the man as a practitioner in the fundamentals, to guide and direct his course of learning, and to give him an enduring inspiration. Life and experience will do the rest, though he will find their yield very different from that of his college, his hospital and the examination hall. But it is for life, and not for the examination hall, that we must prepare him. What we seek, therefore, is a practitioners' curriculum and not a specialist course.

The Practitioners' Requirements.

88. What, then, is the clinical problem that awaits the general practitioner ? Let us consider his situation. He has listened to innumerable clinical lectures, witnessed many complex operations, taken his weary steps through the Pharmacopœia, been initiated into the mystery of many abstruse diseases, and become familiar with the paraphernalia of the laboratory, the clinic, the hospital and the dead-house. But when he enters medical practice he passes into a new and practical world, and he finds himself in the presence of certain forms of sickness and disease, relatively few in number but varied in character by the personality and social and industrial circumstances of those afflicted with them.

Sixty per cent. of the deaths in England and Wales are attributable to half a dozen conditions, bronchitis, pneumonia, heart disease, disease of the nervous system, cancer and tuberculosis. Thirty-five per cent. of the conditions which bring 7,500,000 insurance patients to the panel doctors every year consist of bronchitis and alimentary disorder, and thirty per cent. more are attributable to minor injuries, local septic conditions, " lumbago," debility and anæmia. There are 90,000 factory accidents annually, and nearly all of them call for " minor surgery." There are 800,000 cases of childbirth, and in an average year some 200,000 cases of infectious disease, excluding pneumonia, tuberculosis and measles; and there are vast numbers of patients suffering from defects of eye, ear, nose, throat and skin. Between November, 1917, and October, 1918, there were 2,500,000 medical examinations of recruits for the last stage of the War, and the principal causes of rejection were curvature, deformity, rickets, flat foot, hernia, defective teeth, defective vision, skin disease and dyspepsia; the medical examination of 3,000 men over recruiting age in Manchester and Stockport showed prevalence of varicose veins, disease of the mitral valve, hernia, rheumatic trouble, bronchitis, hæmorrhoids and tuberculosis. In whichever direction we look we find the greater part of that physical impairment, ill-health and disablement is attributable to different degrees, and often early degrees, of the same maladies. Here, then, is the general body of sickness with which the medical man is faced. He has learned his profession in large degree in the Hospital ward, and in the study of the end-results of disease. His patient has been isolated from home and workshop, and treated before him by highly-trained experts and nurses, under favourable conditions and with many kinds of special apparatus and equipment for diagnosis and treatment, with special wards and laboratories. But the practitioner finds that private practice is quite another story. The maladies are different in degree; the facilities of the hospital are unavailable; the difficulties of thorough examination are enormously increased; the circumstances of home and of employment are dominant and insistent; the problems to be met are social, economic and personal as well as medical; and the practitioner himself is thrown on his own resources. It is, indeed, a very different story.

89. Consider what appears to be a simple first case. A platelayer, aged thirty-five, obviously below par, complaining of lumbago, consults the new doctor. The patient is the family breadwinner and he wants to get well quickly. Rest and warmth, radiant heat, massage and salicylates occur to the doctor as appropriate treatment, and he begins to advise accordingly. But the patient asks him four questions:—

(*a*) What is the matter with me?
(*b*) How long shall I be ill and away from work?
(*c*) Will you give me a certificate of incapacity?
(*d*) How can I prevent these attacks of lumbago?

Now, these four questions are far-reaching and raise very practical and difficult problems, namely, (1) exact diagnosis; (2) prognosis; (3) incapacity for work; (4) preventive medicine. In a word, human sympathy, hot fomentations and salicylates do not solve the problem. What is needed is differential diagnosis and social apprehension. Is the lumbago due to changes in or strains of the lumbar muscles, or is it spondylitis, or arthritis of the sacro-iliac joint, or is it renal disease, malignant disease or colitis? All this will occur to the mind of the practitioner, for in this he has been trained and, if well trained, he will as best he may set about the usual tests. But what about incapacity? What *is* incapacity? and what of prognosis and prevention, and how can medical treatment be wisely related to the patient's home and circumstances? And what is the relation between lumbago and platelaying on the railway? Are platelayers and labourers and bricklayers addicted to this malady? and, if so, what can be done for them—at work and at home? The doctor is disappointed to find he has been taught very little about these crucial questions. The next case is a domestic servant suffering from *anæmia*. She asks the same four questions, though in different terms, and the doctor must differentiate between half a dozen forms of anæmia of which he heard in hospital many times, but really studied in but few cases. The prognosis of chlorosis is good and of pernicious and aplastic anæmia is bad. In any case the disease calls for infinite care in diagnosis and treatment, and questions of incapacity and prevention may raise difficult and uncertain issues. Again, bronchitis and alimentary disorder are protean in kind and severity, and they bring with them into the doctor's surgery a whole retinue of social and domestic as well as medical problems. To these two groups of disease together (excluding pneumonia and pulmonary tubercle) were attributed 68,000 deaths in England and Wales in 1921, and they bring not less than 2,000,000 patients to insurance doctors every year.

90. Medical Education must seek to meet the actual situation and not some imagined situation. It must be carried out in adequately equipped and staffed colleges and hospitals, thoroughly and scientifically, with all the resources and facilities which advancing knowledge can provide. But its actual point must be what the opticians call *the principal focus*. The hospital and the Medical School naturally tend to specialism, good for the patient, bad for the student. He should be taught the science and art of his calling *as they are applicable to the work he will have to do*. From a study of the end-results of disease he must learn of all disease, its initiation, its process and its ending: from the use of implements and apparatus of precision he must learn to use his own senses and apply such means as are available to him; his education by experts and in a hospital ward is to equip him to learn to do without either, to require neither except as his last resource.

I.

The Beginnings of Disease.

91. " The most urgent problems of medical education to-day," said Professor Welch in 1912, " relate to the teaching of Clinical subjects." If we are to retain and strengthen sound Clinical Education in England there are four general principles which must be borne in mind as the basis of our clinical teaching. First, the student must study *the beginnings of disease.* In 1908, in an official Report to the Board of Education on the health of school children, I drew attention to the fact that one of the most potent causes of social inefficiency is our neglect to deal with the beginnings of disease, and it was claimed that the School Medical Service ought to be able to measure the magnitude and character of the physical disabilities of the nation, give a wider meaning to the whole business of medical treatment, and establish a relationship between physical and mental development. More than a dozen Official Reports set out the findings in this Inquiry and indicate the progress of the enterprise. Two million children are inspected every year, and all children, healthy or sick, are now under medical supervision in school or at school clinics. Similarly, the Public Health Service has been concerned in dealing with early cases of infectious disease, infancy and child welfare, and with the establishment of Tuberculosis and Venereal Disease clinics for dealing with cases of these diseases. Under the National Health Insurance Act, 13,000,000 persons are entitled to medical advice *when they begin to ail.* In the Medical Schools, too, there has been immense development in the use of Out-patient Departments and children's clinics at hospitals, and there has been a wide movement throughout the profession in favour of the study of disease in its earliest stages. This is all to the good and promises well for the future. *But the student must be brought into it.* The advance of pathology has emphasized in his mind the gross tissue changes and the importance of the autopsy ; the progress of surgery has taught him the immense possibilities of its craft for dealing with advanced conditions of disease ; his life and training in the hospital ward have shown him the end-results of ill-health. That is the omega ; it is the alpha, the beginning, which is urgently calling for attention. The student must learn how disease begins, and why, and what are its first signs and symptoms. It is true he will be wise to study gross conditions and end-results in order to perceive the ultimate processes and issues, but only that he may be quicker and more skilful to discern their beginnings. Thus he will pass in his course from morbid anatomy to morbid physiology, from structure and its abnormalities to function and its irregularities, from signs to symptoms, from a consideration of end-results to beginnings. He must seek a fuller knowledge of the slight deviations from health and the habits or circumstances of the patient which lead to them, of how the patient's life history,

as well as his "tissue texture", concerns or predisposes to degenerative processes. For this will be the general practitioner's main business, and he will acquire experience of it by the careful study of out-patients, of dispensary patients, of children and of the functions of the normal body.

II.

Preparatory Training in Clinical Methods: The Clinical Habit.

92. The second principle is the training of the student in clinical methods before he enters the ward. This obviously necessary course has been followed in the best Schools in one form or another for generations, but now the General Medical Council has recommended its universal adoption. It advises in all Schools the allocation within the curriculum of a period, preparatory to hospital practice, to be devoted to the study of physical diagnosis and training in clinical methods of observation and description. It is suggested that a term, or a portion of a term, should be set aside for preparatory study in the methods of case-taking—the recognition, interpretation, and statement of clinical evidence. A course of study conducted partly in the School of Medicine and partly in the Hospital is proposed, having for its object the co-ordination, by the employment of clinical methods on the living subject, of the anatomical and physiological studies of the earlier years with those of the abnormal manifestations to which the student's attention will be specially directed later. It will form a useful preface to ward work. If taken at the end of the second year, or in the first term of the third, its commencement will coincide with the beginning of the course of study in General Pathology; it will thus facilitate the passage of the student into the new field of work which he is about to enter, and enable the entrant to make full use of his new opportunities without loss of time. The Scottish Branch of the General Medical Council made the following suggestions by way of amplification of the recommendation of the Council:—

(*a*) The fundamental basis of the teaching of clinical medicine is the instruction of the student in the interpretation of physical signs (heart sounds, lung sounds, morbid products in sputum, urine, fæces, etc.); and of subjective symptoms (pain, reflexes, etc.).

(*b*) As clinical signs and symptoms are merely the evidence of disordered anatomy and physiology, *i.e.*, of pathology, they must be interpreted in terms of their deviation from the normal.

(*c*) It is therefore suggested that if the student were to study concurrently the normal anatomy, the physiology, the clinical manifestations, and the morbid anatomy of a given organ or system, he would acquire a clearer conception of the changes produced by disease than he does when he studies the normal and the abnormal separately and at different periods of his course.

(*d*) This could be effected by devoting a *whole term*, say, at the beginning of the third year, to a co-ordinated course introductory

to the study of clinical medicine. Demonstrations on the normal anatomy of, *e.g.*, the heart, would be followed by demonstrations on its physiology. The Clinical Tutors would then teach the students to hear the *normal* heart sounds. Abnormal heart sounds would then be studied in the wards or out-patient departments. The lesions which produce these sounds would then be demonstrated by the Pathologist. And so on with other organs—lungs, kidneys, stomach, nervous system, etc.

(*e*) After such a course the student would be in a position to benefit by an introductory course of lectures on medicine, and to begin his work in the wards as a Clinical Clerk.

(*f*) It will be noted that such a course is more than an introduction to clinical *medicine*; it covers much that applies to surgery and midwifery and to the special subjects.*

93. It is clear that this preparatory class is the bridge between the intermediate and the clinical subjects. But it is more than that. Its purpose is that the student may contract *the clinical habit*. This habit consists of :—

(i) The medical and surgical application of Anatomy, Physiology and Pathology.

(ii) The methods of the clinical examination of the living body normal and abnormal, and the signs of disease.

(iii) The elucidation of subjective symptoms of disease, their differentiation and association.

(iv) The chief laboratory tests and their place as ancillary and auxiliary to the examination of signs and symptoms. Each system is to be taken in turn—circulatory, respiratory, alimentary, urinary, nervous, cutaneous, endocrine and special senses.

(v) The keeping of records and case-taking.

94. The Scottish Branch suggests that the contents of such a preparatory physical signs course might well be disposed as follows :—

I.—CIRCULATORY SYSTEM.

Applied Anatomy.—Demonstrations on cadaver; surface anatomy on living model; normal X-ray appearances.

Applied Physiology.—Demonstrations in Physiological Department; physical examination of *normal* hearts.

Clinical.—Case-taking of Cardiac Case; examination of patients with cardiac lesions; abnormal X-ray appearances.

Applied Pathology.—Demonstrations of cardiac lesions in the P.M. Room and Pathological Department.

Side-Room Work.—(1) Examination of blood; (2) pulse tracings; (3) blood pressure, etc.

II.—RESPIRATORY SYSTEM.

Applied Anatomy.—Demonstrations on cadaver; surface anatomy on living model; normal X-ray appearances.

Applied Physiology.—Demonstrations in Physiological Laboratory; physical examination of *normal* chests.

* Minutes of General Medical Council, 1922, vol. lix, p. 236.

Clinical.—Case-taking of Chest Case; examination of patients with pulmonary lesions; abnormal X-ray appearances.
Applied Pathology.—Demonstrations of pulmonary lesions in the P.M. Room and Pathological Department.
Side-Room Work.—Examination of sputum; examination of pleuritic fluid.

III.—DIGESTIVE SYSTEM.

Applied Anatomy.—Demonstrations on cadaver; surface anatomy on living model; normal X-ray appearances.
Applied Physiology.—Demonstrations in Physiological Laboratory; gastric digestion; intestinal digestion; secretions of liver and pancreas; examination of stomach contents, *normal*; bio-chemical methods.
Clinical.—Case-taking of Abdominal Cases; test meals; abnormal X-ray appearances; teeth conditions; examination of abdomen.
Applied Pathology.—Post-mortem examinations; demonstrations of lesions of abdominal organs in Pathological Department.
Side-Room Work.—Examination of stomach contents, *abnormal*; Examination of fæces; examination of ascitic fluid.

IV.—URINARY SYSTEM.

Applied Anatomy.—Demonstration on cadaver and dissections; surface anatomy on living model.
Applied Physiology.—Demonstrations in Physiological Laboratory; examination of normal urine by laboratory methods; bio-chemical methods.
Clinical.—Case-taking of Urinary Case. Clinical examination of kidney:
Cystological examination, Catheterization of ureters } Surgeon.
X-ray appearances.
Applied Pathology.—Demonstrations at Post-mortems and in Pathological Department.
Side-Room Work.—Examination of Urine.—Chemical, microscopic, bio-chemical.

V.—NERVOUS SYSTEM.

Applied Anatomy.—Demonstrations on gross anatomy of brain and cord; surface anatomy; cerebral localization, spinal localization.
Applied Physiology.—Demonstrations in Physiological Laboratory.
Clinical.—Case-taking of a Nervous Case; Clinical examination:—
Reflexes; sensation; motion; gaits, etc.
X-ray appearances; use of ophthalmoscope.
Applied Pathology.—Demonstrations of lesions of central nervous system.
Side-Room Work.—Examination of cerebro-spinal fluid.

VI.—OTHER SYSTEMS.

(1) Endocrine System.
(2) Eye.
(3) Ear, Nose and Throat.
(4) Dermatology.

Elementary instruction only in so far as they apply to the recognition of physical signs and morbid appearances.*

95. Some such course has been in vogue for many years in the best clinical schools in this country. There lie before me the synopses of the preparatory courses in several Universities—London, Edinburgh, Leeds and others. Here is one from St. Thomas's Hospital as representing London practice. It is

* Minutes of General Medical Council, 1922, vol. lix, pp. 241–243.

described as a course of study for out-patient dressers, and is one of three preparatory tutorials covering medicine, surgery and pathology. The student is first taught the principles underlying surgical technique, the paths of infection, methods of sterilization, and types of dressings, illustrated by inflammation and the healing of wounds, by burns and hæmorrhage. Then the different systems are taken, genito-urinary, digestive, locomotor, etc., traumatisms, minor operations, surgical anatomy. The whole is extremely practical, and deals with the surgical examination of the patient, methods and instruments. A similar set of twenty tutorials concerns the clinical methods of Medicine. Both are models of comprehensiveness, combined with simplicity and practical value. At Edinburgh and at Oxford a practical examination in clinical methods forms part of the Final Examination and provides an example which might well be followed elsewhere. Its scope includes urine testing, the examination of exudations, stomach contents and cerebro-spinal fluid, blood staining and counting, as well as the use of ophthalmoscope and laryngoscope.

III.

Content and Direction of Clinical Work.

96. A third principle which lies at the basis of the sound clinical instruction of a practitioner is a proper content of teaching and its right direction. It is obvious that the *content* must be clinical study, but it must be so designed as to provide the application to it of the intermediate subjects—anatomy, physiology, pathology, pharmacology—nay, we must go further back and add chemistry and physics; and the right *direction* implies that the student is competent to deal not with hospital cases of disease so much as with ordinary patients, with sick men and women and children, in their everyday surroundings and amid the limitations and disabilities of their environment. Let us consider what these things mean.

97. Bio-chemistry and bio-physics, applied anatomy and physiology must now be placed in the forefront of Clinical Study, and the General Medical Council has placed them there in the new curriculum. Continuation throughout the later years of the curriculum of the study of the basal sciences in their practical application to Medicine, Surgery and Midwifery is intended to correct a serious error in our educational system. Under the former arrangements of the curriculum the student was tempted to discontinue the study of each subject in the earlier groups immediately on his completion of the prescribed professional examination. Cramming for an examination, frequently necessitated by the extent of the demands made upon the student, led to an apparent familiarity with the subject-matter which was deceptive and evanescent. Insufficient co-ordination of teaching was apt to aggravate the evil, and the student was liable to pass

through the curriculum from stage to stage separated by examinational partitions, carrying with him from one to another little that could be of practical value in assisting him to realize the supreme object of his labours. It is now proposed that adequate arrangements should be made for *the continuation of the study* of the basic sciences—Physics, Chemistry, Biology, Anatomy, Physiology, Pathology and Pharmacology, in their applications to the practice of Medicine, Surgery and Midwifery, during the last three years of the curriculum, and for the testing of the students' qualifications in respect of the practical applications of the earlier subjects in the final examination. There are two ways in which this continued education in the intermediate subjects can be secured: either the student returns during the last three clinical years to the anatomists and physiologists for continuation courses or they come into the hospital. Some Schools adopt the one method, some the other, and both methods are being more practised where the "Clinical Unit" principle is in vogue than elsewhere.

98. In giving the right direction to clinical study there still remains much to do. In a true sense we must return to the advantages of the apprenticeship system, though the factors which have to be considered have changed since the eighteenth century. The student must learn to treat *persons* rather than diseases, he must know their setting in home and workshop, he must study the effect of external conditions upon disease, he must appreciate the social and economic forces and circumstances surrounding them, and he must use all the facilities available in the treatment of his patient. The periods of work, of sleep, of exercise; the dietary and regimen; the habits and recreation; the strain and stress of life; water supply, housing, sanitation; dispensaries, clinics, hospitals, the poor law, the public health service—all the complex environment and circumstances must be understood and used for preventive and curative purposes. Was it in the wards at Guy's Hospital that Keats learned the wisdom of the lines in *Hyperion*?—

> "For to bear all naked truths,
> And to envisage circumstance, all calm,
> That is the top of sovereignty . . .
> Be thou therefore in the van
> Of circumstance."

99. Different attempts have been made to assist in correlating social circumstance and medical education, of which two illustrations may be named. At Toronto University the student preparing for general practice is officially advised to utilize a substantial proportion of his optional hours of study in acquiring some knowledge of the leading principles of ethics and economics, including sociology, and "optional" courses are arranged accordingly; in other transatlantic schools the teaching hospital possesses a social service scheme. In England another sort of

movement is steadily gaining strength, namely, the appointment of hospital almoners, among whose duties shall be the medico-social correlation for patients attending the hospital and their effective " following-up " after discharge. " They are the human and social complement," says Dr. Fairbairn, of St. Thomas's Hospital, " to the medical and surgical care of patients in the efforts of the hospital to return them to efficiency and usefulness. The social side of the ' follow up ' is essential not only to learn the results of treatment, but for the treatment of the individual and not merely the disease from which he is suffering."*

IV.

A Minimum Standard of Competency.

100. A fourth general principle lying at the basis of a practitioner's education should be that every student should reach a minimum standard of competency in what may be regarded as essentials. The organization of the Medical School and the special attention of the student should be directed to a high degree of efficiency in fundamental matters rather than to a wider and less thorough grasp of the subject as a whole—to be, in fact intensive rather than extensive. An example will illustrate this point. Having in view the safety and confidence of the public, what is the irreducible minimum of Surgery which every student should possess at qualification ? I have discussed this question with representative medical men in England and America, and I suggest for consideration that the surgical minimum may be, approximately, the following :—

(1) An understanding of the Principles of Surgery and their application. The physiological attitude.

(2) Early Surgical Diagnosis and ultimate Prognosis ; what can be accomplished by Surgery and an understanding of its risks and prognosis ; what it can and cannot do.

(3) Surgical technique, asepsis ; indication of the need for operation, pre-operative preparation, the appreciation of the after-results and possibilities ; and post-operative supervision and treatment.

(4) Routine Surgery, *e.g.*, wound closure and dressing, cellulitis, whitlow, abscess, fractures and dislocations,

* I have recently received various criticisms from general practitioners who explain that their medical education omitted to furnish them with practical knowledge on such matters as the social side of general practice. Among the neglected themes named are the following :—(*a*) the organization of a general practice and its bookkeeping ; (*b*) the law in relation to medical men ; (*c*) giving medical evidence in courts of justice ; (*d*) the Insurance Act ; (*e*) certification under statutes ; (*f*) industrial fatigue and conditions predisposing to occupational disease ; (*g*) the social and hygienic conditions of the home affecting illness ; (*h*) the relation of the practitioner to the medical officer of health and to the Poor Law ; (*i*) injury and compensation claims ; (*j*) medical ethics and etiquette, duties to fellow practitioners ; (*k*) domestic hygiene.

modern treatment of gonorrhœa and syphilis, hydrocele, and complete practical "first aid" and use of improvised appliances.

(5) Emergency Surgery, *e.g.*, arrest of all forms of external hæmorrhage, tracheotomy, drainage of empyema, retention of urine (suprapubic drainage), emergency amputation; the prophylaxis, recognition and treatment of shock; diagnosis of "acute surgical abdomen" (strangulated hernia, appendicitis, obstruction, peritonitis), of osteo-myelitis and of "cerebral compression" (and the first-aid treatment, when necessary).

(6) The skilled use of the catheter.

(7) The immediate treatment of poisoning, burns and fits.

(8) The administration of anæsthetics, local and general.

(9) Methods of post-mortem examination.

(10) The practice of vaccination, inoculation and hypodermic injections. Prophylactic treatment of Tetanus.

(11) Proper collection of pathological specimens for laboratory examination.

101. By means of some such standard as this the teacher, the student and the examiner may keep themselves concentrated on the real requirements of the average medical practitioner. Upon this firm foundation it is easy to build, as opportunity, necessity or predilection indicates. The medical man who is in the effectual possession of such a minimum of surgical knowledge can, with intelligence, meet successfully all ordinary emergencies; and he is also likely to make a good obstetrician. At present students spend time watching many complex surgical operations and procedures which they will never have to practise; they attempt to learn, merely for examination purposes, much that is of little value, yet fail completely to master the simpler knowledge and manipulations which may fall to their lot frequently.

"So study evermore is overshot:
While it doth study to have what it would
It doth forget to do the thing it should,
And when it hath the thing it hunteth most,
'Tis won as towns with fire, so won, so lost."*

The British Course of Clinical Study.

102. We are now in a position to set out *seriatim* the constituent parts of the systematic Clinical Course which has been adopted in England, and to which the last three years of the curriculum are to be devoted. The key of the method is to bring the student directly into contact with the patient and leave him there. After the preparatory clinical course to which reference has been made, he may commence his attendance at

* *Love's Labour's Lost*, Act. i.

Hospital. Some authorities recommend that he should start in the Out-patient Department, but there is much to be said for commencing in the Wards, six months' surgical "dressing" and six months' medical "clerking," followed by training in the out-patient departments. The new regulations (1922) of the General Medical Council have summarized the medical and surgical clinical teaching of the best Schools as the Council's recommendation for all Schools, as follows :—

(i) Attendance on general In-patient and Out-patient Medical and Surgical practice, including clinical lectures, during seven terms in the last three (clinical) years of the curriculum.

(ii) A course of systematic instruction in the principles and practice of Medicine and a similar course in Surgery.

(iii) A medical clinical clerkship for six months, and a surgical dressership for six months (not concurrent) ; at least three months of each of these appointments being spent in the ward.

(iv) Instruction in Applied Anatomy and Physiology and in Clinical Pathology. Each student to receive practical instruction in the conduct of autopsies and to have acted as post-mortem clerk in at least ten cases.

(v) Instruction in Medical and Physical Therapeutics and in treatment by vaccines and sera. Instruction in surgical methods, in mechano-therapeutics, in radiology and in operative surgery.

(vi) Instruction in the administration of Anæsthetics, each student himself to have administered anæsthetics on at least ten occasions.

(vii) Instruction in Special subjects, as follows :—

(*a*) In Medicine : Children's Diseases, Acute Infectious Diseases (Fevers), Tuberculosis, Mental Diseases, Diseases of the Skin, and the theory and practice of vaccination.

(*b*) In Surgery : Diseases of the Eye (refraction and the use of the ophthalmoscope) and the Ear, Nose and Throat (use of Otoscope, Laryngoscope and Rhinoscope), Venereal Diseases and Orthopædics.*

The British Method of Clinical Study.

103. How can we make provision for the effective carrying out of this new curriculum ? Our medical colleagues in America or France or Germany would, no doubt, suggest different ways of solving the problem. But what shall we do ? Is a revolution necessary in our methods ? I think not. Some reorganization

* *See* Appendix, p. 167. The Conjoint Examination Board in England have revised their Regulations (1923) in accordance with the recommendations of the General Medical Council, and the prescribed course of study will be found in the Appendix B, p. 170.

or expansion will be necessary, but a study of the new regulations now being drafted or prescribed by the teaching or licensing bodies, in order to comply with the recommendations of the General Medical Council, indicates that the Medical Schools of Great Britain can meet the situation by a natural development of the methods hitherto followed. " We are doing it already," or " We can easily provide for it," are the answers one receives, and the reason for this is obvious. For many years past this kind of clinical instruction has been provided in this country by means of a hospital scheme of teaching which has included : (*a*) a system by which students serve as clerks and dressers in the wards, special departments, laboratories, out-patient department and post-mortem rooms (case-taking, clinical instruction, therapeutics, laboratory), combined with tutorial work, in clinical methods and physical diagnosis ; (*b*) clinical " bed-side " teaching in the ward ; (*c*) clinical lecture-demonstrations outside the ward ; (*d*) clinical teaching in the out-patient department ; (*e*) clinical work in various special hospitals (which should be affiliated with the School), including mental and fever hospitals, skin hospitals, children's hospitals ; in tuberculosis, venereal disease, ophthalmology, diseases of ear, nose and throat, diseases of infancy, orthopædics, and in operative surgery ; (*f*) junior house appointments and clinical pupilships or assistantships of various degrees, in special as well as general hospitals. Each of these six methods of obtaining an adequate training in clinical medicine has its own importance. Some University and hospital authorities lay emphasis upon one, some upon another. They are all widely practised in English Medical Schools and form constituent parts of the English system. They now call for correlation, consolidation and intensive organization.

104. The question which arises at once is this : Can the new curriculum be reasonably undertaken within the five years prescribed ? It must be admitted that it is not a light burden, and indeed in certain clinical directions it makes an increased demand. At first sight, its wider range appears formidable to those familiar with the claims made upon a former generation of students, but compensation is provided by a definite unloading of preliminary science from the medical years and by substantial relief in systematic lectures. Speaking generally, of the five medical years three are now to be devoted to clinical study. Whilst additions to the curriculum are few, the rearrangement of subjects is relatively substantial, and on the whole the reorganization makes for simplicity and unity.

105. There will be some development in clinical demonstration. It is erroneous to suppose that the clinical lecture-demonstration is a feature peculiar to German Medicine. It has been elaborated and relied upon there ; but it is essentially British in origin and of universal use, and in this country it forms a part of a system, it is not the system itself. These lectures should be given regularly by the Professor and his associates, and should be fully prepared,

differentiated to the needs of the student, and abundantly illustrated. Such lectures, which will in some cases take the place of the older form of systematic discourse, should be supplementary to, and not in substitution of, clinical teaching of clerks and dressers at the bedside, and in the small informal clinic. Such preparatory class teaching should include instruction in methods of clerking and dressing, clinical examination, investigation and treatment, physical signs and symptoms of disease, clinical pathology (laboratory testing of urine, blood, sputum, etc.), special forms of therapeutics, the following-up of cases by after-care or at the autopsy. In the surgical and gynæcological departments such instruction will include bandaging, dressing, antiseptic methods and minor surgery. In the out-patient or receiving room it will take the form of the physical diagnosis and symptoms of early disease.* Special attention, too, will be paid to rare and unusual maladies, for their study has high educational value. In a letter to John Vlackveld, of Haarlem, written in 1657, we have a wise admonition upon this point from the great William Harvey, the founder of English physiology. " Nature is nowhere accustomed more openly to display her secret mysteries," he says, " than in cases where she shows traces of her workings apart from the beaten track ; nor is there any better way to advance the proper practice of medicine than to give our minds to the discovery of the usual laws of nature by the careful investigation of cases of rarer forms of disease."

106. It is the pursuance of this system of clinical study which has made English medical education the most practical in the world. The reorganization, or rather the regularization, of it now recommended by the General Medical Council cannot fail to fortify it and make it more nearly universal. In order that it should be effective care must be taken in each Medical School to ensure (i) that proper provision is made for the student in the hospital ; (ii) that the time allocated for the student to be at hospital is not encroached upon by non-clinical teachers, or by the study of special subjects, even though they be clinical ; (iii) that attendances at, and kind of work done by the student in, hospital are recorded ; (iv) that the " systematic " instruction in Medicine and Surgery (which should be reduced and given by teachers actively engaged in clinical work) is concurrent, closely associated and in harmony with the clinical teaching in the same subject in the ward ; and (v) that all the members of the clinical staff have a direct and responsible share in the clinical teaching, which should be carefully organized from an educational point of view, without great overlapping or significant omissions. My notes show that each of these important conditions has been infringed in particular medical schools.

* An account of the daily working of such bedside clinics appeared in the British Medical Journal, 1914, i, pp. 10–16 (Sir William Osler, Bart., F.R.S.).

VIII.

THE CHIEF NEEDS OF CLINICAL STUDY.

107. Such being the clinical problem and the English method of solving it, we may turn to consider briefly the chief needs of clinical study, and, in a subsequent section, their supply. The chief needs are three: first, the inspiration of all clinical study by science; secondly, an increasing opportunity for the student before qualification to undertake responsible practice under supervision; and thirdly, the permeation of clinical work with the preventive spirit.

(*i*) *Scientific Clinical Study.*

108. The history of clinical study in England is full of significance and encouragement. After a sound preparatory training, either in apprenticeship or in the medical school, the student has been introduced to the bedside, to the patient and to the immediate issues. He has become during his pupilage a *praktikant*. In the course of time this commonsense procedure has brought with it a certain measure of routine and habit which has led to some failure to establish his practice (which has been static) upon his science (which has been progressive). There has been, in some degree, an unconscious divorce between the two ideals and between the two groups of teachers; a false antithesis has become current between the scientific man and the practical man. In the old days when the anatomist was also surgeon, and the physiologist also physician, such divorce was less likely to happen. But now, owing to various circumstances, the danger must be recognized and avoided. It is noticeable that some of the clinical teaching has become utilitarian, didactic and matter-of-fact, insufficiently penetrating, investigational and explanatory, and thus it has failed to awaken the student's mental endeavour. Moreover, it has been all too frequently standardized to the lowest mentality of the student group rather than to the highest, and the inequality of student equipment has proved an embarrassment to the teacher. But there can be no doubt of the answer to this issue. The true teacher is not only instructor but leader, whose duty it is to lead, and the students must bestir themselves, and *climb up after him*. In the eighth century a great teacher recognized this danger, and established his remedy. When Alcuin of York became tutor to the children of Charlemagne and their courtier friends, and Minister of Education to his sovereign, he was faced with a similar problem. There was learning on the one hand and the conditions of Western Europe on the other, apparently incompatible. And he tells us how he solved the problem. He cultivated his students, he taught them that comprehension rather than

repetition was the foundation of memory, and he interpreted the learning of the ancient world in the language and conditions of the new Western Empire. It is an impressive lesson in educational method, which served to change Europe, and has yet guidance for us. For it is such *cultivation, comprehension* and *re-interpretation* of which we stand in need to-day. Nearly a century has passed since Latham urged this same lesson on his students in the wards of St. Bartholomew's. Inductive methods were his sheet-anchor. This is what he says :—

> " If ever the desire to view the beauties and sublimities of nature has led you to ascend some lofty eminence, you have probably taken with you one more familiar with the scene than yourselves as a guide ; but you still trusted to your own eyes and your own feelings to fill you with the delight of the prospect, and tell you what to admire and wonder at ; and you have required no more from the guide than to point with his finger and say : ' See here, and see there.' So, in entering this place, even this vast hospital, where there is many a significant, many a wonderful thing, you shall take me along with you and I will be your guide. But it is by your own eyes, and your own minds, and (may I add) by your own hearts, that you must observe and learn and profit. I can only point to the object and have little more to say, than ' see here and see there.' "*

And the little more he said was that he told his students that, having recognized a fact or a symptom, they were to exercise " a process of reasoning, and reasoning is more difficult than seeing and touching." " It has been my chief care," he adds, " to put everything about the sick in the point of view most favourable for being well observed ; that *circumstances* might become didactic ; that they might give their own intimations, and speak to you themselves in their own tongues ; and that thus you might accept knowledge neither from me nor from anyone, but gather it fresh from the reality. Such I consider is the true method of clinical instruction. . . Clinical instruction is not merely occupied in directing observation to facts, but it assists the mind *in estimating their value.*"† Now here, in these golden words, we have the clinical method of university standard—observation, the collection and checking of facts by investigation, deduction, the process of reasoning, estimation of values. There must be for each student intensive study, observation and comprehension followed by rational deduction. Harvey's rule still holds the field in clinical work : first, " the averments of our senses," and, secondly, reasoning on that evidence. If our clinical study is imbued by the scientific method and fortified by a living stream of new truths, as our physiology, pathology and pharmacology have been revitalized, nothing can withstand it. But if it becomes routine, only utilitarian, static, dogmatic, nothing can save it, and with its loss would vanish much of the purpose and genius of English medicine.

109. How shall we apply these principles ? Clinical teaching tends in every generation to become insufficiently scientific in

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* Lectures on Clinical Medicine, 1836, p. 58.

† *Ibid.*, pp. 45 and 55.

basis and application. There is too little chemistry, physics and physiology in it, a lack of the use of science at the bedside ; the examination of the patient has a way of becoming perfunctory and superficial, especially in the out-patient department, quick rather than deep, " spotting " cases rather than comprehending them, obtaining very incomplete data from symptoms. But there is something much more for student and teacher alike, than merely giving a name to a condition. *It must be explored by science*, system by system, symptom by symptom, if it is to be of educational value. The differentiation, exact observation, and association of symptoms—the chemistry and physiology, the pathology and psychology of the case—sputum, blood, urine, possibly the gastric and intestinal content—the complement fixation, or the Wassermann, or the X-ray as auxiliary aids—every true clinical finding, every reliable laboratory datum must be brought into the reckoning. No stone must be left unturned, for the task is not the diagnosis of the case, but the *understanding* of it, the unfolding and exposition of it, the explanation of it—that this group of students may from this unlikely material apprehend for the rest of their lives the method and purpose of the Science of Medicine. They may not, it is true, always be able to practise their profession with this degree of completeness and penetration, but they will *by this method of education* have learned the scientific approach.

110. How shall the student acquire this method of approach ? First, by observation of signs and symptoms, with his own eyes and ears and hands and understanding ; then by use of instruments of precision ; then by correctly recording his results ; then by experience. He may be able to work in a " team " afterwards, but first he must fulfil the whole task himself.* He must learn that observation, the use of laboratory methods or other instruments of precision, and accurate recording should *all be used together*, not supplanting but supplementing each other. There should be no antagonism between them, they are mutually complementary. " Instruments of precision," says Professor Wardrop Griffith, of Leeds," should be treated as valuable servants and not accepted as masters ; they should be used to confirm or compute our unaided conclusions, which will become more and more reliable under their controlling discipline." This view is confirmed by Sir Clifford Allbutt, who has recently reminded us that the gains of simple acute observation are more rather than less since the common use of instruments, and he adds, " in great part we see what we have trained ourselves to see, and lose sight of what we habitually neglect. The ear at the stethoscope

* The " team " method has, of course, its obvious value in investigation, though it may easily be overdone in practice. The brilliant results of certain clinics in the application of this method and the enormous advance of collateral science have tended to give it emphasis. It has, in any case, the advantage of demonstrating the many-sidedness of method of diagnosis.

is of little use if a trained mind is not behind the ear. Instruments by which knowledge is made more accurate and quantitative make observers more apt to perceive. Those facts are most valuable which are recorded by scientific minds."*

111. The student must, therefore, learn to use both methods together, and to make the *records* of his patient accurate, adequate and continuous. Such records are valuable to the patient, essential for research and of use in training the student in thoroughness. Unfortunately, in this country many hospital records are incomplete, discontinuous, unavailable when needed, and insufficiently used for scientific purposes.

112. If the student is to have a scientific apprehension of clinical study a responsibility also rests on *the teacher*. To be effective he must train himself not only in medical skill *but in educational method*. How many medical professors have given serious study to the science and method of Education? Yet if he be a true educator, the teacher can lay, deep and broad, the foundations of clinical habit, he can maintain the balance between clinical and laboratory investigation, above all he can be the practitioner and demonstrator of scientific practice—co-operating, with all his colleagues, in bringing every resource to the focal point. Clinical teachers have been in the past too often isolated, not competent educationalists, not fully availing themselves of the splendid gifts which collateral science is eager to offer, not organizing and distributing their work and the subjects they teach in such a way as most to assist the student, not always ready to " give and take " in regard to beds, patients or appointments, so as to conduce to the maintenance of a university standard of clinical study. The proprietary spirit is not yet dead in England, and more than once it has seriously delayed much needed medical reform in our Universities. " I am afraid," writes a representative correspondent from the provinces, " that this is the one thing which is going to ruin our University." After all, as Sir James Paget pointed out long ago, the best and greatest thing which the clinical teacher can give his student is himself, that they may have the embodiment of science before them as their model. " The most potent factor in all teaching is the personal influence of the wise and experienced teacher."

(*ii*) *Clinical Experience under Supervision.*

113. The second chief clinical need of English Medicine is a fuller opportunity for the student before taking his degree to obtain practice and experience under supervision. Some changes have been taking place which have accentuated this need. The number of men and women entering upon the Study of Medicine has increased out of all proportion to the number of beds hitherto

* *Lancet*, 1922, ii, p. 783.

available for clinical instruction in the hospitals with which the medical schools are associated. A smaller proportion of students can thus look forward to holding resident appointments in their hospitals than was formerly the case. Again, there has been a considerable re-distribution of institutional accommodation for different types of disease. Cases of tuberculosis, cancer and syphilis have been in many instances isolated in special hospitals, maternity homes have been built, the scope of poor-law accommodation has been extended, children's clinics have been established, and many special hospitals founded; and to a substantial degree this has restricted the clinical practice in the hospitals of the Medical Schools. Lastly, the advance of knowledge has rapidly added to the volume of study required of the student, bringing with it the danger of over-burdening his mind on the theoretical side.

114. In the old days the student in England obtained his practical experience partly as an apprentice with a private practitioner and partly by "walking the hospitals" in the wake of the physician; in modern times he has had the opportunity of "clerking" and "dressing," of numerous junior clinical appointments, and, after qualification, of a house surgeonship or a house physicianship. The dispensary system at Edinburgh, by which in his last three years the student undertakes medical practice under supervision, has for sixty years proved invaluable as introductory to private practice in after life. Above all, there has been the system of resident pupilship in hospital for three or four months before qualification which has obtained in Dublin and Belfast. In America the problem has been met in part by the system of internship, by which in certain universities—and in a dozen States as a condition of obtaining a medical licence to practise—provision is made that before qualification a student shall serve as an intern in hospital. Now, however, a new situation has arisen, and in the interest of effective medical education on its clinical side it must in some way be met. It would seem reasonable to seek a solution in several different ways, which are here submitted for the consideration of the Medical Schools and Hospitals concerned.

(*a*) In the first place, more use for the purposes of clinical study might well be made of many hospitals not hitherto connected with Medical Schools. It is estimated that there are in England and Wales 845* voluntary hospitals, general and special, having 44,000 beds. Many of these are, of course, unavailable for educational purposes, either as special hospitals or owing to their geographical situation, but with a substantial number a valuable association might be created, and some Medical Schools have already established such relationship. Again, in London there are thirty poor-law hospitals, with nearly 18,000 beds (excluding the isolation hospitals of the Metropolitan Asylums Board), and in the provinces, in the centres having Medical Schools, there are

* Of this number, less than a hundred hospitals are at present used for undergraduate education.

twenty-five more such poor-law hospitals, with 17,000 beds. In London, Glasgow, Manchester, Bristol, Birmingham and elsewhere, poor-law hospital accommodation is now for the first time being used for educational purposes, and on the whole with excellent results to both patient and student. With careful organization it would seem practicable greatly to extend such clinical facilities, residential and non-residential.

(*b*) A second means for increasing out-patient study could be obtained by making arrangements for students to visit many of the new clinics which have recently been established by the Local Authorities. Under the Ministry of Health there now exist 200 sanatoria (13,000 beds) and 440 dispensaries for tuberculosis, 190 clinics for venereal disease and 1,900 infant welfare centres; under the Ministry of Pensions there are ninety special institutions for the treatment of war disabilities, having a total bed accommodation of 15,000, and twenty-five of these hospitals are in centres having Medical Schools; under the Board of Education there are 1,000 school clinics, a number of which also are near to Medical Schools. Lastly, there are the General Dispensaries, some of which have been, and some of which could be, associated with Medical Schools. Here, as in the hospitals, there lie ready to hand immense and hitherto unused opportunities for clinical study. Great practical educational use is made of institutions of this kind in America, and there seems no reason why similar arrangements should not obtain in this country.

(*c*) Lastly, it is suggested that the resident pupil system of Belfast and of Dublin might, with suitable modification, be adopted elsewhere. The arrangement is that students in their fourth or fifth years are eligible for internships; nine or ten are accommodated, four times a year, for three months, at a nominal charge for subsistence.

Surgical Pupils (*Resident*) have six weeks in the Wards, preparing patients for operations, dressing the wounds, assisting at operations, giving anæsthetics under competent supervision, passing catheters, examining urines, blood and blood pressure, and looking after fractures, simple and compound, in association with the House Surgeons, and occasionally dressing in Out-patient Department.

Medical Pupils (*Resident*) have six weeks in the Wards taking notes, examining urines, blood, sputa, blood pressures; helping with cardiograph, etc., test meals for Medical X-Ray Examinations, the elementary or provisional bio-chemical tests in the small Ward laboratories; leaving the more elaborate examinations of organic fluids, Wassermann's, Widal's, etc., for the large pathological laboratory under the pathologist. They also assist in the Ophthalmic and Gynæcological Departments in rotation, and occasionally in the Out-patient Department.

115. In both cases the resident pupil is responsible for case-taking, is in charge of patients, and works under supervision. The experience is absolutely invaluable. I have received a letter from an old Belfast student who subsequently became a successful general practitioner in a large town in England, in which he refers to the practical worth of such a course :—

" The first three months were spent in the Medical and Isolation Wards (erysipelas and septic cases), and the second three months in the Surgical

Wards. Each pupil was attached definitely to two members of the Visiting Staff and had oversight of their beds under the supervision of the House Physician or House Surgeon. Each pupil was also on duty for twenty-four hours each fourth day for dealing with such emergencies as he could handle, and with instructions to send for the House Physician or House Surgeon for any case which seemed beyond his competence or skill. This out-patient emergency work was a particularly valuable experience, as many things cropped up which were only occasionally to be seen in the out-patient clinics. Here one learned to deal with all the ordinary surgical procedures such as removal of foreign bodies from the eye, ear and nose; arrest of hæmorrhage, including the plugging of the posterior nares; putting up fractures; reducing dislocations of the limbs and lower jaw; strapping broken ribs; opening whitlows and other abscesses; extraction of teeth; and treatment of retention of urine, whether due to enlarged prostate or to stricture, both by the passing of suitable catheters and by suprapubic paracentesis. We got, too, some experience of administering anæsthetics for emergency procedures by the House Surgeon.

"We had practice in the avulsion of nails; division of the fraenum linguae; the reduction of paraphimosis and hernia; the tapping of hydroceles; and the replacing of dislocated cartilages in the knee.

"In the Medical Wards we had much experience in testing urines; in administering enemas; and in tapping the abdominal and pleural cavities. We examined emergency admissions to the wards and dispensed emergency medicines at night. We had frequent opportunities of giving hypodermic injections; of supervising the giving of hot-air baths and cold packs; of dry cupping; of blistering; of electrical treatment of nerve lesions; and of the use of Southey's Tubes and setons. We learned, too, how to put on the straight-jacket in cases of delirium tremens, and had experience in treating cases of poisoning and of venereal diseases.

"We had opportunities of dealing with fractures and dislocations of the lower extremity; of dressing wounds of all kinds; of watching patients suffering fron post-operative shock; of passing sounds and catheters; of washing out bladders, stomachs and pleural cavities; of passing the oesophageal bougie, the stomach tube and the long rectal tube; of assisting at operations; of dealing with extravasation of urine; of strapping joints and varicose ulcers; of putting up fractures in plaster of Paris; and of skin grafting."

116. These words describe, of course, an experience of utmost value, and one which ought in a general way to be the lot of all qualified men intending to practise. With extended hospital arrangements it would seem practicable to organize somewhat similar intern work in the fifth year in all Medical Schools: (*a*) by residential or non-residential clinical posts; (*b*) by dispensary practice; or (*c*) by a system of modified apprenticeship under selected general practitioners attached to the Medical School for this purpose. Looking back over his long life Sir Henry Holland wrote, in 1872, "I went through the accustomed routine of lectures, demonstrations, clinical practice, and the less profitable teaching of books—learning at a later period, for it requires time for the lesson, that actual experience, with a sense of responsibility attached to it, is the sole school in which to make a good physician."*

117. The relationship between Clinical Study and Preventive Medicine is dealt with in a subsequent section of the present report.

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* *Recollections of Past Life*, 1872, p. 88.

IX.

UNIVERSITY CLINICS (CLINICAL UNITS).

118. The previous chapter sets out in general terms the requirements of clinical instruction in the medical curriculum. The problem now facing English Medical Schools is to express and interpret these general principles and methods through the machinery and institutions already in existence. That organization and these institutions have behind them a long and fruitful history.

119. Modern systems of medical education arose in the sixteenth century, when the study of biology was vitalized by Gesner and that of anatomy by Vesalius. Wootton and Caius were the two great English teachers who introduced the new teaching into England, and from that time these two subjects formed the principal preparation to clinical studies, themselves brought into prominence by Montana, Paracelsus, Ambroise Paré and the illustrious masters of Padua. Then in the seventeenth century came physiology under Harvey, Malpighi and Borelli, physics under Gilbert, Galileo and Newton, and medical chemistry under Helmont. Pharmacology emerged from the work of the great herbalists, and Mayerne, Glisson and Sydenham carried forward clinical study. Morbid anatomy beginning in that century became dominant in the eighteenth under the Hunters and Morgagni. These immense strides in the Science of Medicine revolutionized the whole business of medical education.

120. With the Renaissance came a new understanding of the necessity of the medical student doing something more than learning his craft by merely looking on whilst his master did the work, or assisting him in a perfunctory and casual manner. He became a student in theory and practice. Through the influence of the Greek learning on the medical universities the physician came to be more regarded as a member of the learned world. Medicine was taught as a branch of philosophy, and the older authors, Hippocrates, Galen, Avicenna and Rhazes, though not discarded, began to make way for the new learning, particularly in botany and anatomy, to be followed by physics and chemistry, then by physiology and pathology, and ultimately by clinical medicine. From the time of Boerhaave and Haller, and the famous British clinicians of the eighteenth century, clinical instruction took on a wholly new and more penetrating character.

121. The London Medical Schools had their origin, with one or two exceptions, in the informal arrangements by which the

medical staffs of certain hospitals provided some tuition at the bedside for their apprentices and pupils.* Students who had served their apprenticeship to an apothecary or practitioner "walked the hospitals" and studied anatomy at one of the anatomy schools then existing in London. John Hunter taught anatomy in the famous Windmill Street School (established by his brother William in 1770) and clinical surgery to his pupils at St. George's Hospital. Baillie taught anatomy at Windmill Street and medicine at St. George's. Hunter found that his clinical teaching had to be sacrificed to his study of anatomy. We shall remember his remark to his assistant in the dissecting room, "Well, Lynn, I must go and earn this damned guinea or I shall be sure to want it to-morrow"; and Baillie likewise found that the claims of his private practice trespassed more and more upon his teaching work in anatomy and clinical medicine, and ultimately both had to be given up. Throughout the eighteenth century this same conflict of claims everywhere disturbed medical education. At Edinburgh, at the beginning of the century, one professor taught Medicine and Botany, another Medicine and Chemistry; the second and third Monroes filled the Chair of Anatomy and Surgery; and separate Chairs had to be established in Materia Medica in 1768, in Pathology in 1831, in Chemistry in 1844, a differentiation which continued till 1921, when Materia Medica was subdivided into two professorships of Pharmacology and of Therapeutics. The differentiation of subject taught and of function fulfilled by the teacher was inevitable. From the golden age of Padua and Bologna down to the present time, for 400 years, this process of differentiation has proceeded.

122. By the end of the eighteenth century the course of medical education in London, as well as all over Europe, had been reorganized and mainly within the respective hospitals. At St. Thomas's, St. Bartholomew's, the London and Guy's Hospitals systematic lectures had been commenced. Both in London and the provinces changes and differentiation gradually took place. The clinical staff found it impossible to teach both the clinical and intermediate subjects, hence special teachers were appointed to give instruction in anatomy and physiology, as had formerly proved necessary in chemistry and physics. In due course there arose therefore a double medical staff consisting of experts in what were called the scientific subjects—expert in their subject and competent as teachers—and the clinical physicians and surgeons who were on the staff of the hospital. The former were appointed by the Medical School on their merit as teachers and were paid for their services, and the latter by the Governors of the Hospital as experienced physicians and surgeons "to treat the sick poor," and were unremunerated. It was to their professional advantage in various ways to be on the staff of

* For the advantages of the apprenticeship system as practised a century ago, see *Memoirs and Letters of Sir James Paget*, pp. 19–38.

the hospital, and they eagerly sought and waited for these honorary appointments, which were naturally enough conferred on a basis of seniority and length of service to the hospital. This arrangement proved efficacious as far as the primary function of the hospital, namely, the treatment of the patients, was concerned, and was valuable also in its day from an educational point of view. Its value was, however, restricted, as Sir James Paget has shown. But in the course of time, the claims of clinical education became more insistent and exacting, because the advance of knowledge had made the clinical subjects more scientific. The result was that effective clinical teaching made a demand which an honorary visiting physician or surgeon found he could not meet without (1) a reorganization of the clinical staff which made provision for more time and leisure to be devoted to teaching clinical subjects, and (2) the provision of the necessary equipment. "Hospitals have been built," said Sir William Osler, "by men who had no idea whatever of their scientific needs, and too often staffed by men who knew little and cared less for anything beyond their primary function," the cure of the sick and the relief of suffering.

The University Clinic.

123. It is this situation—this need for the organization of staff and the provision of equipment—which has given rise to the establishment of University Clinics, or, as they have been termed, "Clinical Units." Whatever be the terminology used, let us recognize that this further step in organization is a perfectly simple, natural and inevitable stage in the development of the teaching of Clinical Medicine and Surgery. It is not a new invention, still less is it a movement athwart the normal development of Medical Education. It is in the direct line of succession. Harvey sat at St. Bartholomew's, and though giving no formal clinical instruction to students taught the world; the Hunters and Monroes taught anatomy systematically and clinical surgery as opportunity offered; Abernethy, Addison, Stokes, Bright, Charles Bell, Astley Cooper, Syme, and the great clinicians of their age taught and practised concurrently, and they have been followed ever since by worthy successors. But one fact is both certain and universal—the claims of clinical teaching and the need for adequate equipment for such teaching have advanced in such a way, and to such a degree, as to make reorganization absolutely necessary. Such reorganization may well take different forms, but it must provide opportunity for effective teaching in the clinical as in the intermediate subjects, and it must furnish ways and means. Let it be said at once that it is not a question of the former clinical teachers being unable or unwilling—precisely the opposite is the case. It is a question of occasion, facilities and organization.

124. The component parts of a University Clinic are as follow :—

(*a*) An adequate whole-time and part-time Staff.

(*b*) The control of wards (50 to 100 beds).

(*c*) A proper and effective out-patient department.

(*d*) Ample laboratory accommodation for investigation.

(*e*) Adequate equipment for effective clinical work and teaching.

Not one of these components is new. They exist in some degree in every Medical School. What is new is their association together for specific purposes in a comprehensive self-contained clinic under a single command.

125. The educational purposes of the University Clinic are two, and they may be stated quite shortly. The first is *to provide education of University standard in the clinical subjects for all students*. Elsewhere I have set out in some detail the characteristics of such education,* which need not be repeated in these pages. It involves a mental discipline, a scientific habit, an intellectual mastery of principles, as well as professional skill and knowledge. It embodies the University spirit and reaches the University standard of learning. It implies a training in observation and the inductive method, a well-designed curriculum, an apprehension of the rationale of the science and art of Medicine as distinct from mere empiricism, *and it must be undertaken upon the confines of the unknown*. It must be thorough, exploratory, adventurous. It must seek the origin, the process, the destiny of its theme. It must win full value out of every case of disease it studies. It must give us as its final product a well-informed, well-trained, well-educated medical man, alert and alive, with a forward-looking mind, and a wide and sensible comprehension of his calling.

126. Such a scheme of education has been applied to the fundamental sciences, and must now address itself to the clinical work of medicine and surgery. In approaching this application two matters require consideration. There must be a foundation of science and there must be an integration of subject. The real reforms in American medical education were made in 1871, when the entrance requirements of the Harvard Medical School were raised to University standard and in 1893 when the Johns Hopkins Medical School at Baltimore under Billings, Welch and Osler, established a university clinic on the basis of full integration. Those two events altered the whole orientation of American medicine. We cannot in England, perhaps, point to two similar isolated events, but there can be no doubt that the successive reforms in our medical curriculum, culminating in the new recommendations of the General Medical Council, express precisely

* Some Notes on Medical Education in England, 1918. Section III.—A University Education in Medicine.

these two developments, that the entering student shall be better furnished for the medical course and that the contributory sciences shall be integrated. Only the other day a competent American critic of large experience in the teaching of Medicine and the administration of one of the chief Schools of the American Continent gave it as his opinion, after visiting England, that the Secondary School boy in this country is more individualistic and capable of scientific learning than the American boy of the same age, but he was constrained to add that the American student entering upon the medical curriculum, was older by two or three years, and had passed through a more complete preparation in Arts and in Science than his British compeer. This is a fundamental requirement which in this country we shall do well to consider and make provision for. No clinical study of University standard is possible except on a sound foundation of general science. Further, as no true progress can be made in the basic medical sciences without a foundation of biology, physics and chemistry, and some apprehension of the scientific method, so no real understanding of the clinical sciences is possible without an effective integration of anatomy and physiology, of pathology and pharmacology into them. University education stands *for* this integration and *against* the old empirical approach, which left Clinical Medicine a subject apart from the sciences essential to it. Chemistry and physics, anatomy and physiology, pathology and pharmacology *must be brought into the clinical sphere.* No deftness of hand or acuity of sight or hearing, no assessment of subjective symptoms, can be of ultimate value to the clinician without an interpretation and application of these auxiliary sciences. We must, by all means, demand of the student a high degree of skill in clinical methods and the examination of the patient—through his own eyes and ears and fingers—but, first, let us require of him a complete understanding of the fact that without a knowledge of the structure and functioning of the body itself all talk of such clinical laying on of hands is mere sounding brass and tinkling cymbal. This knowledge of the body can only be obtained in the special departments and laboratories of anatomy, physiology, pathology and pharmacology. It cannot be obtained in the hospital alone or by questioning the patients. "A disease must always have a relation to a healthy action, or healthy structure of parts," wrote Matthew Baillie long ago, "for it is only a deviation from them, so that a knowledge of disease would appear to rest on a knowledge of the body in its healthy state. It is in this point of view that Anatomy and Physiology become so very important, as being most likely to afford the means of relieving the body when suffering under disease."* There can be no question that Baillie's study of anatomy made him the pre-eminent pathologist he became, and its integration with clinical work placed him among the great physicians. Of the supreme educational value of such integration

* *The Works of Matthew Baillie*, 1825, vol. 1., pp. xxiii, xxiv.

there can be no doubt. It makes for unification of the many into the one, it gives reason and substance to clinical study, it vitalizes the intermediate sciences, it makes the whole curriculum, as nothing else can make it, a single purposive piece of scientific education.

127. If the first specific purpose of a University Clinic be to teach, the second is *the advancement of learning*, the search for new truth, the increasing of man's knowledge of man and of nature. Still more important is it to teach the student the need for research, its spirit, its methods, its results. Not every student can undertake research, but every student should be imbued with its spirit, should understand its principal methods and should appreciate its achievements and its failures. Round about him in his clinical subjects lie the vast fields of the unknown, and he only is the true student who is inspired by the spirit of discovery, by finding truth and making it his own. In no other science all through the world is the scope so wide or the rewards so abundant. For here all the sciences may be harnessed to prolong and enlarge human life and to raise man to his highest capacity. Individual health and growth and longevity, their meaning and scope and safeguards; the bounds of physiology; physical and mental content; the causes of disease; the sphere of pathology; diagnosis, physical signs, subjective symptoms, "instruments of precision"; the relation of physiology and pathology to the social life of the community and the individual, his heredity, habits and manner of life; the science and art of rearing a healthy race, maternity, infancy, childhood, adolescence, adult life and old age —a great company coming in, a great company passing forth; the effect of disablement and invalidity; the means and methods of therapeutics; basal metabolism, nutrition, immunity, psychology, prognosis, preventive medicine—this wide and splendid field is the sphere of the practitioner of Medicine. I suggest that to be a clinician, the practitioner of the science and art of medicine, inspired by the spirit of research, is a very great calling. To compare such a comprehensive office as this with the bacteriologist and the pathologist is to misapprehend the issue. In so far as their work concerns the practitioner they are ancillary and auxiliary to the ultimate ends of Medicine. It is the goal of Medicine which here must be striven for, it is the sum total of knowledge applicable to the betterment of man's physical estate which must be synthetized. The ordinary dispensary treats the case; the University Clinic does the same, but out of the case it should draw a liberal education and provide for the sounder and fuller treatment of all similar patients, for it should so think and work as both to train the student and extend the frontiers of knowledge and of life.

128. These two principal purposes have been recognized in Great Britain for generations. But owing to absence of organization, lack of funds or the allurements of lucrative practice, the traditional structure of the teaching clinic has proved inadequate

to the growth of the knowledge and art of medicine and to the expanding requirements of the medical student. Much expenditure and educational attention have been devoted to the sciences of anatomy and physiology, but the clinical subjects have not, until recently, received their due. All too often they have been left to the chances of incidental teaching by an honorary hospital staff, unable to devote itself principally to teaching and research. Incidental teaching of clinical subjects cannot uniformly be of University standard.

(*a*) *Staff.*

129. We may now turn to consider the structure of the University Clinic, and the first essential is the Staff. The head of the Clinic must be appointed as such by the University and not only by the proprietors or governors of the hospital. First, he must be a sound clinician—for he is to treat patients and instruct students in clinical methods. Secondly, he must be experienced in investigation—for he is to undertake, and guide others in research. Thirdly, he must be an administrator—for he is to control a complex organization of wards, out-patient departments, clinics, laboratories, lectures. The requirement is that he must supervise them, he must direct all their functions, concentrating and co-ordinating. Lastly, and above all, he must be a teacher —for his principal task is that of education. These are the four essentials. But they carry some corollaries. Such a Professor should be of a sympathetic and understanding disposition and temperament; he should be broad-minded and of good judgment, able to lead, willing to follow; he should be capable of drawing the best out of men; he should be trained in laboratory work as well as clinical; he should have had a varied experience of teaching. "He should have a comprehensive and thoroughly scientific training," wrote Sir William Osler in 1911, "and should enter clinical medicine through one of three portals—physiology, chemistry or bacteriology, and pathology. He must be keenly practical, keenly scientific, fond of his patients, fond of his work, and devoted to his students. He should live as much in his wards and laboratories as do his colleagues in their laboratories of anatomy, physiology, chemistry or physics."* Happily such men exist, but they are not to be met with every day; and even when found they may not be willing to undertake the exceptional burden of such a post as Director of a University clinic. Was it not the great Erasmus who met the objection "What a load you are putting on the back of the poor educator," with the words, "I burden the one to relieve the many." His staff should be like their chief in many respects, but different from him in others. For they will be something more than deputy; they will be complementary and will represent special branches of work on the

* *Lancet*, January 28th, 1911, p. 212.

clinical and laboratory sides—associate professors (specialists in different branches of medicine—nervous system, alimentary, circulatory, renal, dermatology, etc., or in surgical specialties, or in pathology or physiology),* laboratory workers (specialists chemically or bacteriologically trained), resident staff. They should all share, as far as possible, in teaching duties. The vexed question arises whether they should be wholly employed in the service of the clinic, or allowed a greater or less degree of private practice.

130. This question of whole or part-time employment has become a bone of contention and must be considered. It is an issue which is liable to occupy a place in controversy out of all proportion to its real relationship to the principles and validity of the case for the establishment of University clinics. Two things are perfectly obvious: first, it is advantageous to have some whole-time and some part-time members of the staff—the crux of the question concerns the Director and his deputy; secondly, the issue is a practical rather than a theoretical one, and personal and local circumstances may well govern the matter in any particular case. The issue is, however, a general one, and a brief discussion of it may be convenient. The case for a whole-time appointment is put in some such terms as these: A whole-time Professor of Clinical Medicine or Surgery is comparable with a whole-time Professor of (say) Anatomy or Physiology in the same University; and is able to devote himself exclusively to teaching, to hospital work and to research; by being excluded from general, special or consulting practice, he is removed from all external enticement and pre-occupation; he devotes his life, all its energy and time, to this one specific calling; his students, his patients and the nursing staff find him always available, and this is to their great benefit, individually and collectively; he is excluded from competition with his peers, in the hospital and outside it; he is disinterested, and his colleagues find it easy to co-operate with him; he has control of his time and its "lay-out," and can ensure that amount of leisure which is necessary to composure, reflection, personal study and research.

131. To this substantial argument the opponents of the whole-time Professor put forward a weighty argument in some such terms as these: A whole-time Professor of clinical subjects is deprived of the advantage to himself and his students of being in touch with private practice in the home; he is deprived of the wholesome incentive of earning fees, of the individual responsibility of treating persons of social standing, education and worth, and he lacks the stimulus of being in touch with the outside world. Removed from these quickening influences he loses their inspiration and tends to become academic and hospitalized. This is a disadvantage to his students and himself, and makes it financially difficult for him either to accept such a post or, if necessity should dictate, to relinquish it.

* Attached to University College is a teacher of the History of Medicine.

132. Before offering any observations on these two arguments, I ought perhaps to quote my previous statement on this part of the subject :—

> " Apart from any reform of the examinations, it must be said that, broadly speaking, the solution of the problem of clinical teaching is a reorganization of the system in such a way as to place a great responsibility on the teacher, and provide :—
>
> (*a*) for the appointment and adequate remuneration of professors of clinical medicine, surgery and obstetrics* who would devote *the greater part of their time* to teaching and research ; though such professors need not be wholly debarred from private practice (success in which is a valuable asset in teaching work), they should be prepared so long as they continue to be head of their clinical department to be primarily teachers, and only in a minor degree practising consultants ; in other words, their first and predominant interest must be in the University ;
>
> (*b*) that the qualifications for such appointments shall be clinical experience and proficiency, ability to teach, sound scientific training, high character, enthusiasm, and capacity to investigate, to lead and to organize ; promotion should be by merit and not by seniority or length of time on junior staff or prolonged service to the hospital ; the duty of the post would be the treatment of the patients, the investigation of disease and the teaching of the student ;
>
> (*c*) that the professor shall have the control of wards (50 to 100 beds), an out-patient department and ample laboratory accommodation (in immediate proximity to the wards) for research and clinical pathology (cardio-respiratory work, bacteriology, microscopy, X-ray and electrical work, etc.) ;
>
> (*d*) that the professor shall have an adequate professional staff of tutors and assistants of University status, properly paid and graded, consisting of *some whole-time men and some part-time* (including those engaged in practice), sufficient in number to permit of small clinics, and representative of the various branches of medicine and surgery, all of which cannot be taught by a single professor. The lesson of team work is thus inculcated, and the student learns the necessity of it in his subsequent practice."†

From these words it will be seen that as a result of comparative study of the experience of Medical Schools and Universities in Great Britain, Germany and America, I had formed the opinion that, as a general rule, a strictly whole-time appointment of a clinician was at present impracticable and perhaps disadvantageous.‡ I recognize, however, that there may be exceptions and that a University may deem it expedient to require whole-

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* In some schools it would be practicable and desirable to appoint professors of neurology, psychiatry, pediatrics and other sub-divisions of medicine.

† Some Notes on Medical Education in England, 1918 (Cd. 9124), p. 77.

‡ The official Memorandum of the University Grants Committee, 1920, also recommended that " A Professor or Director should devote the greater part of his time " to his professorial duties. *See also* Report of Royal Commission on University Education in London, 1913 (Cd. 6717), p. 116.

time service from all its professors and debar them from any and all other service, even though such service might improve and enhance their professorial duties. In point of fact, the Academic Council of the University of London in 1920 advised the Senate not to confer the title of Professor upon Directors of University Clinics unless their appointments were definitely whole-time appointments with a bar to private practice.

133. From an academic point of view the advantages of whole-time clinical professorships seem to ensure judgment in their favour. The case appears to be unanswerable. But in practice it is difficult to carry out. What we have to do is to establish the principle and method of a University clinic in all Medical Schools and under all circumstances. Our problem is not to establish the perfect model, to start a new organization, full-grown, immaculate and complete. We are not a New World, with new cities, new Universities, new ideals, and without a past. We have a hospital tradition which has more than a thousand years behind it, and the first organized British Medical School is 400 years old. We cannot dissociate ourselves from our inheritance. Our problem is to continue an evolutionary process; to gather a sense of inspiration, endurance and settlement from the ancient ways and to direct them in new paths; to build on the old foundations which have withstood the strain, and raise a superstructure for the new time. On the whole, I am disposed to think the crux of the problem is the professor rather than the students, for we can meet the needs of the students for instruction in the requirements of general practice either by means of part-time consultant members of the unit staff or by means of other clinical "firms" in the hospital which are staffed by consultants. In any case, the professor cannot teach the students everything in the professional sphere and a variety of instruction is valuable. But what of the Professor? Can we secure the best men in the profession, especially in Surgery, for these posts, not as an exception but as the rule, not temporarily but permanently, if the scope of the University professorship be restricted to whole-time service and the rewards narrowly delimited? and if we secure them, can we retain them? and if we retain them, can we, *over a long term of years*, prevent staleness of outlook, "hospitalization" of the professor, or settlement on his lees? We must face the plain fact that the answer to these questions from various Universities of the New World and the Old is up to the present generally in the negative. The answer in Glasgow, Edinburgh, Newcastle, Leeds, Sheffield, Manchester, and in London, too, is that at present we cannot get an open and free choice if these posts are made strictly whole-time; and it must be added that the past history of the great School at Edinburgh rather confirms that answer, as it has also been confirmed in some famous Schools of the New World. Nevertheless, longer experience may modify opinion, and especially so when the existing clinics have trained competent leaders for whole-time posts.

134. What, then, is the present solution of this practical problem ? There are several possible solutions, and four may be named. First, in point of historical order, the clinical professor may be permitted to undertake such degree of outside private practice as will not interfere with his duties as head of the University clinic. Such restriction may take various forms, either on a time basis or in respect of the character of the practice undertaken. An example is the Regius Professor of Clinical Surgery at Edinburgh. Secondly, the whole-time professor may be permitted to include within his sphere at the hospital a special ward or consultations for private patients, whose fees may be paid to him or to the governing body of the hospital or otherwise. Examples of this arrangement are to be found in various University Medical Schools in America. A third method is to give a part-time Professor or teacher whole-time educational assistants and impose upon them some of the professorial duties. At first sight this method, which has recently been adopted at Leeds, Middlesex Hospital and elsewhere, appears to be but a modification or addition to the first method named above. But it will probably be found to be different in kind. The arrangement at Leeds is to establish a University Clinic on the basis of the present honorary staff, under the regulation of a Clinical Sub-committee of the honorary staff, of which the part-time Professor of Medicine (or Surgery) is *ex-officio* Chairman. This Committee supervises and co-ordinates all the clinical teaching, and recommends a competent candidate selected from the junior staff for the post of whole-time Medical or Surgical Tutor, at a salary of £500.* In other words, the whole-time appointment is to be not that of the Professor but of a junior member of the Staff, who will thus be able to devote his time to teaching and research, with a prospect of succeeding to a position on the honorary staff or entering consulting practice. Fourthly, we may proceed with the plan of whole-time professors at adequate salaries, with part-time practitioners on their staff, and look to the future for whole-time successors being trained in the University Clinic. Of these four types of solution English Medical Schools generally would appear to be likely to be in favour of the first, but much depends on definition, on circumstances and on the results of the trial of various methods. But let us be clear as to our objective. The issue before us is not only the advisability of setting apart one or more whole-time clinicians for educational work, but the best method of creating a team of clinicians who are also laboratory workers, in a unit, under the leadership of a Professor who has control of beds, laboratories and Out-patient Department, with adequate provision as regards time, equipment and teaching ability, in order that the clinical education of the student may be directed along lines that will produce the best treatment for patients and the advance of knowledge.

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* British Medical Journal, 1922, I., pp. 22 and 844.

(b) Study in the Ward.

135. The number of beds available in a University Clinic will vary in the circumstances of each individual case and the size of the Medical School. Broadly speaking, experience shows that from 50 to 100 beds is a desirable standard. This means in practice one male ward (20 to 30 beds), one female ward (20 to 30 beds), and several convenient small side wards. The basis of the ward work should be clerking and dressing. Each student should have four or five or more cases in his direct charge, and for these patients he must have large responsibility, and undertake as far as practicable all the preparatory and systematic work on its laboratory as well as its clinical side. He should see the case right through, following up its after-care to subsequent recovery, or completing its full pathological study at autopsy. He should have fairly free access to the ward, under suitable restriction and regulation, and if the patient returns during his studentship with sequelæ he should again see the case. His complete records of his case should be available for submission to his examiners. The University Clinics in London have an average of between fifty to sixty beds to each clinic, and ten to twelve clerks or dressers.

136. In order to make the ward work of the clinic of educational value the Professor should have certain definite facilities. First, he should in practice have as much control as possible of the admission and discharge of cases; and this calls for careful organization in relation to the medical registrar, the house physician or surgeon, the Out-patient Department, and the system of admission obtaining in the hospital. Clearly, the primary purpose of a hospital is the treatment of persons requiring hospital service, and this function obviously and rightly governs admission. But in a large hospital it is possible to arrange for cases of certain diseases, or at certain stages of disease, to be so placed as to facilitate investigation, treatment and education. Secondly, the Professor should be in a position to exercise control over the nursing, dietary and routine management of the patients in his charge. This is not invariably the case; and the result is that the student is taught, let us say, the diagnosis and general lines of treatment; he administers, or assists in the administration of, the anæsthetic, he learns the steps of the operation, he dresses the case and he knows the general result. But what he is frequently not taught in sufficient detail is: (*a*) the careful daily preparation of the patient for operation; (*b*) the risks of the operation and how they are reduced; (*c*) the avoidance of shock and secondary hæmorrhage; (*d*) the post-anæsthetic nursing; (*e*) the day-by-day dietary (what food, how cooked, how much, when given, what effect?); (*f*) the treatment of minor difficulties which arise, such as sleeplessness, pain, irregularity of the bowels, vomiting, flatulence, pyrexia, bed-sores, cleansing, medicine-taking, and the general and particular after-care of the case. *Yet these are the points on which he will be consulted in private practice.*

The operating surgeon comes to a private case ; the operation is performed and reported to have been entirely successful ; and the surgeon departs. But the private practitioner remains, and he must know his way thoroughly in every detail of after-care if the patient is to make sound recovery. It is the control of nursing, not the control of nurses, that the Professor must teach—and it has been estimated that not one student in ten is being properly taught the necessary medical details of the nursing of his case. The points of the operation and the outstanding signs of the disease—these are the things the student concentrates upon, for these are the subjects of the stock questions of the unimaginative examiner. The practical things the student requires for his life's daily work are all too often assumed or neglected. Thirdly, the Director of a University Clinic must organize the ward teaching of the student, in order to bring science to the bedside. It should consist of :—

(*a*) A preliminary course in physical signs and clinical methods.

(*b*) The complete clerking and dressing of the case in the ward, the student *doing* rather than *hearing*.

(*c*) Clinical bedside instruction in the ward and clinical demonstration outside the ward (cases, pathology, apparatus and instruments, records and case-taking).

(*d*) The routine laboratory work of the ward.

(*e*) The effective correlation of medicine and surgery.

It is important that the Director should understand that from an educational point of view the teaching of the clinical subjects ought to cover the whole field of physical observation and examination as the foundation of bedside study. The student must learn to use his own eyes and ears and hands first. Apparatus and instruments may supplement such investigation, the laboratory may be ancillary and confirmatory to it, but careful, thorough and repeated personal examination of the patient—the history, the signs, the subjective symptoms, their progress and *the meaning of them*—is essential, not always perhaps in the treatment of the case but always in the education of the student. It is upon that training that he will fall back in subsequent practice, it is that which gives him confidence and which may truly educate him. The introduction of laboratory methods and tests is invaluable, but it does not mean that the student can afford to neglect, or perform perfunctorily, the full clinical examination of his patients. The reverse is the case, for the laboratory has enhanced the meaning of the signs and symptoms.

(*c*) *Teaching in Out-patient Department.*

137. The design and structure of the Out-Patient department of a University clinic should provide for the convenient collection, classification and distribution of patients, for their adequate

examination in side rooms and for demonstration and educational purposes. It should be something much more than a mere waiting-room, and should be equipped for first-class and not third-class work. For here the student is to study disease at its beginnings and the common ailments. Some authorities believe he should begin his clinical studies in the Out-patient Department, whilst others believe he gains more advantage from the out-patient clinic by first clerking and dressing in the wards. On the whole, perhaps, the balance is in favour of the latter course, but in any event the out-patient clinic and Receiving Room constitutes one of the most serious and important parts of the true University clinic, and few departments of medical education have derived more benefit from the establishment of the University Clinic. The members of the teaching staff should take turns in seeing out-patients, who should not be left only to the junior staff, and the teaching should be almost entirely practical. It is the true apprenticeship—early cases, methods of case-taking, mutual discussion of the issues raised, the indications of team work, and the continued observation of discharged in-patients. A special out-patient clinic for children is of great advantage to the student. At St. Thomas's Hospital the student's first hospital appointment is as dresser in the Out-patient Department, where he sees minor surgery casualties, fractures and emergencies on admission. Whilst doing so he receives preliminary instruction in clinical methods and a short course of clinical pathology. At Edinburgh the Professor of Clinical Surgery lays great store on out-patient instruction. His dressers attend on receiving day, and on Tuesdays he has a special clinic on out-patients recommended to his wards. "The patients are brought into the arena of the theatre one by one," writes Sir Harold Stiles, "and the students are brought down in turn to examine the case, make a diagnosis and suggest treatment. The patient generally comes with a letter from the doctor, the contents of which are frequently communicated to the students. After discussing the case, the class is told what the gist of the reply to the doctor will be. This is one of the most valuable teaching days in the week's programme, the students being taught (*a*) how to examine a case; (*b*) what questions to ask in order to obtain the essential facts relating to history and symptoms; (*c*) how to assess the value of the information obtained; and (*d*) to decide as to treatment. On the same morning old patients frequently come to report progress." This is a succinct account of a manner of procedure widely adopted in British medical schools; but to have the true educational value the Out-patient instruction should be undertaken as part of a Clinic in continuity with the wards and laboratories.

(*d*) *Laboratory Work.*

138. Laboratory accommodation should be provided for cardiographic work, for bacteriology and vaccine therapy, for

bio-chemistry and metabolism tests, for clinical microscopy and examinations, for X-ray and electrical work, for general pathology. In practice provision must be made for : (*a*) clinical laboratories ; (*b*) pathological laboratories ; and (*c*) research laboratories. The clinical laboratories are usually three, for X-ray and electrical work, for cardiographic work and for routine examination of sputum, urine, blood, etc. They should be adjoining the wards and are an essential part of the University clinic. The physiological, pathological and research laboratories may on the other hand be for general use of the Medical School, though their work should be co-ordinated with that of the Unit. At the London Hospital there is a fully equipped experimental workshop for designing splints and other apparatus which the Director has fitted and finds valuable.

139. The practice of the Clinical Unit as to autopsies is to use the hospital accommodation, the carrying out of the work being in the hands of the pathologists to the hospital. The clerks or dressers attend their own cases and receive instruction from the pathologist and from their own clinical staff. A system of special clerking in the post-mortem room has long been in vogue, and students are required themselves to undertake autopsies under supervision.

(*e*) *Auxiliary Equipment.*

140. As we have seen, it is essential that a University Clinic should be adequately equipped. In general this means adequacy in respect of beds, laboratories, apparatus, and so forth. But other provision is also necessary. First, there must be available, though perhaps not in the same hospital, the means of study of the collateral clinical subjects, fevers, mental disease, sick children, dermatology, diseases of the ear, eye, nose and throat, venereal and nervous disease. Several of these conditions are dealt with separately in the present report. In regard to all of them there should be close co-ordination and even overlapping, and the student should learn that these specialties are not *ad hoc* specialties which he can afford to ignore, but essential subjects of everyday practice, part and parcel of his clinical medicine and surgery. Where it can be arranged some of the student's time should be devoted to attendance at special hospitals or poor-law institutions. The Medical Schools at Edinburgh, Glasgow, Liverpool, Birmingham, Sheffield and elsewhere, as well as several of the London Schools, have recently greatly extended their usefulness and equipment by undertaking clinical work in connection with such special hospitals. Another form of equipment, long used in Britain, is the teaching museum. We are rich in such collections, thanks to the inspiration of John and William Hunter, and they are now made more available by re-classification on a clinical or pathological basis, by continual renovation, and by the addition of the clinical and pathological particulars and history of the case. Sir Harold Stiles uses for instruction all his

more important specimens, macroscopically and microscopically, week by week, his " museum " being therefore current. Professor Elliott and Sir Thomas Lewis have been engaged in overhauling the collection at University College and making it of immediate clinical value. Even the smaller schools have improved their educational museums, and English Medicine as a whole owes an immense debt in this matter to Sir Arthur Keith and Mr. Shattock. A third recent improvement in most of the Schools in this country has been in the libraries, and here again the last ten or fifteen years have shown advance. The housing is modest, and sometimes even domestic, but the use of standard books of reference, of special research literature and of current periodicals, home and foreign, has increased.

141. Before leaving this question of auxiliary equipment, I ought to mention the admirable example set at Edinburgh of assessing the student's surgical work and using a record of it at the Examination table. A card index system has been introduced which records the student's hospital attendance, his work, his case-histories, " the intelligence he displays when called upon to examine patients at the clinic," and the marks obtained at his class examinations, and this card is utilized at his final degree examination. It would be well if this plan were adopted everywhere, for if there is one thing more certain than another it is the necessity of removing the hazards of examination, of " passing " no candidate who has been merely crammed, and of making the dominant purpose of the student's course a matter of training and not of examination.

142. In the Appendix will be found brief Abstracts of the work of the eleven University Clinics hitherto established, and in receipt of special Exchequer grant. For comparative purposes, similar abstracts have been appended for the clinics at Cardiff and Edinburgh.

Present Position of University Clinics.

143. We have seen that the twofold purpose of the University Clinic is the raising of Clinical teaching to University standard and the advance of knowledge. Our conservative temperament in this country naturally leads us to be suspicious, and even sceptical, of improved organization or revised methods. We instinctively prefer the old ways, and estimate highly their virtues and advantages. Nevertheless, it must be said that, generally speaking, the reorganization embodied in the so-called " Clinical Units " has been welcomed, and particularly so by the students. " In every adequate clinical school," says Sir Clifford Allbutt, " there must be a *professoriate* ; whole-time, or nearly whole-time professors, with technical laboratory, bio-chemical and pathological, who with their assistant staff shall be engaged continually in irrigating our profession from the springs of the pure sciences."*

* British Medical Journal, April 12th, 1919, p. 438.

144. Before summarizing some of the principal features and results of the University Clinic it may be well to repeat that the organization is not a new invention, but is the natural development of the English system of clinical teaching. It is a reorganization which comprehends all the essential elements of a system of clinical instruction which, long ago, justified themselves and proved their worth. It may well continue for a time, as at present, to be parallel with and supplementary to the honorary system of teaching which has existed in England for four centuries. There are signs already of change in that ancient system, but we shall be wise not unduly to hasten or precipitate such changes. We may well be content to allow development to proceed naturally and gradually, observing and studying its form, meaning and results, as it occurs—for occur it will—in the fully organized University Clinic as well as in the less formal teaching by those mainly engaged in practice. We must learn to know "the seasons when to take occasion by the hand, and make the bounds of freedom wider yet." Thus in casting our minds forward we must, I think, assume that some kind of University Clinic as here described will continue to form an essential part of English clinical teaching; that all students, and not a selected group only, should receive at some stage of their curriculum such instruction; that some teachers in such an organization should devote the whole of their time to their University duties; that the best and widest facilities of the hospitals attached to Medical Schools should be available for clinics of this kind; and that adequate educational funds from the Exchequer or elsewhere should be allocated in their support, for it is obvious that they cannot be maintained only out of students' fees.

(*a*) *Improvement in Clinical Teaching.*

145. From these preliminary observations we may turn to consider the early fruits of this work. What have the three years shown? First, it is certain there has been substantial improvement in the clinical teaching and in the treatment of patients. Further, there has been organized association between these two branches, which is in itself an important step. The improvement in teaching is apparent in the fuller and more complete study of each patient; more data have been obtained regarding the patient, his needs have been more clearly understood, the records have been more comprehensive, and the study of each patient has been made to contribute to the student's whole understanding of his subject. A whole-time service makes possible an immediate and continuous attention to the patient by physician, student and nurse, with the result that the patient gets more attention and quicker treatment. For example, in one of the London University Clinics the number of patients passed through its wards was nine per bed in twenty-six weeks,

whereas in the parallel honorary and part-time "firms" with similar cases the average number of patients was five per bed in the twenty-six weeks. Circumstances will, of course, alter cases, but generally speaking this quicker and fuller action may, for obvious reasons, be expected.

146. There is ample collateral evidence of improved teaching. In the eleven London University Clinics more time and supervision are devoted to the students than in other instructional clinics, and more detailed work is expected from the clerks and dressers; there is, in a word, more actual work to be done by them, from both the clinical and the laboratory points of view. There is less spoon-feeding. Again, clinical demonstrations have been organized and placed upon a definite basis. Formerly in the London Schools clinical lectures were somewhat casual and unequal, good in themselves, but intermittent, incidental, and sometimes irregular. But now, at St. Bartholomew's Hospital, clinical lectures arranged by the University clinics follow well-designed courses in, say, disorders of the stomach, the kidney and urinary tract, then the liver, followed by a series on tuberculosis or on syphilis. There lies before me a calendar for November, 1922, which shows that in that month there were five clinical lectures in Surgery, four in Medicine, four on special subjects, and four professorial lectures on syphilis—seventeen in all, out of twenty-one available days—all senior members of the staff and some outside authorities taking part in such lectures. For St. Thomas's Hospital, I have a similar calendar for October to December, 1922. The clinical lectures, medical and surgical, are delivered at 9 a.m. in the Medical Theatre and special pathological demonstrations are "correlated" with them. This particular series includes Diseases of the Ductless Glands (7), by a team of four teachers; some Specific Infections (7), four teachers; Diseases of Children (6), one teacher—the pediatrician to the hospital; Diseases of the Nervous System (26), five teachers—a total of 46 clinical lectures in the term. The calendar indicates that in the spring term these are to be followed by thirty-nine clinical lectures on Diseases of the Alimentary Canal. The lectures are not "systematic" but clinical, their purpose being to elucidate practical points. Each lecture is given by a teacher especially competent in the particular subject, and the Professors of Anatomy and Physiology take their share. At University College all the medical lectures and teaching in the Hospital are arranged by the Director of the Clinical Unit and are shared in by the honorary and unit staff. Three surgical clinical lectures are similarly given every week. At Edinburgh there are two surgical clinical lectures per week and evening demonstrations and tutorials; indeed, at all the large Schools there is a system of preliminary instruction in clinical methods, particularly well worked out at University College, London, St. Thomas's Hospital and Edinburgh. Now, whilst there have been clinical lectures in all English Medical Schools from

time immemorial, there has recently been substantial development. They are more clinical in form, more comprehensive in character, more varied in subject, more co-operative in arrangement. Another new feature of clinical teaching has been the holding of Clinical Conferences or "staff rounds," a method highly developed in some American Schools. The Director and his Assistants, with their hospital colleagues, and with practitioners from outside and from other countries, discuss obscure cases and review all the data available. Another form of conference is the weekly demonstration at St. Thomas's Hospital of all the pathological material of the week. Here the clinical history and pathological findings are discussed between staff and students. A somewhat similar plan is a "follow-up" department for assessing the value of the treatment provided and for dealing with the after history of old cases. In several of the University Clinics fuller attention is also being given to pediatrics, but here there is need for much further development. At Edinburgh the surgical clinic includes orthopædics.

147. No one who knew intimately the formal clinical teaching which was provided in England a decade ago, in addition to that given in the ward, can be in any doubt as to the expansion and improvement which has recently taken place in the Medical Schools possessing clinics of University standard. Formal clinical instruction is taken earnestly, is organized and is prepared for; the demonstrations are given by physicians and surgeons particularly competent in the subjects of which they treat; the laboratory work as well as the clinical is brought fully into instruction; improved (though not yet adequate) equipment and facilities have been made available; *and for the first time medicine and surgery have been effectively correlated.* Whilst it is true—and entirely to the common advantage—that all senior members of the hospital staff share in this clinical teaching, the fact remains that it is the wider conception of the University Clinic which has brought about these improvements, the rationale of which is the better equipment of the student.

"Empirical medicine is at best only guess work," writes Professor Hugh Maclean, the Medical Director at St. Thomas's Hospital, "and so an attempt is made in the Medical Unit to get the student to study his cases thoroughly by scientific methods. The most important point in the whole scheme is that the student should correlate laboratory work with his clinical work in the wards and carry out his investigations directly on the living subject. I have given it a good trial and am now firmly convinced that there is no other method that can at all approach it in training students to appreciate what can be done in Medicine. The student has to think for himself and get his results for himself—quite different from accepting a text-book statement. It would, of course, be quite impossible to give this sort of training in any but a full-time post, *i.e.*, a post in which the Director gives at least the greater part of his time to the running of the Unit."

I concur in this expression of opinion, which represents generally the view of the Directors in the London Schools.

(b) Association of Research with Education.

148. Secondly, the University Clinics have made a beginning in research in association with Medical Education. Within two years upwards of sixty pieces of original work have been published by the Clinical Unit Staffs in London alone,* and a substantial amount of work is in hand. Obviously, the labour of organizing these Units and establishing their routine has made exceptional claims on the time of the Directors and their Assistants, and it would not have been surprising if there had been little or no special research attempted. What is of much greater importance than any actual work undertaken is the introduction of the *methods and spirit* of research as an essential factor in the routine of the University Clinic. Let us cultivate no illusion in this matter. To assume that the ordinary fourth or fifth year medical student is capable of extending in any worthy degree the frontiers of exact knowledge is futile and reveals a misapprehension of research. Worthy research requires a prepared mind, experience, leisure, imagination, learning and high technique. It is not for the inexperienced undergraduate with other

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* The principal subjects in which research has been undertaken are :—

Bacteriological and histopathological investigations of various surgical conditions.
Acute intestinal obstruction.
Toxic and Malignant thyroids.
Arterial disease in nephritis.
Myelin Kidney.
Diabetes.
Jaundice.
Post-operative Embolism of the Lung.
Cardiac Dyspnœa.
The Van den Bergh Test.
Gaseous changes in blood in artificial pneumothorax.
Basal metabolism in various conditions.
Diseases of pancreas.
Intravenous protein therapy.
Effects of peptone injection in septicæmia.
Therapeutic use of Digitalis.
Arterio-sclerosis.
Glycæmia and Glycosuria.
Types of pneumococci in Lobar Pneumonia.
Tests of renal function.
Blood transfusion.
Cysts of the epididymis.
Nervous Mechanism of Micturition.
Diseases of Cerebellum.
Clinical Pathology of Sclerema neonatorum.
Diseases of the Liver.
Surgery of Intrathoracic tumours; Surgery of the Parathyroids.
Muscular Rigidity.
Retinal changes in Renal Disease.
Fractional Test Meals.
Pernicious Anæmia.
Symptom-complexes of Encephalitis Lethargica.
Chronic Gastric Ulcer.
Function of Basal Ganglia.
Renal Conditions in Enlarged Prostate.
Protein in Renal Disease.
Bacterial Infections of Kidney.
Insulin.
Disorders of Movement and Cerebellar Ataxy.
Inheritance of Blood Groups.
Syphilis of the Stomach.
Abnormalities of Bone Growth.
Radium Treatment of Carcinoma.
Osteo-arthritis.
Growth of Displaced Cartilage.
Pathology of Supra-renal Glands.
Wound healing.
Post-operative blood changes.
Hypopituitarism and obesity.
Genito-urinary surgery.
Treatment of eclampsia.
Still-birth and neo-natal death.
Brachial paralysis.
Colon carcinoma.
Chronic and acute duodenal ileus.
Sacralisation of lumbar vertebræ.
Hirschsprung's disease.

tasks on hand. But there is here, nevertheless, something vital for him, which has hitherto been gravely neglected in our national schemes of Medical Education, and that is to learn to love research, to know its methods, to be moved by its spirit, to appreciate its stupendous achievements, to recognize that in it and in it alone can the future be secured. This is what we have neglected to teach him. It has not been explained to him that all knowledge comes by scientific investigation and research, clinical as well as other. Moreover, the teacher who is not imbued with the spirit of research is unable wisely to teach, and thus it comes about that an inspired teacher and a seeing student are the two desiderata.

149. Professor Fraser, of St. Bartholomew's, has described the sphere of research work in his own Clinic as follows :—

(*a*) Each member of the Staff is encouraged to work on his own research problems for which he is specially trained. He selects patients that are suitable to his problem, and undertakes the care of such patients under the supervision of the Director.

(*b*) Problems involving the co-operation of two or more members of the Staff, or of members of other Departments in the hospital or university, are undertaken jointly.

(*c*) Volunteer assistants, or special research workers (under the Medical Research Council or Beit endowments) are attached to the Unit, utilizing the clinical material and working in the wards or laboratories of the Unit.

(*d*) Junior members of the Hospital or University Staff who have no control of clinical material may carry out their investigations in association with the Unit and under the supervision of the Director.

From all this work the student derives direct benefit. "We regard a very thorough system of examination of each patient," says the Surgical Director at the London Hospital, "as our chief contribution to research," and in all these University Clinics a distinguishing characteristic is the thoroughness of clinical and laboratory investigation. I found in Professor Maclean's Clinic at St. Thomas's Hospital that his clerks were, in addition to the clinical examination, themselves undertaking ancillary tests which modern knowledge has made available for :—

(*a*) Investigation of a renal case—urine examination (protein, casts, blood), blood urea estimation, urea concentration factor and test, diastatic activity of urine, cardio-vascular system, general condition of patient and examination of eyes with ophthalmoscope ;

(*b*) Investigation of gastric cases—test meals and the full examination of the result ;

(*c*) Glycosuria and diabetes—sugar tolerance tests and in diabetic cases investigation as to risk of coma-urine, blood and CO_2 in alveolar air.

(*d*) Pancreatic disease, urine for sugar and diastatic content, fat in fæces, etc.

(*e*) Coma of unknown origin—urine for sugar, acetone bodies and protein, blood for urea and sugar.

(*f*) Investigation of liver efficiency—urine for bile pigment, urobilin, amino-acids, sugar, etc.: laevulose tolerance test, lipase in blood serum, and fats in fæces;

(*g*) Investigation of a jaundice case (obstructive or toxic), urine for bile pigments, etc., blood serum for Van den Bergh tests, fæces for bile and fat.

Investigation of this kind may not always be practicable either for the student or the practitioner, but of its value in awakening and informing the mind, and enforcing it to "think physiologically," there can be no doubt. By such means, combined always with full clinical examination, the student himself becomes an investigator and his patients the medium of genuine research.

150. Sir Wilmot Herringham and Sir Walter Fletcher have expressed themselves clearly on this research question:

"If medical practice is to improve and physicians are to cure more sick people than they now can," they say, "someone has got to find out things that we do not yet know, and the only methods by which this can be done are by observing more closely the laws of disease and the effects of remedies. We have by no means exhausted even the field of the simple clinical observation which up to sixty or seventy years ago was the only method in use. But the chemical and physical methods of physiology, and the extraordinary discoveries of bacteriology and immunology have so greatly increased the means of attack, that the laboratory has become an indispensable part of medical equipment. We in England are sadly behind the best standard in provision for such work. The Clinical Units in some of the London Hospitals, and arrangements somewhat similar at one or two other British Schools, are the only attempts now being made to study disease after this fashion. Neither in the number of the personnel nor in the laboratory space or equipment are they nearly so well provided for as are the best American Schools."*

(*c*) *Training of Future Teachers.*

151. A third advantage of a University Clinic is that it constitutes a training school for its Staff. It is significant to observe that the professors and teachers of the preliminary and intermediate subjects of the medical curriculum are all appointed as such because they are trained men—experts in their particular subjects and experienced in educational work. But hitherto in this country the clinical teachers have been the physicians and surgeons of the hospital attached to the Medical School, who obtained their senior posts by age promotion. It sometimes happened that they were teachers by training, but this was incidental and not an essential qualification of their appointments. Rarely could they be described as educationalists or researchers. Distinction in consulting practice, long experience of hospital posts, and a "good bedside manner" are valuable attributes, but they do not necessarily make a man a teacher and leader of others. Here and there an exceptional man arose, who both taught greatly and greatly added to human knowledge. But the

* Report to University Grants Committee on visit to the United States, 1921.

rule was otherwise, and the claims of consulting practice outside the hospital, and not the duty of teaching, became paramount.

152. In course of time, a further stage of evolution arrived in Germany and in America, and it became recognized that the clinical teacher *must have a training as such*, even as the Professor of Chemistry or Physiology. He must be differentiated, as they were, for his special task. He must bend himself to that task as the principal, and not the subsidiary or auxiliary, function of his life. He may well obtain the assistance on his staff of men experienced in medical practice, but he himself and his deputies must be *trained* men. That was the conviction in Germany and America, and that was the reason why the formal clinical teaching in both countries excelled. They lacked our clerking and dressing system in the wards, and this has been their weakness ; but they provided *educational* clinical instruction of a high order, and this has been their strength. Consider for a moment the plain hard facts of the English method of imposing upon a busy surgeon of a London Hospital (who has been appointed in order of seniority to " treat the sick poor ") the added duty of providing a University education in clinical surgery to students—and then compare it, for instance, with the long years of whole-time training in educational and research work of the Professor of Surgery in an American University. There lies before me the precise record of such a Professor. First, he was the prize-man in Surgery of his year ; then he was intern in Medicine for one year, followed by a second year as intern in Surgery ; then he was assistant resident surgeon for two years, and began his teaching of Surgery ; next he became resident surgeon, and then for two years more was assistant to the Professor of Surgery, being required to undertake research work ; then he became instructor in surgery, associate professor and clinical professor ; lastly, he emerges as Professor. The whole course of training may cover ten or more years, which time he has devoted wholly to teaching, to treatment of his cases and to research. If he goes outside, attracted by the allurements of lucrative private practice, he is out of the running for a professorship. This system has its disadvantages, but it is indeed a different story from our failure to recognize that, as a rule, to become a teacher of University standard, whatever be the subject, demands a full, prolonged and comprehensive training. We found this to be the case generations ago in every other part of the medical curriculum. Now we are also finding it true of clinical teaching ; happily, steps are being taken in some of our medical schools to remedy our neglect.

153. Where then is this training of teachers to be obtained ? It is difficult to escape the conclusion that it will be found in the University Clinic—for there alone are the conditions and circumstances favourable to such training, there alone the main purpose of the institution is education in scientific treatment and research—without waste of time, overlapping, and coming and going—there alone the outside allurements are restricted or removed. Professor

Elliott, of University College, places this function of a Clinical Unit only second to that of teaching the student. He says that the Unit must make " provision of free facilities for clinical experience and for laboratory work to junior men of ability, so that in their years of greatest energy *they may be shaped* with least waste of time for their life's work, either as trained physicians with a full knowledge of science or as men devoted to teaching and research."

(*d*) *Full integration.*

154. Lastly, the University Clinic is integrating Medicine. For many years past medical education has been provided in water-tight compartments, designed in large measure to meet the requirements of examiners and often remote from actual life and the practical treatment of disease. There have been remarkable advances in knowledge—in physiology and pathology, in immunology, and laboratory diagnosis, and yet these have not been brought together into routine practice. As a result, much medical practice has remained at the same standard as it was in the days of our fathers. " We talk a great deal about modern medicine," writes Dr. Hermann Biggs, of New York, " but modern medicine does not reach a large portion of the population. Probably 90 per cent. of the people are getting almost the same kind of medical care which they had 25 years ago."* The reason for it is not doubtful. The medical student has been advised to base his surgery upon anatomy and his medicine upon physiology, but he has not in fact done so, first, because the examination system isolated the subjects of the curriculum from each other, and secondly, because his clinical instruction made no direct provision for the integration of the new knowledge and the old clinical methods ; it was in fact idle to urge the student to bring his physiology and pathology into the ward if there was no concrete means of doing so. But bring the teachers of these subjects into the wards, attach to the wards well-equipped working laboratories, make the student himself do the tests and witness the results, and let him see his clinical teacher as keen and devoted to teaching as his professors of pathology and physiology—and the result is a transformation. His clinical work on the one hand and his anatomy, physiology, pathology and pharmacology on the other suddenly become alive, united, purposive. He knows that both clinical and laboratory work are needed, and are needed in close, living and complementary relation, if the patient is really to be cured of his malady. He knows that the laboratory supplements but cannot supplant clinical observation, that clinical observation gives him the signs and symptoms of the organic or functional disorder which is the result of the physical or chemical changes that have taken place in the body and can be tested in the laboratory. Thus both become methods of precision, and

* New York State Bulletin, March, 1922, p. 75.

it is the joint use and integration of both which solve the problem. Above all, *medicine and surgery have been correlated*, and, as a rule, this has not been witnessed by the student before.

155. Now this appears to be what is happening in these University Clinics. Here is an example from St. Bartholomew's Hospital, as the direct result of the establishment of Clinical Units. Professor Fraser's medical clinic has the following co-ordinative arrangements :—

(1) The Director and the Professor of Physiology have devised jointly to teach Applied Physiology ; the Professor of Physiology visiting the wards with the Director weekly, and being in close co-operation on the research side ;

(2) The Demonstrators of Anatomy (the Chair of Anatomy being temporarily vacant) are in contact with the Unit in research ;

(3) The Professor of Pathology conducts a ward demonstration periodically ; and one of the chief staff assistants of the Clinic acts as liaison officer with the Pathological Department, which provides facilities for the post-mortem examinations of the Unit ;

(4) The Bacteriologist of the Hospital visits the wards with the Director weekly ;

(5) The Lecturer on Morbid Anatomy gives a post-mortem demonstration to the Staff and students of the Unit weekly ;

(6) The Medical and Surgical Staffs of the two Units are in continual contact at the bedside and in the Laboratories shared by them, and are engaged in joint research.

(7) The eight other firms of the Hospital are in co-operation with the two Unit firms, share in the course of clinical lectures organized by the Units and select their house officers from Unit clerks ;

(8) The Staff of the University Clinics undertake the preparatory course of instruction for all students in physical examination, clinical methods and case taking.

(9) The radiological and other special departments, and the Library and Museum, are shared in by all firms equally.

156. A similar scheme of co-ordination now exists in other University Clinics, and particularly valuable co-ordination work of various kinds has been done at St. Mary's Hospital. The beneficial effect upon the student and the patient of such practical integration as is represented in these arrangements cannot be doubted. Nor is it feasible to secure and retain such co-operation when an honorary visiting staff are in charge. An honorary staff may well be characterized by exceptional ability and abundance of goodwill, but its members can only give several scattered hours per week to teaching, have predominant and insistent outside claims, and in all their hospital service have rarely had the opportunity or facilities for practising the full integration of medicine. The difference, be it noted, is not one of philosophy or goodwill—the brains, experience and intention may be the same on both sides—it is one of *mechanical impossibility*. A man cannot be, as John Hunter found to his cost, in two different places at the same time. Clinical teaching of university standard requires, in short, sufficiency of time, adequate equipment and

facilities, the detailed study of the patient, full integration of knowledge, and the spirit of research—and these five requirements can be provided only by organization. There is nothing celestial about the term "University clinic" or "clinical unit." It is not a complete or perfect contrivance, nor is it immune from error. It is, indeed, only in a state of growth, a growth which is proceeding in greater or less degree in all our medical schools. It may be misdirected—and an unsuitable Director or an incompetent and unperceiving colleague may have mistaken his vocation; they receive their appointment from the University, which has its remedy. The attention devoted to research may be inappropriate in kind or degree; the laboratory or clinical work may be overdone or underdone respectively; the work of the clinic may be overloaded and insufficient time allowed for study and reflection; there may be a failure to secure that true and ultimate synthesis which is the harmony of detail and the poise of truth. These are matters which are remediable and adjustable, but broadly the organization seems to be a necessary one. For the future we must wait and watch, and the evidence indicates that we may do both hopefully. For such an educational organization may be expected to produce a well-equipped medical man, not complete in all regards, but able and ready to learn.

X.

OBSTETRICS AND GYNÆCOLOGY.

157. There can be no question that the effective teaching of this subject stands in the forefront of the student's needs. For, first, every practitioner must know thoroughly well and in a practical way how to conduct safely a case of labour, particularly a complicated case. The need is absolute. Capacity in this respect is comparable to capacity to deal with the commonest emergencies of minor surgery, and no qualified medical man in ordinary practice can possibly afford to be incapable in either matter. That 60 per cent. of confinements in this country are conducted by midwives furnishes no alleviation of this fact, for the remaining 40 per cent. fall to medical practitioners, and the midwife is required by statute to call in medical aid in all complicated cases. Secondly, midwifery concerns the birth-rate and the survival of the race; it is of national importance. Thirdly, each confinement represents two patients, the mother and the child. And yet, until recently, the teaching of this subject in the Medical Schools has been, as a rule, perfunctory and inefficient.

158. There is another kind of reason why the teaching of obstetrics should be reformed, and that is the total mass of suffering and mortality which follows child-birth. In 1921 there were in England and Wales 70,250 infants who died under one year of age (29,932 in the first month of their lives), and 3,323 mothers who died from conditions directly assigned to child-birth or pregnancy. These figures show that we are incurring a loss by death, in mothers and children, which we can ill afford. Yet that is not our total loss. For associated with maternity, as occurring in this country, there is a very heavy burden of invalidism, suffering and incapacity which is both filling our gynæcological departments with patients, and exerting a serious effect upon the well-being of the community; and to which must be added the further loss of 30,000 dead-born children. Now here we have a fourfold evil—a high maternal mortality, the death of infants, a relatively large number of still-births, and a great body of invalidity among women. It is no doubt a highly complex problem in which many social and economic factors play a part, but a substantial proportion of each of these grave disabilities is traceable, directly or indirectly, to inefficient midwifery. The solution of the problem is dependent, in part, as we should expect, upon a variety of medical measures directed to the safe-guarding of child-birth—the provision of maternity centres, maternity homes and lying-in institutions, competent and sufficient midwives and nurses, maternity insurance benefit and medical skill. Perhaps the chief of these requirements is medical

skill, for trouble arises principally in the abnormal case. It is within the power of the medical profession to make in this issue an invaluable national contribution to the safety of child-birth. It can only do so by the effective and adequate training of every medical student in Obstetrics and Pediatrics.

159. In 1919, the Royal Society of Medicine published a valuable Report by a Committee of its Section of Obstetrics and Gynæcology on the Teaching of these subjects to Medical Students in London.* The Committee report on the existing system of instruction as carried out by the London Medical Schools in pursuance of the recommendations of the General Medical Council in 1906—systematic lectures, practical midwifery (twenty cases), and clinical instruction—in hospitals with, and without, a students' midwifery ward. "The *systematic* instruction given is, generally speaking, satisfactory," they say, "and is in the hands of the obstetric physicians. The *practical* instruction leaves very much to be desired, and in some respects merits emphatic condemnation"—a view which confirms the criticisms in my official Report in 1918. The principal defects found by the Committee were the inadequacy in the number of obstetric beds, and the lack of ward-teaching in hospitals without obstetric wards, and in the lying-in institutions; recognition is given of "the great improvement which has followed the establishment of midwifery wards for the instruction of medical students" at certain hospitals (*e.g.* the Royal Free Hospital, St. Bartholomew's, St. Thomas's, and University College). But even where ward-teaching is provided the Committee find it insufficient, too brief, discontinuous, and in the hands of junior medical officers. The Committee make various recommendations for the improvement of these conditions. They desire to see obstetric "departments" in certain of the larger teaching hospitals, developed out of existing maternity wards providing a minimum of 75 beds each (50 for midwifery, 25 for gynæcology), and new obstetric "centres" in outlying districts of the Metropolis with 200 beds each (100 for labour, 20 for ante-natal conditions, 20 for isolation of infectious cases, and 60 for gynæcology). In both these kinds of institution the Committee advocate the instruction of medical students separately from pupil midwives, by senior officers, and in ante-natal, natal, and post-natal work. They make many useful suggestions and outline their requirements of a satisfactory scheme.

Recent Progress.

160. Though this report is valuable as expressing on the part of leading obstetricians both the need and means of reform it does not claim, of course, fully to represent the progress which has been made in recent years. The first necessity is an increase in the number of beds available for the teaching of medical

* Proceedings of Royal Society of Medicine, 1919, vol. xii, pp. 108–134.

students. Nine of the twelve hospitals attached to London Medical Schools have now obstetric departments with beds, and all of them have gynæcological beds. Such provision is still seriously deficient for the complete training of all London students requiring it, but progress has been made and several extension schemes are in contemplation. There are two directions in which this can be attempted. First, an increase should be made in the number of beds allocated to obstetrics in the teaching hospitals. It is wholly disproportionate that out of more than 5,000 beds in these twelve London teaching hospitals some 150 only should be devoted to midwifery and 300 to gynæcology. There can be no doubt that the governing bodies of these hospitals would be well advised to consider a gradual increase in the number of obstetric beds (at the cost, if need be, of medical or surgical beds) until each hospital has not less than twenty-five to thirty beds allocated to midwifery, which should, if possible, be reserved for the instruction of medical students. Secondly, the lying-in institutions might improve and enlarge their facilities for the instruction of medical students, and a certain number of beds could be directly used for educational purposes in the Poor Law institutions. There are difficulties, geographical and administrative, in using Poor Law institutions, but they are not insuperable.

Within the metropolitan area there are twenty-nine Poor Law hospitals and institutions containing 23,000 beds, of which 500 are set aside for maternity and in which 4,000 confinements took place in 1921. Some of these labour cases were used for the instruction of 130 pupil midwives and adequate provision should, no doubt, be made for their training, as well as for the 120 pupil midwives trained in the hospitals of the Medical Schools. But the claims and requirements of the medical student should come first. The opinion of the Chairman of the Central Midwives Board naturally carries weight on this question. " Cases of pregnancy, delivery, and lying-in are necessary for the education of midwives as well as students," reported Sir Francis Champneys to the General Medical Council in 1920, " and both midwives and practitioners are necessary for the State. But a large number of women who are trained for the Examinations of the Central Midwives Board never intend to practise as midwives, and the cases allotted to such women, so far as the primary requirements of the State for the safe delivery of women and their care during pregnancy and after delivery are concerned, are, in a sense, wasted. I showed last year that in some twelve years these amounted to no fewer than 356,420 cases."* At present only 22 per cent. of trained midwives actually practise. It is recognized that Sir Francis Champneys fully appreciates the situation, and it is difficult to see any satisfactory solution short of bringing more beds into educational use. In the present financial state of the country new and ample obstetric " centres " cannot be provided, and it is all the

* Minutes of General Medical Council, 1920, vol. lvii, p. 260.

more necessary that we should husband our present resources and use them economically and to the best advantage.

161. In the provinces also there has been a steady movement in favour of providing more teaching beds, but much remains to be done. The beds in the maternity hospitals at various places have been increased and about sixty new municipal maternity homes have been approved by the Ministry of Health since its establishment in 1919, most of which are used for the training of pupil midwives. One fact is clear, no substantial progress can be made in the teaching of Obstetrics to medical students until and unless the number of teaching beds is increased.

162. A second sphere in which substantial progress has been made is in regard to general organization. Closer supervision of the instruction and the devotion of more time to the subject are both important improvements. Several illustrations of different kinds of improved organization may be mentioned. At the School of Medicine for Women in London and at the Welsh Medical School two special University Clinics in Obstetrics and Gynæcology have been established under Professor Louise McIlroy and Professor Ewen Maclean respectively. The Midwifery Department at Edinburgh has been reorganized as a complete maternity Unit under Professor Watson (who has returned from Toronto). At Sheffield students attend the practice of the Jessop Hospital for Women for three months, whole-time, attending twenty labour cases in the hospital itself and witnessing many other deliveries. Each student usually sees all the common and many of the rarer abnormalities. At Manchester the student lives in the maternity hospital for a month ; at Bristol each observes 30 labours and sometimes as many as 50 ; at Birmingham increased hospital accommodation has been provided and the course made more practical ; at Dublin, for resident students, three months and for non-resident, six months at a lying-in institution are required ; at Belfast a course in pediatrics is also imposed ; at Guy's Hospital whole-time Obstetric Registrars have the sole function of advancing the teaching of Obstetrics, Gynæcology and Pediatrics ; at St. Bartholomew's and King's a period of four months is similarly employed ; and at St. Thomas's three months' whole-time study of Midwifery and Gynæcology has been the rule for ten years. In some Schools, however, there is urgent need for reorganization.*

163. The most significant educational advance which has recently occurred is, however, instruction in regard to the application of the principles of Preventive Medicine to Obstetrics in four respects, namely, ante-natal work, the conduct of labour, the prevention of congenital syphilis, and the care of the infant. The two last subjects are referred to elsewhere in the present Report (Venereal at p. 145, and Pediatrics at p. 134).

*A general review of the present position of midwifery in British medical schools will be found in a Special Report on *The Arrangements for Teaching Obstetrics, etc.*, by Janet M. Campbell, M.D. Ministry of Health Reports, No. 15, 1923.

164. For many years it has been the custom for pregnant women applying for admission to a lying-in institution to furnish particulars of their health, and when necessary to be examined some weeks before the prospective date of confinement. Some courses of systematic lectures also included brief reference to the importance of ante-natal supervision in the interest of mother and child. Thirty-five years ago, attention was first prominently directed in this country to intra-uterine death, and historically the movement in favour of *ante-natal supervision* sprang from the desire to reduce abortions and still-births. In 1907 the notification of still-births was established by law,* and the necessity of preventive care of the expectant mother came to be more generally recognized. Ballantyne and others have shown that adequate supervision of this kind does, in fact, substantially reduce the occurrence of still-births, and the early information gained as to morbid conditions conduces to normal pregnancy and safe delivery. It is now well recognized that systematic ante-natal observation furnishes important data as to the probable course of pregnancy and labour. Such measures as enquiry into the previous obstetric history, systematic examination of urine, pelvic measurement, careful estimation of disproportion between child and pelvis, and abdominal palpation to determine presentation enable many dangers to be foreseen and forestalled. Opportunity is also afforded for the early recognition and treatment of such morbid conditions as toxæmia or Venereal Disease; moreover, the general hygiene of the expectant mother can be safeguarded and she can be prepared for child-birth and nursing. Now all this is of essential importance to the mother and child, and there has recently been a widespread movement in its behalf. All the Medical Schools and maternity hospitals have made provision for the teaching and practice of ante-natal methods, and many ante-natal clinics have been established by municipal or hospital action, and increased supervision (ante-natal and post-natal) is exercised by midwives and medical practitioners.

165. How a co-ordinated three months' system of education, commencing with ante-natal study, actually works out in practice may be seen at St. Thomas's Hospital in London :—

The Department serves as an object lesson in the methods of Preventive Medicine applied to a section of the community and a much more correct perspective of the relative importance of the different parts of the work is obtained than was formerly the case, when the maternity cases were attended as an isolated event in the curriculum. The student now begins with the pregnant woman in the Ante-natal Clinic (two mornings a week) and learns the diagnosis and treatment of the diseases and disorders of pregnancy and how to avoid preventable difficulties in labour. The more serious cases admitted for further investigation and treatment afford opportunities for more detailed observation. The actual birth he is taught to look on not as the sole or even chief object of his study, but as merely a stage, though a critical one, and one calling for special care, in the life-history of mother and infant. For a month he is drilled in the examination and management of the woman in labour in the Maternity

* The records are published in the Annual Reports of the Ministry of Health *On the State of the Public Health.*

Ward (600 deliveries per annum) and learns the work with all the resources of the Hospital to his hand; then, for a couple of weeks, goes out in the district to apply those methods to the very different conditions he finds in the patient's own home. Throughout this service he is in close touch with the Social Workers of the Almoner's Department and thus acquires some acquaintance with the relationship of his professional studies to human society and the great social problems which he will soon discover to be pressing around him.

The second half of his term is devoted to the study of the Diseases of Women in out-patient and in-patient departments, where the results of the injuries and infections of childbed, which his previous training was designed to teach him to avoid, are seen, together with other ailments of the female reproductive tract.

By occasional visits to the Infants' Clinics he can follow the mother, watched during labour and lying-in, and her baby, whose early management he has studied, and if he proceeds to an appointment in the Children's Department, a further opportunity is afforded of learning the application of the methods of Preventive Medicine to the developing child and thus to the improvement of the physique of the race.

A course of Lectures is delivered during the second half of the Winter Session and the Summer Session, embracing the physiology and pathology of pregnancy, labour, and the puerperal state, and the injuries and diseases of the female reproductive tract. A course of Obstetric Demonstrations on the model is given three times a year.

166. Another illustration of the recent application of new knowledge is afforded in the improvements in the actual practice of the obstetrician at the time of labour, and this, too, has sprung in considerable degree from the growing appreciation of the importance of preventive methods. Mr. Eardley Holland has shown that of 300 dead fœtuses examined death was caused in 10 per cent. by toxæmia, in 16 per cent. by syphilis, in 23 per cent. by various maternal and other conditions, and in 51 per cent. by complications of labour, and he estimates that more than half of these children might have been saved by ante-natal treatment or improved technique in practical midwifery.* Both Mr. Holland and Dr. Francis Browne, of Edinburgh, have confirmed from their researches the importance of avoiding breech delivery by early version, of eliminating unnecessary forceps deliveries, of restricting the induction of premature labour to suitable cases, and of avoiding any intervention at the time of labour which may lead to puerperal infection Their recommendations have received general support. Dr. Eden has summarized four principles which should always be followed by the general practitioner in the conduct of delivery: (*a*) careful examination of the patient before labour; (*b*) a simple but complete antiseptic technique; (*c*) the avoidance of vaginal examination until expulsive pains occur; and (*d*) great restraint in resorting to operative delivery.† Now here we have both science and art in favour of a *thorough* education of the student in practical midwifery, an education which, as a rule, he is not at present receiving. He must be taught the absolute necessity of ante-natal work, surgical technique in the conduct of labour, the avoidance of precipitate

* Report to the Ministry of Health on the Causation of Fœtal Death. No. 7, 1922.

† *Lancet*, November 11th, 1922, pp. 998–1004.

intervention or operative procedure in normal cases, and the adequate after-care of mother and infant. He must also know how to deal practically and promptly with the abnormal case and the complication.

167. The problem and its solution have been clearly stated by Professor Thomas Wilson, of Birmingham :—

"The only possible way," he writes, "to reduce the deplorably high mortality and morbidity of child-bed lies in the better education of our students and midwives, and in the better supervision of women during and after pregnancy as well as at the time of labour. When treatment is only begun after a serious emergency has arisen, the mortality is high. A properly organized and staffed Ante-natal Clinic cannot fail to reduce this mortality by the discovery of these cases early enough to prevent the emergency developing; obstructed labour due to contracted pelvis or undue size of the fœtus can be forestalled; the toxæmia of pregnancy can be discovered long before eclampsia breaks out; and abortions and premature labours may be warded off and precautions taken to prevent them in future pregnancies.

"A more liberal provision of beds in hospitals and institutions is necessary, not only for the reception of first and difficult labours, but also for the observation and treatment of affections of pregnancy. I am further strongly of opinion that six or eight weeks after labour a careful re-examination of every patient should be made. Arising out of child-bed chronic inflammations and various displacements of the uterus form a very large proportion of the diseases peculiar to women; early recognition of these permits of easy and effective treatment, whereas neglect for a few months often leads to life-long misery."

A Scheme of Obstetric Teaching.

168. I turn now briefly to consider how the student is to be adequately trained. The General Medical Council recommends that during a period of at least two terms, in the three clinical years, he should have a course of systematic instruction combined with demonstrations and attendance on in-patient and out-patient practice, including ante-natal conditions and infant hygiene. Subsequently he should give "continuous attendance" on obstetrical hospital practice under competent supervision for three months, during at least one month of which he should be an intern student. During the three months he should also personally attend and examine twenty cases of labour under adequate supervision. Extern and district cases should not be taken until the student has personally delivered five cases in hospital to the satisfaction of his teacher.

169. In order to comply with this recommendation it seems clear that each Medical School must possess a complete Obstetrical Department (or have the facilities of such a department immediately available), and administer an effective, properly organized scheme of teaching. Such teaching should be undertaken by senior officers and not exclusively by junior teachers, should inculcate modern methods of practice and prevention, should cover the whole ground from ante-natal supervision to the proper care of the child, should fix a definite period of time to be devoted to such a course, and should be provided with the necessary facilities and equipment for teaching students

separately from pupil midwives. In arranging such a Course there are substantial advantages in considering together as one subject the three aspects, obstetrics, diseases of women and pediatrics, and in dealing with all three within the walls of the School or the general or special hospitals attached to it. Chemistry and physics, anatomy and physiology, pathology and pharmacology should all be integrated with obstetrics. The closer the association with the Medical School the better, and the more the obstetrical subjects are studied together within the same six months the better, following, as they must, the dressing and clerking in surgery and medicine.

(1) The Systematic lectures should deal with principles, and should be given by senior obstetrical teachers.

(2) The Demonstrations should include: (*a*) practice with the dummy fœtus and pelvis, the mechanism of labour, the use of instruments, operative procedure, etc.; (*b*) examination of urine, blood, milk and the stools of infants (normal and abnormal); (*c*) recent or preserved pathological specimens.

(3) The Clinical teaching should include instruction and practice in—

(*a*) Ante-natal clinic.
(*b*) Labour wards.
(*c*) Lying-in Wards.
(*d*) Infant welfare centres.
(*e*) Gynæcological wards and operating theatre.
(*f*) Out-patient department.
(*g*) The female venereal department.

The anatomy, physiology and pathology of Obstetrics and Gynæcology and children's diseases should be dealt with, and in the gynæcological department the results of bad obstetric treatment should be demonstrated.

(4) The Maternity District work should be effectually organized and supervised, and should not be commenced until the student has had clinical experience in the ward and himself delivered at least five cases in hospital. The fifteen or twenty cases taken on the district should as far as practicable be personally delivered by the student.

170. Dr. Eden has outlined the details of a possible Course extending over six months as follows:—

1*st Month.*—The student's principal work should be to receive practical instruction in the conduct of labour in the Labour Wards, where he would see a considerable number of deliveries carried out by others, and in the management of the mother and of the infant in the lying-in wards. In addition, he would attend a special series of lecture-demonstrations directed to the same end and he would also begin his attendance on the systematic lectures. He should also attend the Ante-natal Clinic and the Infant Welfare Centre; in the former he will learn best the diagnosis of pregnancy,

and in the latter he will learn the management of the infant from the pediatric physician.

2nd Month.—The student should be in residence in or near the Hospital, and in addition to continuing the work of the 1st month he should personally attend and deliver a certain number of women in labour under the supervision of his teacher. Five cases delivered under these conditions would be sufficient, and no student should be allowed to attend women in the District until this has been done to the satisfaction of the teachers. Clinical instruction in the complications of pregnancy and in the conduct of abnormal labour would be received during this month by the students in residence, from the Visiting Officers. They should be required to be present at all obstetric operations and all abnormal deliveries occurring in the Midwifery Ward. Attendance at the Ante-natal Clinic and the Infant Welfare Centre should be continued.

3rd Month.—During this month the student would attend his cases in the District; he might begin his attendance during the 2nd month when his five cases have been taken in the Midwifery Ward. An adequate system of supervision by the Obstetric Registrar and the Obstetric Residents is essential, and a weekly conference of resident students and resident staff with one of the Visiting Staff should be held, at which every abnormal case occurring in the District should be reported by the student in charge.

Lectures, demonstrations, etc., would be attended during the previous month subject to the requirements of his midwifery work, lectures, clinics. Although during the first three months the student's work would be chiefly Midwifery, he would have time frequently to attend Gynæcological Wards and O.P.

4th, 5th and 6th Months.—In these months the student would not be in residence and his principal work would be Gynæcology and Pediatrics. Clerkships in the Gynæcological Wards and in Gynæcological Out-Patients should be held for three months running concurrently. The Clerks should be taught: (1) to take the history of a gynæcological case; (2) to make the bimanual examination, opportunity of learning the examination under anæsthesia being made use of as far as possible; (3) to make a visual examination of the cervix with a speculum; (4) to carry out simple operative procedures such as diagnostic curetting, removal of polypi, etc. Pathological demonstrations of operation material should be given regularly either by the Operator or the Obstetric Registrar.

During these three months the student would also attend all Ward visits of the Visiting Staff, both Gynæcological and Obstetric, and would be present at all operative deliveries in the Midwifery Ward, so far as this is possible when he is not in residence. His attendance would continue on Systematic Lectures and Lecture Demonstrations, Ante-natal Clinics and Infant Welfare Centres.

171. Professor Watson, of Edinburgh, has rightly pointed out that if we in Britain are to keep abreast with other nations in regard to Obstetrics and Gynæcology, we must be prepared to give a fuller and more intensive training in midwifery to our medical students. Such training cannot be given by making attendance on a certain number of confinements at the patient's house the chief feature. Clinical medicine and surgery could never be taught in such a way, nor can clinical obstetrics. What is necessary, as Professor Watson claims, is more intensive training, so that the student may concentrate his study and live, as it were, in its atmosphere, seeing all the work of a Maternity Hospital, an ante-natal clinic, the technique of the labour room, the care of the newly-born infant, and the after-care of both mother and child. This is what he says :—

" It has long been recognized that most of the complications arising in pregnancy, in labour, and after labour are preventable. If they are

detected early they can be easily cured. In the case of most of them it is only when they have progressed, unrecognized and untreated, that they are dangerous. The progress which Midwifery has made in the last twenty years, and is destined to make in the next twenty, is along the lines of preventive medicine. Preventive medicine as applied to obstetrics means ante-natal care during pregnancy, a minimum of interference during labour, the most rigid attention to asepsis, and the earliest possible carrying out of surgical interference when it is required.

"Ante-natal care implies a thorough general examination of the patient as early in pregnancy as possible, and a special examination to make sure that she has the physical configuration necessary for a normal labour. It implies a careful watch on the patient at regular intervals throughout the pregnancy, and the immediate institution of appropriate treatment whenever the least departure from normal is detected. . . . . .

"The problem which faces us is to convince women generally of the necessity for ante-natal care. This, as I have said before, can only be done by the efforts and example of the whole body of medical practitioners. An isolated ante-natal clinic here and there will benefit the community which it serves, and public opinion will be educated to a certain extent, but it will not be until the consulting-room of every practitioner is an ante-natal clinic for his district that the maximum of benefit will be obtained."*

172. Finally, two essential clinical points remain. First, it is necessary that Midwifery should be taught at the bedside as fully as Medicine and Surgery are now taught, and, secondly, during his clinical instruction and practice careful records should be kept of the work done. In his report to the General Medical Council on the Final Examination in Obstetrics and Gynæcology, Sir William Smyly has drawn attention to the necessity of including a clinical examination (which has not hitherto been included by all Licensing Bodies). "The general impression made upon me by the candidates," he says, "was that they seemed to know more about Gynæcology than they did about Midwifery, and in the latter to be more at home in describing rare diseases, such as chorion epithelioma, than in common things, such as the management of abnormal presentations and the application of the forceps." And again, "In my opinion the obstetrical education of medical students is inadequate, and to have attended twenty deliveries, most and sometimes all of which were normal, no more fits a man to practise Midwifery than it would fit him to practise Medicine if he were to examine the hearts and lungs of the same individuals."† Hence, he claims that a clinical examination is essential, as it makes careful and thorough study necessary. Where such an examination is impracticable, at a prescribed date, owing to number of candidates or probable shortage of suitable patients, arrangements should be made to substitute for it examination in the ward during the course of study. The General Medical Council recommended in May, 1922, that, "In midwifery, where a Clinical Examination is not held, the duly attested records of the work done by the candidate in Clinical Midwifery must be presented to the Examiners for assessment in the Final Examination."

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* British Medical Journal, October 21st, 1922, p. 714.

† Minutes of General Medical Council: Inspection of Examinations, 1920-21, pp. 394-395.

XI.

PREVENTIVE MEDICINE IN MEDICAL PRACTICE.

173. "When the thoughtful historian gets far enough away from the nineteenth century to see it as a whole," said Sir William Osler, "no single feature will stand out with greater distinctness than the fulfilment of the prophecy of Descartes that we could be freed from an infinity of maladies, both of body and mind, if we had sufficient knowledge of their causes and of all the remedies with which nature has provided us. Sanitation takes its place among the great modern revolutions—political, social and intellectual. Great Britain deserves the credit for the first practical recognition of the maxim *salus populi suprema lex.*"* And by sanitation the Regius Professor at Oxford did not only mean "drains" and the removal of refuse and other nuisances; he meant the conquest of typhus fever in Britain, of malaria and yellow fever in the tropics, of plague and of cholera, of typhoid fever and of tuberculosis; he meant their conquest by knowledge of their cause and by improved environment. Others had seen the vision for centuries, dimly or clearly, but in our own day, in this very epoch of the world's history in which we live, there has happened this amazing thing—the fulfilment of the vision. For many centuries the ravages of disease have altered the fate of nations. But within the lifetime of men now living conquest has been achieved—*and it has been achieved by prevention.* Cholera, plague, typhus, typhoid, smallpox, tuberculosis and malaria have at last become controllable. They are not yet harnessed or completely controlled, because men and Governments have not been willing or able to fulfil the conditions of their control. But the conditions are known; we are not now any longer in the dark. We know (*a*) their cause, or (*b*) many of the circumstances which pre-dispose to them, and we know (*c*) the method of their reduction. It is this astounding fact which has given us the Golden Age of Medicine in which we live, and which, though unperceived, is rapidly changing the face of the world and the destinies of men.

174. Preventive Medicine stands therefore at the gate of the future. Of that there can be no doubt. How has it come there? Harvey, Sydenham and John Hunter did not foresee it; the early clinicians never dreamed of it; the pioneer surgeons did not foretell it. Yet they have all helped to lay its foundations. Every competent practitioner of Medicine is a builder of it, for

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* *The Evolution of Modern Medicine.* Sir W. Osler, 1921, p. 222.

there are three departments of knowledge involved in its construction: a knowledge of—

(1) The natural history of disease;
(2) The cause and circumstance of disease;
(3) The effect of environment upon disease;

and these are the direct concern of medical men. Now it is in our own day that the giants of the laboratory—Pasteur, Koch, Ehrlich—have unveiled the secrets of causation; and it is in our own day that the social reformers—Southwood Smith, Kay, Chadwick, Simon—have demonstrated the effect of environment. The natural history of disease, its diagnosis and prognosis, has been slowly built by the pathologists and clinicians for 300 years, and thus an intimate relation exists between the practice of medicine and the prevention of disease. Indeed, the practitioner has laid the foundations of Preventive Medicine, and in an age of laboratory advancement it is important not to forget this fact. We must avoid the false assumption sometimes made that the clinician has no part or lot in this great new chapter of Medicine—the direct contrary is the truth. Three centuries ago Harvey indicated for us the true experimental method; he placed the blood in the forefront of physical life and gave it a new chemical and physiological meaning, and by his demonstration of the circulation he provided a new conception of nutrition. Fifty years later, Thomas Sydenham, another practitioner, living in a "generation of the strongest and most active intellects that England has produced," laid the basis of epidemiology by his observation of cases, his power of analysis and comparison, his deduction of laws of prevalence. Richard Mead, the most successful of English practitioners in the first half of the eighteenth century, left behind him published works on poisons, on the plague and the methods of its prevention, on smallpox, measles and scurvy. Bradley and Rogers deduced from their general practice some of the principles of epidemiology, Fothergill described "putrid sore throat," and Heberden, chickenpox. Huxham, of Totnes, became an authority on the treatment of fevers, recommended vegetable dietary in cases of scurvy and defined Devonshire colic, which his medical neighbour, Sir George Baker, traced to lead in the vats and cider presses. Withering, of Shropshire, contributed to our knowledge of the epidemiology of scarlet fever, analysed water, was a climatologist and used digitalis. Edward Jenner, a practitioner in Gloucestershire, introduced vaccination. James Lind issued the first treatise on tropical hygiene. Thackrah, who practised in Leeds, defined industrial health problems and described dust diseases and brassfounders' ague, and Michael Taylor of Penrith was the first to elucidate milk-borne epidemics. Indeed, the eighteenth and nineteenth centuries furnish a remarkable record of clinical discoveries which prepared the ground for the study of causation and the influence of external environment in relation to communal disease. Further, these advances were made by the direct

association of prevention and cure in daily practice, by *clinical study*, by *observation* and by *reasoning*, and without the facilities of laboratory work, of instruments of precision or of modern experiment. Preventive medicine thus found its modern application and practice in the ordinary day-by-day work of the medical practitioner. Its foundations and its superstructure are *medical*, though engineers, analysts, administrators and municipal workers are its agents in certain communal fields of its application. But even to-day, when the broad principles of Preventive Medicine are understood by the lay public, and when the State and the Local Authority through special medical officers are engaged in carrying some of them out on a communal scale, much of the actual investigation and differentiation is falling to the medical practitioner. He is, and must remain, not only one of the principal interpreters of prevention to his patients and to the public, but he himself should be a discoverer and practitioner of prevention.

The Scope of Preventive Medicine.

175. There are, for practical purposes, three groups of maladies which come to the practitioner—infectious diseases, non-infectious diseases, surgical conditions. Preventive Medicine concerns all three, though obviously in varying degree and in different ways. The principal infectious maladies which occur commonly in private practice are measles, whooping cough, scarlet fever, diphtheria, intestinal infections, puerperal fever, tuberculosis and venereal disease. The toll which these conditions take in their incidence, their remote effects and their mortality, is extremely heavy, particularly in subsequent invalidity and incapacity. The application of the scientific method to the control of infectious diseases has built up a national system of dealing with them which intimately concerns the practitioner, for it includes :—

(*a*) the study and investigation of the causes, conditions and character of infectious disease, and its accurate and early *diagnosis* ;

(*b*) the prompt application of prophylactic methods (such as sera and vaccines) ;

(*c*) the notification of these diseases in order to ascertain their occurrence and whereabouts ;

(*d*) the effective isolation of persons suffering from them, and their treatment ;

(*e*) disinfection when necessary of clothes, other belongings, premises ;

(*f*) the detection and control of " contacts " and " carriers " ;

(*g*) the adoption of special methods of prevention, varying in different diseases (smallpox, diphtheria, tuberculosis, venereal).

Here is a great group of sickness, all of it really preventable if we chose to prevent it, and the medical practitioner is always first on the scene. Is it not desirable, and indeed necessary, that he should know what to be at ? Consider for a moment what is possible. Take diphtheria ; the anti-toxin treatment has prevented much mortality, for it has been reduced in the Metropolitan Asylums Board Hospitals from 29·8 per cent. in 1890 to 9·3 per cent. in 1922 (*i.e.*, 200 additional lives are saved in every 1,000 cases). Vaccination has reduced smallpox to a vanishing point, and has almost abolished it in Germany. Again, the death-rate from enteric fever in England and Wales in 1871 was 374 per million of the population ; in 1922 it was 12 per million. Or once more, the deaths from phthisis per million of the population in England and Wales have been as follows :—

Year.	Males.	Females.	Persons.
1847 ..	3,065	3,306	3,189
1867 ..	2,669	2,638	2,653
1887 ..	1,809	1,568	1,685
1907 ..	1,315	948	1,125
1921 ..	965	754	854

There cannot be any question that something very remarkable is happening to reduce smallpox, typhoid and tuberculosis in this way. What is happening is *prevention*.

176. For a long time it was assumed that infectious diseases, and particularly those of which we knew the *verae causae*, comprised the only sphere for preventive action. We now know, however, that there are many non-infectious morbid conditions which are also the effects of causes which are removable or reducible, and thus such disease is also preventable or its total mass of invalidity or mortality may be lessened. Abortion, miscarriage and still-births (say 30,000 per annum) are preventable conditions. Much infant mortality is preventable, and is being prevented (some of it, of course, is due to infectious disease). In 1851–60 the number of infants in England and Wales in every 1,000 born which were dead before reaching the age of one year was 154, and the figure remained stationary for half a century, but in the twentieth century it began substantially to decline and by 1901–10 it had fallen to 128. From 1911–15 it fell again to 110, and in the next five years to 90. In 1922 it was 77. This amazing decline is due to Preventive Medicine as expressed in the advance of sanitation, better nursing and improved infant management. The establishment of 1,900 Infant Welfare Centres where medical practitioners, nurses and others advise mothers in the care of infancy and the prevention of sickness is probably saving the country

many thousands of lives every year. Children's disorders such as ophthalmia, rickets, dental decay, and malnutrition are preventable, and the same may be said of many diseases of the skin, the eye, ear, nose and throat. The examination of recruits and of insurance patients (under the War Office and the National Health Insurance Act) shows that much physical impairment is due to the effects of rheumatism, dyspepsia, constipation, bronchitis, anæmia, debility, neurasthenia, heart disease, dental decay and mental disease. Some of these conditions are due to factors such as infection (fevers, rheumatism, tuberculosis, venereal, etc.), or degenerative processes, like arterio-sclerosis and nephritis, or fatigue and unhygienic living ; others are more obscure, but the great bulk of them are in large degree preventable.

177. There is a third group, surgical conditions, which seems at first sight to be less directly preventable. Surgery seems to be curative only. Yet the task of the surgeon is to serve and assist nature by placing the human body and its organs at her service, by removing obstructions from her path, by supplementing and aiding her processes, and by fortifying the body defences against infection or accident. All this is of the essence of preventive medicine. It is an alliance with nature against disruptive forces. Surgery finds its preventive expression in a great variety of ways. The fundamental principles of aseptic surgery are the elimination of sepsis, and its practice is repair, the removal of hurtful tissues and the avoidance of disablement. Preventive Surgery may be illustrated in a general way as follows :—

(*a*) Surgery in children's conditions—enlarged tonsils and adenoids, phimosis, hernia, ophthalmia.

(*b*) Surgery in deformities—rickets, tuberculosis, scoliosis, talipes, flat foot, hammer toe, fractures.

(*c*) General surgery—sepsis, tuberculosis, varicose veins, hernia, venereal disease, malignant disease, tumours, thoracic conditions, abdominal and genito-urinary surgery, gynæcology, dental caries.

(*d*) Industrial surgery—wounds, fractures, injuries, poisons, fumes, anthrax, tetanus, etc.

178. It is because of these direct and indirect, yet wide and numerous, applications of Preventive Medicine in infectious disease, non-infectious disease and surgery that the General Medical Council recommended in their new curriculum , " that throughout the whole period of study the attention of the student should be directed by his teachers to the importance of the preventive aspects of Medicine." The spirit of preventive medicine should *animate all the teaching* to students, and be illustrated in the treatment of cases. In fact, it is not so much a separate subject of the curriculum that is required as a pervading nfluence, an attitude of mind, permeating and guiding all clinical tudy and practice.

The Kind of Knowledge Needed.

179. Before we turn to consider the ways and means by which Preventive Medicine should be included in the curriculum, we must answer the question: What kind of knowledge is necessary for the general practitioner rightly to appreciate the part played by Preventive Medicine? We have already seen the wide scope of prevention in general medicine and surgery, and the student and practitioner alike should learn to approach such work in the preventive spirit. Then it must not be forgotten that Parliament has placed upon medical practitioners certain statutory duties which call for particular knowledge in certain specific directions—diagnosis and notification of infectious disease, official certification, the elements of sanitation; some knowledge of dangerous and offensive trades; the early diagnosis of mental abnormality; the medical treatment of the poor; and workmen's compensation.* These duties, which fall within the purview of the private practitioner and are exclusive of the public health service, must be taken into account.

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* Alongside the entrance of medical men into direct State service there has been constantly proceeding a further imposition by Parliament of statutory duties upon the medical practitioner. Apart from the fact that he may be called upon to undertake official duties in the public service, he is liable *under statute* in the following respects:—

1. He must certify births and deaths (Births and Deaths Registration Act, 1874), and notify all births within thirty-six hours (Notification of Births Acts, 1907–15); he must notify cases of infectious disease (Infectious Diseases Notification Acts, 1889 and 1899, and special notification regulations as issued), of industrial poisoning (Factory and Workshop Act, 1901), and of verminous children (Children Act, 1908). He must also be ready to vaccinate (Vaccination Acts, 1867–1907), and to certify the removal of infectious cases to hospital (Public Health Act, 1875).

2. He may be called upon to inspect and certify for house disinfection (Public Health Act, 1875, and Infectious Disease Prevention Act, 1890), and to issue certificates for the removal and burial of dead bodies (*Ibid.*).

3. He must be available to respond to the requirements of the local sanitary authority for the provision of medical assistance and treatment for the poorer inhabitants of the district in which he lives (Public Health Act, 1875, s. 133).

4. He may be required to inspect and condemn in regard to nuisances and insanitary house property (Public Health Act, 1875, or Amendment Act, 1907); or inquire into unhealthy or insanitary areas, or be appointed to act temporarily as Medical Officer of Health (Housing of the Working Classes Act, 1890).

5. He must know something of the ill-effect upon health of dangerous or offensive trades (Public Health Act, 1875), and of unsound food (Public Health (Unsound Food) Regulations, 1908).

6. He may be appointed medical attendant to a retreat under the Inebriates Acts, 1879–1900.

7. He must be competent to diagnose all forms of mental disease (Lunacy Act, 1890, and Mental Deficiency Act, 1913).

8. He may be appointed to carry out various duties under the Merchant Shipping Acts, 1894 and 1906.

9. He may be called upon to certify children under the Elementary Education (Defective and Epileptic Children) Acts, 1899, s. 1, and 1914, ss. 1 and 6.

[*Continued on next page*

180. The kinds of knowledge are in the main, therefore, these four: First, the student requires to have a standard of physiological health and capacity, attained by personal hygiene of body and mind. This great theme of *personal hygiene* has been strangely neglected in Medical Schools. There has been recognition from the earliest times of the need for a knowledge of normal human anatomy and physiology before morbid anatomy and pathology could be understood, but we have far too long sought medically to deal with the individual and the community without recognizing that there must be a normal standard of health to be defined by biology, anthropometry, and the estimation of physical and mental capacity; in a word an efficient and healthy man.* Everybody has some nebulous idea in his mind of such a standard, and sound data are being steadily obtained for a clearer conception. If every individual could forthwith practise a life of hygiene, in accordance with his own physiological and psychological faculty, a vast mass of functional disease would disappear in a month, and a great deal of preventive work for the individual and the community, now incumbent and imposed upon us as a nation, would be redundant and unnecessary. The practical basis of the work of preventive medicine is personal hygiene, its associated mental and moral factors, a knowledge of the laws of health, sound physiological living and the avoidance of slight, but habitual, departures from it.

Secondly, a fairly comprehensive grasp of the etiology of disease, whether infectious or non-infectious, is essential to any scientific understanding of prevention. The student is taught to

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[*Continued from previous page.*

10. He may be appointed as a Certifying Surgeon (Factory and Workshop Act, 1901, s. 122) and would thereupon become liable for various duties under that Act, particularly the detection of minor ailments and defects.

11. As Medical Officer of certain charitable and reformatory institutions he may be appointed Certifying Surgeon of such institutions (Factory and Workshop Act, 1907, s. 5).

12. He is liable for a series of duties in regard to workmen's compensation (Workmen's Compensation Act, 1906 and 1918), old age pensions (Old Age Pensions Act, 1908, and Treasury Regulations as issued), superannuation, and pension claims (Ministry of Pensions Act).

13. He may undertake service as an insurance practitioner under the National Health Insurance Acts, 1911–1921.

14. He may be appointed as a member of a Maternity and Child Welfare Committee (Maternity and Child Welfare Act, 1918, s. 2).

15. He may be called in by a midwife to assist in cases of emergency (Midwives Act, 1918, s. 14).

16. He must observe the regulations affecting the issue and dispensing of prescriptions containing such drugs as Cocaine, Morphine, etc. (Dangerous Drugs Act, 1920, s. 7).

17. The Local Education Authority may avail themselves of his services in connection with the treatment of children and young persons (Education Act, 1921, s. 80).

18. Lastly, the medical practitioner may be required, from time to time, to give certificates, reports, etc., for use in Courts of Justice or in connection with the public services or ordinary employments.

* *The Efficiency of Man and the Factors which Influence it.* By Professor E. P. Cathcart, M.D., F.R.S., British Association, 1922.

observe a phenomenon ; it would be well that he should always answer, or attempt to answer, the further question, *what is its cause* ? In many disorders an answer is now available ; in others, such as rheumatism, smallpox, scarlet fever, measles, influenza and cancer it is not yet ascertained, and the most that can be done is to define and understand the predisposing conditions. Preventive Medicine is a warfare against such causes and conditions, and the student must be definitely taught about them. Thirdly, to understand Preventive Medicine the practitioner must be able to appreciate the place and purpose of sanitation and a hygienic *environment.* In hospital he observes disease isolated from its local surroundings, and the tendency of his studies, except in out-door dispensary practice, is always to detach him from the home conditions of his patient. Yet it is housing, water supply, dietary, occupation, leisure pursuits, and personal heredity and habit which produce conditions which predispose to, or aggravate or mitigate, sickness. Further, he should know what can be done, and has been done, to change environment and so modify the incidence or character of disease.

181. Lastly, it is necessary to be able to evaluate the effect upon health and disease of *social evolution.* What has been the *medical* effect of the industrial revolution, or the introduction of steam ? of elementary education and religious liberty ? of the improvement of roads and transport ? of the rise and fall of wages and the cost of living ? of the importation of meat and corn ? of the growth of the towns ? Consider, for instance, the effect on the health of communities of improved transport in the last generation. It has made it possible for the town worker to live in the country ; it has revolutionized the dietary of the people by supplying home markets from the ends of the earth ; it has made climatological treatment and " change of air " practicable for millions ; it has placed the patient within easier reach of the doctor and the hospital ; it has brought New York and Cairo so near to London that they are within the incubation period of smallpox ; it has made an insulating sanitary cordon a necessary item in national policy. Think what rapid transport did on the Western front in the European War to carry food to the fighting line and quickly to bring back sick and wounded to the base. Or again, a moment's reflection makes obvious the intimate relation which exists between the social and personal environment of the patient and his illness—his home, his employment, his recreations, his sleep, his diet and drink, his clothing and habits, the company he keeps—there is no essential item of his social habitude or custom which does not affect his health, and, therefore, his doctor, and thus his doctor's training. Medicine is sensitive and responsive to all forms of social and racial evolution, and the wise student will not forget it. He should study for this purpose, not the classics of Hippocrates and Galen—not Avicenna's *Canon,* Galen's *Ars parva,* or the *Aphorisms* of Hippocrates—but the works of Simon, of Chadwick and of

Farr, not the history of the Renaissance, but that of the eighteenth and nineteenth centuries.* The movements and modification of disease are social and secular, and he who would interpret them must possess the sociological and historical spirit.

182. From these general propositions we may turn to name some illustrations of the chief articles of study, with suggestions as to their place in the curriculum (in brackets).

1. Meaning and Scope of Preventive Medicine. Its relation to other subjects of medical curriculum. Principles and methods of Personal Hygiene. (*Hygiene.*)
2. Administrative Applications of Preventive Medicine, and how to use them in relation to practice :—
   (*a*) Outline of English Local Government.
   (*b*) Outline of English Sanitary Law and Institutions.
   (*c*) Relation of Public Health and Poor Law Services to general medical practice.
   (*d*) Legal obligations of general practitioner.
   (*e*) Public Medical Services, their scope and purpose.
   (*f*) The principal contents of the Annual Report of the Registrar-General. (*Hygiene.*)
3. Maternity—especially ante-natal and post-natal supervision. (*Midwifery.*)
4. Medical Supervision of Infancy and its Physiology and Pathology. Nurture, management, feeding. The principles and elements of Pediatrics. (*Pediatrics.*)
5. Hygiene of the Child and School Hygiene—physical and mental. (*Pediatrics, Hygiene.*)
6. Adolescence, puberty, sex developments, physical training, juvenile employment. (*Hygiene.*)
7. Sanitation of Dwelling House.—The Housing Question. The relation of water supply to health. Nuisances. (*Hygiene.*)
8. Dietetics and Nutrition—food values, food poisoning, milk supply, specialized milks, pasteurization. (*Physiology, Hygiene.*)
9. Alcoholism—uses and abuses of alcohol. Industrial, dietetic, convivial drinking. Relation of excess to disease and accident. Clinical and pathological signs. (*Physiology, Pathology, etc.*)
10. Infectious Diseases and their Prevention—Etiology, channels of infection, clinical characters, course, atypical forms of all principal fevers, sequelae. Diagnosis, notification, isolation, treatment, disinfection, special methods. Principles of Epidemiology. Methods of investigation. (*Fevers, Hygiene.*)
11. Diseases of Animals communicable to Man—Tuberculosis, anthrax,

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* Among the general books which should be read by the student of Preventive Medicine are Creighton's *History of Epidemics in Britain*, and *English Sanitary Institutions*, by Sir John Simon. Other books which fall rather into a Public Health course are :—*A History of Factory Legislation*, by Hutchins and Harrison ; *The History of Trade Unionism* and *The State and the Doctor*, by Sidney and Beatrice Webb ; Chadwick's *Report on the Sanitary Conditions of the Labouring Population in Great Britain*, 1842 ; *The Town Labourer* (1760–1832), by J. L. and B. Hammond ; *The Industrial Revolution*, by Arnold Toynbee ; *The Health of the Industrial Worker*, by Collis and Greenwood ; *The Collected Writings of Dr. William Farr*, edited by Noel Humphreys, 1885 ; *Industrial Health and Efficiency* (Final Report of Health of Munition Workers' Committee, 1918), Cd. 9065 ; and selections from the current official reports of the Ministry of Health, the Home Office, the Medical Research Council, the Scientific and Industrial Research Committee and the Registrar-General.

rabies, tetanus, glanders, parasites, protozoa, etc. Means of communication and prevention. (*Pathology.*)

12. Prevention of non-infectious diseases—medical, surgical, obstetric. Conditions and influences leading to such disease. (*Clinical Subjects, Hygiene.*)
13. Serum Therapy. Smallpox, typhoid, tuberculosis, streptococcal infection, and diphtheria as types. Prophylactic and therapeutic sera. Manufacture, dosage, use and effects of vaccines and antitoxins. Immunology. (*Pathology, Pharmacology.*)
14. Health Insurance. Relation to medical practice, contract and private, and hospitals. Benefits and disadvantages. Administration. (*Hygiene.*)
15. Industrial Hygiene—Diseases and injuries of occupation. Industrial fatigue and sickness. (*Hygiene.*)
16. Medical-sociological Questions and Medical Ethics. The position of the Medical Profession: its governance and control. Brief sketch of its history. Relation to other professions. Duties to fellow practitioners. The State and the Doctor. Voluntary and State Hospitals. Labour and its conditions in relation to sickness. The Problem of Poverty. Pauperism in relation to disease. Crime, insanity, inebriety, suicide, their relation to disease. Social immorality. The venereal problem. Old Age Pensions, Army Pensions. (*Hygiene, Forensic Medicine.*)

Obviously, this is the merest outline of the ground to be covered, but even this sketch will make it clear that some sections of Preventive Medicine will be taught under one subject of the curriculum and some under another.

Ways and Means.

183. The General Medical Council in its new curriculum had in mind a dual presentation of the ever-widening subject of Preventive Medicine. First, the Council recommends that the subject should be a pervading influence all through the curriculum, affecting every subject in it, so that the student naturally and almost unconsciously adopts in his daily practice of medicine the attitude and spirit of scientific prevention. He acquires a ready preventive habit. As Horatio says in *Hamlet*, "Custom hath made it in him a property of easiness." Secondly, the Council recommends that definite courses of instruction should be given, concurrently with the later stages of clinical work, in Forensic Medicine, Hygiene and Public Health. These two recommendations follow the general arrangements now being pursued in Britain. A subsequent section of the present report is devoted to special training in Public Health.

184. The first of the recommendations just mentioned calls for consideration. When the General Medical Council came to explore the question of the teaching of Preventive Medicine raised in 1918, it found that no mere addition of a new subject, or the amplification of an old one, would meet the situation. Nothing but a complete revision and recasting of the whole curriculum would suffice, for it was perceived that what was required was that the spirit and methods of Preventive Medicine should permeate the student's entire study. Now this meant such a

re-formation of the curriculum as would provide (*a*) for an understanding of the knowledge recently acquired in regard to the causation and treatment of disease, and (*b*) for a new orientation and correlation of the constituent subjects of the curriculum in such a way as to give the whole of it a trend which would provide for the scientific application of prevention. Obviously, prevention is dependent upon a knowledge of causation, of early and thorough diagnosis, of prompt and effective treatment, and of avoidance of, or direct attack upon, causes or conditions predisposing to disease. The published Minutes of the Council are deeply instructive in making manifest the unfolding problem. The story begins with some simple questions concerning Preventive Medicine put by Professor Elliot Smith and Dr. J. C. McVail, but it ends in far-reaching debate, and of reform not of one subject but of the whole course of study. That is very significant. And this reform was not to be a revolution, but an evolution; it was not to be a break with the past, but its fulfilment; it was not to be palliation, but radical treatment of the curriculum—*an inherent alteration in its purpose.* It is hardly too much to say that hitherto the medical curriculum has been a collection of ten or twelve subjects, undirected and unrelated, "constituent parts of a meal thrown into a quart pot." It is now an organized diet, duly proportioned and designed so as to allow of digestion and to yield nutrition. It is not perfect, but it is re-formed. "The ideal curriculum cannot yet be established," wrote Principal Yule Mackay, of Dundee, "and it will be long before we are entitled to expect ideal results," because of immature students, overburdened teachers, inadequate equipment, the external conditions of teaching in hospitals, and the Examination Board. But it is now all of one piece and directed to one end—the production of a practical practitioner who appreciates prevention. The content has been altered, the sequence and co-ordination of subjects have been revised, there is a trend. For the science of Medicine is more than a combination of subjects; it is a philosophy as well as an art, both of them directed to a specific purpose. "It is the study of the end," said Aristotle, "that gives true insight."

185. First, therefore, of the ways and means of teaching Preventive Medicine is for teacher and pupil to see the subject as it really is, and not as it appears to be. No man can understand prevention without regard to the science and art of Medicine. The first step in the study of this subject is to give it a correct setting *among the clinical subjects,* for there it belongs. It borrows from the basic sciences and acts upon Internal Medicine, Surgery and Obstetrics; and it lends inspiration to them all. No longer is it to be considered a Cinderella, no longer a mere appanage of the curriculum, no longer "drains" and a nuisance. It has become the *ultimate* purpose of the whole. Hence, in the most enlightened Medical Schools, Preventive Medicine will become a part of all the other subjects of the curriculum. The causation

of heart disease, rickets, scurvy, the rheumatisms, alimentary disease, bronchitis, dental caries, blindness, nervous conditions, skin disease—these are to be explored, and especially in out-patient departments and dispensaries, their prophylaxis and amelioration are to be studied. In the wards, attention will be given to the causation of complications, disablements, and sequelæ, and, more thoroughly than hitherto, to after-care and convalescence. Disease will be followed to its lairs, and the "contacts" and "carriers" of infection traced and controlled. Surgery will be taught on preventive lines, and the same spirit will permeate obstetrics and gynæcology.

186. Secondly, whilst this comprehensive way of teaching Preventive Medicine is now coming rapidly into vogue, steps have recently been taken in many English Schools to reconstruct the arrangements for direct instruction. A short course of systematic lectures may be given, generally in the Summer term, dealing with public and personal hygiene, and covering a number of the matters to which reference has already been made (in para. 182). Laboratory and practical work are also undertaken in some Schools. The former includes elementary bacteriology and the laboratory work involved in applying the Wassermann-Bordet, Schick, Widal and other similar tests; the latter, which is practical "field" work, may comprise visits to maternity and child welfare centres, tuberculosis dispensaries, fever hospitals, and those places of public health interest in which the medical practitioner is directly concerned.* As a National Health Insurance Service becomes stabilized we may anticipate that it will prove an effective instrument in behalf of Preventive Medicine, for, by its means, the patient is brought early to the doctor, and in due time the doctor will have been trained to cultivate the preventive attitude and method. It is important that the direct instruction of medical students by means of special courses or lectures should not be overdone, nor over-weighted with Public Health.

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* Similar courses of study are now undertaken in the best Medical Schools in the United States of America and Canada. For instance, at Toronto in the first trimester of his fifth year the student attends two lectures a week on Hygiene and Public Health from the practitioner's point of view, communicable diseases being dealt with from the preventive aspect; Laboratory demonstrations in vaccination work and testing (Wassermann, Schick, etc.); and a month's practical work under the local Medical Officer of Health (child welfare, tuberculosis, venereal and school medical service).

XII.

SPECIAL SUBJECTS ASSOCIATED WITH MEDICINE.

187. Whilst the preceding pages set out the case generally, it is necessary before concluding this Report to add a few notes on certain special subjects by way of illustration of their content and position in the curriculum. They are not unimportant, but they are secondary and subsidiary to the principal question. Specialization is a large and debatable theme which cannot be discussed here. Yet, if misunderstanding is to be avoided, three observations must be made. First, the study of special subjects should not be undertaken until the fundamental subjects have been dealt with; secondly, no attempt should be made, within the minimum medical curriculum, to do more than handle the elements of the special subject, competence in which is necessary to the medical practitioner; and, lastly, the special subject should be taught not as something *ad hoc*, separate, but as an intrinsic part of the whole of Medicine.

Pediatrics.

188. During the last twenty years the regard of the State for the health of children has undergone a profound change. A hundred years ago, after the Napoleonic Wars and before the age of Factory Acts, the condition of the children of the workers was wretched. Mothers and children worked from twelve to fifteen hours a day under insanitary conditions, small children were often cruelly treated to keep them awake during the long hours of inhuman tasks, which shortened their lives or undermined their health. After the factory, there was all too often but a return to a dismal slum home and to inadequate and unattractive food, no schools, no playgrounds, and country life fast disappearing before industrialism. Fifty years ago came compulsory elementary education as an immense boon, and there quickly followed the great reforms of restricted employment of children under fourteen years of age and more careful regard for their health and upbringing. Much had been done voluntarily through the nineteenth century to respond to "the cry of the children," and before its end the foundations were laid for progress. The campaign against excessive infant mortality was followed by a worthy succession of enactments and enterprises by which the nation began the great business of child reform—hospitals were built for sick children, hygiene was taught and practised in the schools, the hungry child was fed and the verminous child cleansed, physical training was introduced, the defective child was cared for, school nurses and health visitors were appointed, infant welfare centres and milk depots were established, and school medical inspection and treatment became universal. The

result has been an immense saving of life and a steady improvement of the health and physique of children.

189. It is significant that alongside these great changes there was little or no advance in the special equipment of the medical student to deal with the growing child. Twenty-five years ago not one of the general hospitals associated with the London Medical Schools had a special children's department, with a child specialist in charge of it, and with few exceptions the position in the provinces was little better. The regulations of some of the Universities and Licensing Bodies now demand that before his final examination for a degree in Medicine a student must furnish evidence that he has attended a special course of instruction in Diseases of Children. In many Medical Schools provision is made for instruction and clinical work for those who desire it, *e.g.*, Edinburgh, Manchester, Birmingham, Sheffield, Newcastle and some of the London Schools. At Leeds there is a Children's Department at the Infirmary with a "nutrition" section; at Sheffield and at Belfast attendance in the Children's Clinic is required for three months, and in the latter, at Queen's University, the subject is included in the Final Examination; at the Children's Hospital at Edinburgh some twenty-five years ago, clinical instruction in children's diseases was organized, which included physiology and physical signs, the principal diseases and clinical pathology, but the course, which covered three months (about sixty hours), was not compulsory. Some of the best recent work in this subject has been accomplished by Dr. Leonard Findlay at Glasgow, and here attendance is now required from the student. In London particular attention is given to the subject at St. Thomas's, St. Bartholomew's, and Guy's Hospitals. At St. Thomas's Hospital the Children's Department forms one of the special departments of the hospital and consists of a children's ward of eighteen beds and an out-patient department. Its function is both prevention and treatment. It is linked up with the Maternity Department and thus covers the child's life from birth to the fifth year. Infants born in the maternity ward or in the "district" are brought to the clinic and the student is instructed in the feeding and management of the normal child. When one year old the child attends an "extension" clinic for minor ailments. The Department registered 22,000 total attendances in 1922. A children's out-patient department is held daily, and special clinics have been arranged by Dr. Jewesbury for congenital syphilis, rickets and rheumatism. The mothercraft Training Centre at Trebovir Road is associated with the Department, and under its direction, which thus provides for the study of the normal child and the prevention and treatment of children's diseases. Students are now required to hold appointments in this Department for three months, and are thus provided with every facility for effective training. At St. Bartholomew's there is a Children's Out-patient Department in charge of a member of the Medical Staff. Infants and children are admitted

to the general wards, though there is a demand for the creation of a special infants' ward and a children's department, under a pediatrician. Every student undertakes three months' clerking (with which are associated demonstrations) for child out-patients, making perhaps twenty afternoon attendances. Associated with the hospital is a consultative infant welfare centre. At Guy's Hospital pediatrics is taken in conjunction with midwifery during the last six months of the clinical course, and the student attends the out-patient department and the children's ward for clinical instruction. He also gains some experience of the diseases of infancy in the lying-in ward and the associated infant welfare centre.

190. In the United States of America and in Canada, it is almost universally demanded of the student that he shall attend certain specified courses of instruction and that he shall be examined particularly on this subject for his degree. The whole subject is treated as one of great importance, both as a science and an art, and is separately organized under a University Professor much more elaborately than in Great Britain. At Toronto the course in Pediatrics under Professor Alan Brown is taken during the last two years of the curriculum and consists of: (*a*) thirty-two clinical lectures dealing with the physiology and pathology of digestion in infants, methods of feeding, deficiency diseases, skins, cardiac diseases, tuberculosis, syphilis, rheumatism, nephritis and the acute conditions of the new-born infant; (*b*) bedside and out-patient work, child welfare clinic, milk-modifying laboratory, etc. In the out-patient department of the Children's Hospital is a municipal welfare centre where the student studies healthy infants, ante-natal supervision and social pediatrics. The course is co-ordinated with all the Children's Clinics in Toronto and the subject is included in the Final Examination. A somewhat similar course is established at McGill. At Harvard, the course in pediatrics takes place during the last three years of the curriculum. At the end of the second year six lectures are attended on infant feeding to familiarize the student with the subject before he comes into contact with patients; in the following year he attends clinical lectures in hospital on children's diseases and works in the out-patient department; and in the last year he clerks for a month in the children's ward. At Johns Hopkins University, Baltimore, pediatrics is included in the last two clinical years, first in the form of lectures on the growth and development of the infant and its nutrition, and subsequently by attendance at a weekly clinic throughout the year dealing with the diseases of children.

Reorganization of Pediatrics.

191. The General Medical Council has now placed pediatrics foremost among the special subjects to be incorporated under the teaching of Internal Medicine, and consideration is being given

to its reorganization by the educational authorities of the Medical Schools. I have been impressed with the widespread criticism among medical practitioners concerning their insufficient equipment to deal with the diseases of infancy and childhood. In some medical schools students are almost without training in pediatrics, yet of its importance to the general practitioner there can be no question—in private or in public practice new and enlarged responsibilities are now imposed upon him in this matter, and certain changes in the presentation of the subject seem inevitable. First, it should be treated separately from Internal Medicine; the child is not merely a diminutive adult requiring similar study to that of the adult. The child constitutes a different *kind* of problem, in physiology, in medical education and in practice, and the subject should receive particular attention. The principles of physiology are the same in the dog, monkey, and man, but the problems raised are different. Secondly, attached to or associated with every Medical School there should be a Department of Pediatrics dealing with what may be termed the systematic or scientific aspects and with the applied aspects of the subject. The former will include instruction in the growth, development and nutrition of infancy and childhood, and the latter will concern practice in care and treatment. In a word, the normal child and its feeding and upbringing must be dealt with as well as the diseased child. Thirdly, a definite period of time in the curriculum during, say, three months, should be allocated to child study. It should follow obstetrics (which follows in its turn medical and surgical clinical work), and jointly they may well extend over a period of six months, an arrangement which has among its advantages the opportunity for the student to observe the growth of a child for that period. Fourthly, some questions relating to pediatrics should always be included in the final examination, either in separate form, or in the papers on Medicine or Obstetrics. A pediatrician should be included in the panel of Examiners, and a clinical and oral examination in the subject should be provided.

192. These requirements seem to be the minimum necessary in order to bring pediatrics into its proper status, and they already obtain in several Universities. They are matters not of innovation but of organization. A final and more important element in such reorgniazation is the content of the teaching to be given. Judged from recent experience in this country, it is suggested that pediatrics should be understood to deal with infancy and childhood to the age of, say, ten to twelve years, and its study should comprise :—

(i) A few lecture-demonstrations on the anatomy and physiology of the child and their clinical application, the hygiene of infancy from the moment of birth, mother's milk and its substitutes, breast feeding and its periodicity, nutrition, digestion and infant metabolism, growth and development.

(ii) Clinical instruction in the children's ward and in the out-patient department, clinic and dispensary. Such clinical work should include :—

(*a*) methods of physical examination (including case-taking, normal and abnormal stools, vomit, etc.) ;

(*b*) minor ailments and their prevention (oral sepsis and earache, flatulence, indigestion, diarrhœa, constipation, skin troubles, complications of teething, insomnia, the pre-tuberculous child) ;

(*c*) common diseases of children—diseases of new-born, rickets, broncho-pneumonia, rheumatism, convulsions, heart disease, nervous disorders, nephritis, diseases of skin, malnutrition, infectious diseases. Relation of child disease to impairment of health in adult life.

(iii) Applied pediatrics—modification and pasteurization of milk, vaccination, methods for reduction of infant mortality, infant welfare centres, infant clinics, crèches, nursery schools, the school medical service and the purpose of the school nurse and of school feeding, the training of the child in practical hygiene, the protection of eyesight, nursery hygiene, the design and management of a children's hospital, the open-air school and heliotherapy, the children's sanatorium.

Throughout the student's study of pediatrics the simple and minor medical problems of daily life should come first, and the theoretical and practical instruction should be appropriately co-ordinated. Systematic pediatrics (as taught in America), and child welfare (as practised in England), should be associated together, for they are mutually complementary and inter-dependent. Hitherto, they have been almost divorced.

Psychology and Psycho-Pathology.

193. The general practitioner stands in somewhat peculiar need of knowledge of mental conditions. He must first know the normal mind and its development, then the unbalanced and neurotic mind, then the signs of true mental deficiency, and lastly, the various forms of mental disease. His need in these respects becomes obvious to him at the outset of practice, for mental factors play a part in almost every case of illness. All functional disease may be modified by the mind of the patient, functional nervous diseases are governed by it, and mental disease is its ill-health. Pure psycho-neuroses or bodily derangements coloured by a psycho-neurotic element will provide the general practitioner of medicine with a very large proportion of his most difficult cases. Yet at present we teach the student

nothing of the make up of the normal mind; we give him no help in separating the false from the true in the wordy strife as to the nature, etiology and treatment of psycho-neuroses.

194. Bethlem Hospital (the Bedlam of Shakespeare) was founded in 1247, and began to admit the insane in 1377. But the history of the scientific treatment of mental disease dates only from Philippe Pinel and William Tuke. Pinel began his medical work at the Bicêtre in Paris at the time of the French Revolution, and produced his famous book in 1801. William Tuke, a Quaker merchant at York, founded the Retreat in that city in 1792 from benevolent motives. Both men independently practised a form of sympathetic and intelligent treatment of the insane instead of mere incarceration, though it was not till 1806 that Tuke became acquainted with Pinel's methods. Early in the nineteenth century began the study of the pathology of mental disorders, and during the last forty years immense progress has been made in placing the subject upon a scientific foundation. There are now in England and Wales upwards of 400 public asylums and mental hospitals with upwards of 120,000 patients (22,000 new admissions yearly), and in many of these institutions modern pathological, clinical and therapeutic methods are applied. As in pediatrics, the advance of medical education has followed this progress somewhat tardily. Practically every Examining Body requires its candidates to furnish a certificate of instruction in mental diseases and prescribes attendance at an asylum, but only a minority actually include the subject in their examinations. At Liverpool, Manchester and Bristol, it has been the rule to put a short separate paper on this subject, and at one or two other places a question may be included in the paper on Medicine. At Durham for many years past there has been a clinical and oral examination of a thorough and practical kind. For example, a case of dementia, melancholia, imbecility, or delusional insanity is placed before the candidate by the warder with the history of the case, and the candidate is required to examine the patient and furnish a diagnosis and prognosis, filling in the necessary certificates in lunacy. He is then subjected to an oral examination on the patient, or more generally. A similar examination takes place at Dublin. The rarity of these examinations is one of the contributing factors to the rather frequent neglect of education in mental diseases in England.

195. What is really necessary for the general practitioner in this branch of knowledge? The answer, I think, is clear. He must in the first place be given a clear account of the content of modern psychology, in language free from the mere technicalities of provisional hypotheses. He must be shown what truth has been admitted by all schools of psychologists to lie in the concept of the Unconscious Mind, to what extent valid inferences as to the idiosyncrasy, the personal peculiarities in the make up of the normal mind, can be deduced from a self-study of normal psychological phenomena, tricks of conduct,

lapses of attention, dreams. He must be told how far deductions from the study of abnormal but not insane patients justify inferences as to therapeutic measures. He must be equipped for miscellaneous medical practice and emergencies, and he must be competent to diagnose all the chief forms of mental disease and defect (Lunacy Act, 1890, Mental Deficiency Act, 1913, Elementary Education (Defective and Epileptic Children) Acts, 1899 and 1914). The certificates under these Acts necessitate a diagnosis, a record of the clinical grounds for it, and in some cases the medical reasons for detention or custodial care. Excluding the needs of the specialist (for whom a Diploma in Psychological Medicine is available) these requirements are sufficiently exacting to render necessary the proper education in this subject of every medical student; and it should be practical and the subject of examination.

196. Such instruction should have special reference to the minor psycho-neurotic disorders, many cases of "dyspepsia," of "asthma," of "neurasthenia," of "neuritis," of "nervous exhaustion," which are responsible for much misery and invalidity; it should not deal in controversial issues, the advertisement or the denunciation of particular therapeutic technics. The maintenance of a high degree of mental health and capacity in the population is a primary national asset; and therefore it is of importance that mental inefficiency and impairment should be prevented, that the earliest departure from the normal should be detected, that conditions favourable to mental illness should be removed, and that prompt and effective treatment should be available. "The hope of reducing the amount of insanity in the country lies," said the Board of Control in 1917, "more in the steps that may be taken *for preventing the occurrence of the disease and for its treatment in the initial stages* than in improved methods of treatment when the disease has become confirmed." This is the opportunity of the general practitioner. It is he who can first deal with mental disorder, because it is he who should first know of its beginning. The mental hospital deals mainly with advanced disease or end results, the practitioner should meet with incipient conditions. But his undoing is his helplessness *because of his lack of training.* He has often been taught in a perfunctory and theoretical way regarding the gross forms of melancholia, mania or dementia, but he has not had the whole subject presented to him in a broad and comprehensive way as something which *may* concern the recovery of every patient who consults him. Such is mental disorder, of all grades and degrees, from backwardness or dulness to insanity, from mental disease which is nervous in origin to nervous disease which is mental in origin; it is the whole psychological field, physiological and pathological, which must be viewed as one problem, and into that field, in some degree,may come every patient. The practitioner should not wait for mental disease to mature and develop before he recognizes the psychological factor. He is

taught to think of the action of the heart in every patient that lies before him. Should he not likewise consider the action of the mind ?

197. This approach means that the subject is twofold, psychology and psycho-pathology. The former should belong to physiology in its wide sense, and its elementary study may be included in that subject, as at Manchester under Professor Hill and Professor Pear ; the latter is the morbid aspect and falls within the clinical years. Between the two, or as part of either, may well come a brief course of a few lessons in medical psychology, with particular reference to psycho-neuroses, with instruction as to the examination of patients, the practice of suggestion and persuasion, psychological analysis, and mental testing. To these courses would be added clinical work, first in a mental hospital and then in the out-patient clinic for nervous and mental disorders at the general hospital. The curriculum in mental diseases which I suggest would thus be as follows :—

(i) A short course of Lectures (5-10) in Normal Psychology, preferably as part of the Course in Physiology (reflexes, habit, instinct, emotion, intelligence, the conscious and the unconscious mind, Binet tests, investigational methods, etc.).

(ii) Half-a-dozen explanatory discourses in Abnormal Psychology, to be taken concurrently with clinical work in mental disease.

(iii) Ten or twelve systematic lectures on Mental Disease, concurrently with clinical work, and clinical demonstrations at a Mental Hospital of in-patients, pronounced cases (recent or chronic) and the usual types of insanity.

(iv) A series of demonstrations in the out-patient clinic for nervous and mental disorders at the general hospital.

What the student needs is instruction in the etiology, symptoms, diagnosis, treatment and prognosis of the morbid mental states most commonly met in general practice. The student must also be trained in case-taking, the examination of patients, dealing with relatives of patients, certification, precautions, etc.

198. The following statement comprises suggestions as to the principal sphere of psycho-pathology for the medical practitioner. Its purpose is merely to set out in schedule form the main points and their mutual relationship.

" *Unsoundness of Mind,*" as a comprehensive term, including mental deficiency and mental disorders : conception and etiology of—including the biological aspect ; physical and toxic factors and the relation of endocrine disturbance ; and such mental factors as mental trauma, prolonged mental stress, the repression and operation of " complexes," and sub-conscious states. The relation of Psychological to General Medicine. The preventive importance of the foregoing considerations.

Mental Deficiency.—Degrees of, as defined by Statute. " Stigmata "

of degeneration. Sociological importance of "Moral Imbecility." Distinction between mental deficiency and backwardness. Recognition of the more important clinical forms. Principal lines of treatment, supervision and training.

Mental Disorders—including the Psycho-neuroses and the more important of the Psychoses. The Symptomatology includes Insomnia, Confusion, Delirium, Hypochondriasis, Depression, Agitation, Exaltation and Excitement, Illusions, Hallucinations and Delusions, Sexual perversions, etc.

(*a*) *Psycho-neuroses* :—Hysteria, Anxiety Neurosis (including possible relation to Exophthalmic Goitre). Neurasthenia. Obsessional states.
Their symptoms, diagnosis, prognosis and treatment.
Differential diagnosis between so-called functional and organic conditions.

(*b*) *Psychoses.*—General Paralysis—its etiology, early symptoms, course, prognosis and treatment.
Mental Disorders in connection with Epilepsy.
Dementia-Præcox, Paraphrenia, Paranoia, and Manic-Depressive Psychosis—outline of these conceptions and group forms and of their respective phases, with symptoms and treatment of the earlier stages.
Confusional Psychosis (states of confusion and delirium)—toxæmia, exhaustion, and other etiological factors; symptoms; diagnosis; prognosis and treatment; multiple foci of infection.
Alcoholic Psychoses.—Delirium Tremens, Chronic Alcoholic Hallucinosis, Alcoholic Paranoia, and Polyneuritic Psychosis. Alcoholic excess and other psychoses.
Drug-habit Psychoses.—Morphinism, Cocainism, etc.
Arterio-sclerotic Psychosis—especially its earlier symptoms and their treatment, and Senile Dementia.
Traumatic Psychoses, and others associated with organic brain disease.
Endocrinal Psychoses.—Myxœdema. Exophthalmic Goitre, Acromegaly, etc.

(*c*) *Epochal and other "Critical" Influences.*—Puberty, adolescence, climacterium, and senescence; gestation, puerperium and lactation. The relative likelihood, at each of these periods, of the onset of one or other of the Psychoses. The milder mental disturbances, not amounting to a psychosis, liable to be associated with each period, and the treatment of these disturbances.

199. It is not practicable to lay down in precise and narrow terms the allocation of each part of the subject in the curriculum suggested (in para. 197) owing to differences of equipment and local circumstance. We have unfortunately no psychiatric in-patient clinic in England, apart from the Maudsley Hospital* and the new clinic at Bethlem Hospital, both in London; hence

* The foundation of the Maudsley Hospital by the London County Council was initiated by the munificence of the late Dr. Henry Maudsley. It is the first fully-equipped institution in this country on the lines of the Neurological and Psychiatric Clinics of Europe and America, which are designed for the combined treatment and investigation of organic nervous disease, neuroses and incipient psychoses (early and recoverable types of mental disorder). The hospital is also designed to afford opportunities for the study of Psychological Medicine, especially by qualified practitioners. It will provide 157 beds for In-patients and an Out-patient Department.

our Medical Schools are not yet provided with the equipment necessary for the proper instruction of the student. Even the fulfilment of the restricted scheme outlined above necessitates the existence near to the Medical School of a mental hospital and the collection of suitable early mental cases in the out-patient department of the general hospital—conditions not invariably obtaining. Advantage should be taken of the 200 Special Schools for Mentally Defective Children which now exist, and which accommodate 16,000 children and include twenty residential schools. Some of these schools will be found available and conveniently situated for instruction of medical students in mental testing, diagnosis, education and treatment. Short courses in these subjects have been arranged by London University for medical practitioners.

Ophthalmology.

200. The medical practitioner meets with Diseases of the Eye in two aspects, local and general. Both of them are so important that ophthalmology cannot well be considered a specialty in any narrow sense. Every student should be sufficiently informed in the subject. For the care of the eye is necessary at the moment of birth and throughout life. *Ophthalmia neonatorum* has been notifiable since 1914, by the practitioner or the midwife, and the average number of cases returned annually is approximately 8,000 or 1 per cent. of the births. In some districts 5 per cent. of new-born infants show signs of ophthalmia, and to it has been attributed much blindness.* In childhood, too, there are many instances of eye trouble, blepharitis, conjunctivitis, eye-strain, errors of refraction, myopia and squint ; and not less than half a million school children in England and Wales are under medical supervision every year for these conditions. In adolescence and adult life also eye disease is frequent, as is indicated by rejections for the army and industry, and by the large attendance at ophthalmic hospitals for foreign substances in the eye, for penetrating wounds, blows and other injuries, for eye-strain and defective sight, and for many acute diseases of the eye. Morbid conditions of the eye in general disease are, perhaps, of even greater importance, especially from an educational point of view. A defect or disease of the eye itself may, in many cases, be properly referred to the oculist, but such reference is less practicable when the condition of the eye is part of a general disease. Thus in the clinical study of certain toxæmias, renal disease, some of the anæmias, syphilis, diabetes and lead poisoning, the examination of the eye may be necessary to correct diagnosis ; and this is even more so in many of the diseases of the nervous system, cerebral

* Departmental Committee on Causes and Prevention of Blindness, 1922. For methods of prevention, see *On the State of the Public Health*, 1920, pp. 31–33.

tumour, cerebro-spinal fever and meningitis. These facts confirm the findings of Frank the Bavarian in 1780, James Ware in 1812 and Lorinser in 1836, the pioneers who first drew attention to the far-reaching importance of defective eyesight. Four years after the publication of Lorinser's book school doctors were appointed in certain training colleges in Sweden, but in England we have been slow to learn the consequence of eye disease and equally slow to appreciate the necessity of educating our medical students in this subject.

201. In 1879 some of the principal ophthalmic surgeons petitioned the General Medical Council in favour of a compulsory three months' course in practical ophthalmology, and contrasted the English neglect of training in this subject as compared with continental universities. The Council approached the Licensing Bodies, who expressed the opinion that "it would not be desirable" to require students to attend special courses in the subject or make ophthalmic surgery a distinct subject of examination. The Ophthalmological Society petitioned again in 1891 without success; but in 1910 the General Medical Council adopted a report of its Education Committee as follows:—

> "In the curriculum of all the licensing bodies, with three exceptions, special courses on Ophthalmology form an essential part. The Committee are of opinion that every student of medicine should receive some special instruction in the subject. The Committee do not think it necessary to insist that every student should be examined in ophthalmology, but they are of opinion that all students should be liable to be examined in some branch of the subject."

Nine years later the Council resolved:—

> "That every student should be required to attend a course of practical instruction in *Ophthalmology* of not less than ten weeks' duration, and that no student should be admitted to the Final Examination unless he presents a certificate to the effect that he has attended such a course regularly, and that his work in connection therewith has reached a satisfactory standard."

Finally, in the new curriculum of 1922 the Council resolved that in every course of professional study and examination for qualification for the medical profession there should be included instruction in diseases of the eye, refraction and the use of the Ophthalmoscope.*

202. It must not, however, be assumed that this subject has been altogether neglected in the past. For many years attendance by the student at ophthalmic classes or clinics has been recognized by many of the Licensing Bodies, the subject has been included in the examination as part of general surgery, and special qualifying examinations conducted by ophthalmic surgeons have been carried out at Oxford, Cambridge, Manchester, Birmingham and the Irish Medical Schools. At Edinburgh, Glasgow and St. Andrews, before admission to a qualifying examination, candidates have had to be certified as having passed specified class examinations in

* The Departmental Committee on the Blind, which reported in September, 1922, strongly recommended that every medical student should be trained and examined in ophthalmology.

ophthalmology. It is a uniform and regular system of instruction and practical examination which has been lacking, and to this defect Dr. Tooth and Sir Hector Cameron call attention in their Inspection of Examinations.* What, in view of an overcrowded curriculum, is reasonable in this matter? In answer to this question, I may quote Dr. Maitland Ramsay's advice to the General Medical Council:—

> "It is a general practitioner's knowledge of the subject that is required," he says, "and therefore the medical student should be discouraged from considering ophthalmology as a separate entity. He must be taught to regard diseases and injuries of the eye as a part of general medicine and surgery.
>
> The time at the disposal of the undergraduate is very short when considered in relation to the number of subjects he requires to study. Consequently, he cannot be expected to devote more than one term to ophthalmology.
>
> The class in ophthalmology should be taken during the fourth or the fifth year of the Medical Curriculum. The arrangement of the work, the scope of the teaching, and the number of attendances required will vary in different schools, but from twenty-five to thirty meetings of the class should be regarded as the minimum course of instruction.
>
> The class should be held in the dispensary and the wards of the Eye Infirmary, or in the Ophthalmic Department of a General Hospital. The teaching should be clinical, and the number of students attending the class ought to be limited.
>
> The actual clinical work of examining and treating patients should be supplemented by a few lecture demonstrations."†

Dr. Ramsay also advises close co-operation between the teacher on ophthalmology and the professors of medicine and surgery, and he recommends that "every student should buy an opthalmoscope, and after he has been taught how to use it in the ophthalmic clinic, he ought to be encouraged to perfect himself in the use of the instrument in the medical wards, and trained to examine the fundus of the eye as part of a routine clinical examination." The student would also be well advised to see something of the treatment of ophthalmia neonatorum in hospital or infant clinics, and of squint and errors of refraction in school clinics, myope classes, etc. The Licensing Bodies are at present engaged in organizing courses extending over three months, and all students may now anticipate an examination in practical ophthalmology conducted by ophthalmic surgeons.

Venereal Disease.

203. The wide and anxious attention recently devoted to the subject of Venereal Diseases is due to their prevalence and far-reaching effect, and to the new forms of treatment which emerged on the brilliant discoveries of Schaudinn, Bordet, Wassermann and Ehrlich. Arsenical compounds have been proved to be

* Minutes of General Medical Council. Inspection of Examinations, 1920–21.

† Min. of Gen. Med. Council, 1922, vol. lix, p. 251.

as specifically therapeutic and prophylactic in syphilis as quinine in malaria and their application now falls within the daily routine of medical practice. Moreover, following the recommendations of the Royal Commission on Venereal Disease, 1916, the State has now established 190 Special Clinics where free treatment of these diseases is provided, and these clinics have been available for the education of the medical student. The subject is now compulsory, and many courses of training hitherto partial, casual and indifferent are being reorganized. Whilst it is not desirable to lay down in hard and fast terms exactly what such courses should comprise, the experience at the Venereal Clinic at St. Thomas's Hospital, London, under the directorship of Colonel L. W. Harrison, suggests the following:—

(i) The course should follow bacteriology and pharmacology, and should be included in the third or fourth years of the curriculum.

(ii) It should consist of demonstrations, lectures and clinical work.

(iii) Colonel Harrison advises the following minimum:—

(*a*) Twelve combined demonstrations and lectures, the latter occupying about half the hour on each occasion.

(*b*) Twelve finished reports on cases of Venereal Disease, the reports to include all necessary microscopical examinations.

(*c*) Attendance at four demonstrations on administration of anti-syphilitic remedies and taking of blood specimens.

(*d*) Attendance at three demonstrations on the simpler measures employed in the treatment of gonorrhœa (*e.g.*, irrigations, injections and prostatic massage). These could be taken at the same sessions as (*b*).

(iv) It is suggested that students should begin with microscopical methods and the collection and examination of specimens in the laboratory. The correct interpretation of laboratory reports is essential. Then follow the clinical methods of the complete and systematic examination of the patient. Lastly, come the lectures, which should deal with the whole subject: laboratory work, clinical examination, differential diagnosis, treatment—syphilis, soft chancre, gonorrhœa, with their complications and sequelæ.

204. In addition to the direct work indicated in such a scheme the student should also be led to see and understand the wider issues of this subject, of which two illustrations may be mentioned. Galliot, Adams, Findlay and others have shown the significance and possibilities of ante-natal treatment of syphilitic pregnant women with salvarsan or its substitutes. By this method

Adams, working at Thavies Inn in the City of London, has been able to save the lives of a substantial number of syphilitic infants, and others have obtained similar results. Nor is the saving only one of life, for by this treatment the child has a prospect of subsequent health. A syphilitic pregnant woman can thus be treated by salvarsan substitute up to the day of confinement and be delivered of a child whose blood gives a negative re-action; syphilitic children can be similarly treated. Another illustration of the wider aspects of this subject is found in the movement in various countries for the introduction of methods for the prevention of venereal disease, and the student should be instructed in their relative value.

Dental Education.

205. The association of the practice of medicine and dental work has become closer as the relation of disease to dental caries and sepsis has been more fully appreciated. Partly owing to this fact and partly owing to other circumstances the problem of dental education and qualification has in recent years become acute. First, there has been a shortage of dentists. When the Dentists' Register was instituted in 1879, there were 5,289 names placed upon it, and of these 4,800 were admitted in virtue of having been in practice prior to 1878. Whilst the population steadily increased and the demand for dental treatment grew, the number of dentists did not rise in proportion. In 1916, thirty-eight years after the Act of 1878, the number of registered dentists was 5,453 (an increase of 3 per cent. as compared with an increase of 36 per cent. in the population). Meanwhile, medical practitioners had nearly doubled in number, with the result that in 1916 there were 931 medical men for every million of the population and only 117 dentists. The shortage was intensified by the war, and by 1919 whole districts of the country, and sometimes large towns, were without a registered dentist. A second fact, and one which had much to do with this shortage of properly qualified dentists, was the enormous increase in unregistered practitioners, in unregistered dental companies, and in dental mechanics—plying their calling to the danger of the public, but with very lucrative results. Thirdly, the dental findings of the medical inspection of school children from 1909 onwards which had been reported to the Board of Education, the excessive sickness owing to dental conditions recorded by the Approved Societies under the Insurance Act of 1911, and the examination of the teeth of recruits to the Army in 1914–16, demonstrated beyond all doubt the extremely defective condition of the teeth of the people as a whole. These three facts led, in 1917, to the appointment by the Lord President of the Privy Council of a Departmental Committee to enquire into the extent and gravity of the evils of dental practice by persons not qualified under the Dentists Act of 1878.

206. The Departmental Committee found that unqualified practice was "a menace alike to the public health, the registered dental profession, and the more reputable unregistered practitioners." They received a large and varied mass of evidence, written and oral, from all parts of the country and came to the conclusion that the practice of dentistry and dental surgery by persons not qualified under the Dentists Act is mainly responsible for the following evils:—

(*a*) Lowering the social status and public esteem of the dental profession.
(*b*) A great shortage of registered dentists owing to the unattractiveness of the profession.
(*c*) Inability by the general public to distinguish between a registered and unregistered practitioner.
(*d*) The dental treatment of the public being largely in the hands of uneducated, untrained and unskilled persons.
(*e*) Grave personal injury on account of lack of skill and of technical knowledge.
(*f*) Extractions of sound and only slightly decayed teeth.
(*g*) Application of artificial teeth over decayed stumps and into septic mouths.
(*h*) The existence in the public mind of the belief that there is no advantage in preserving the natural teeth and that these should be allowed to decay and when trouble arises have all the teeth out and substitute a plate of artificial ones.*

"Having regard to the large amount of preventable sickness and chronic invalidity terminating, in many instances, in premature death which results from the effect of oral sepsis and decayed teeth, the Committee view the facts which have been brought to their notice with the gravest concern. They are of opinion that the state of affairs revealed should receive early attention with a view to the improvement of the health of the nation and an increase in its industrial efficiency."† Elsewhere, I have discussed both the causation of dental caries and its results.‡ It is now recognized that dental sepsis may lead to many and serious morbid conditions in the body, and that to preserve a sound denture is a direct method of Preventive Medicine. It was on this ground that the Departmental Committee recommended extension of public dental services for the whole civil community. Such dental services (for school children, for insured persons, for industrial workers, for the army, etc.), they urged, should be founded upon conservative dentistry, should be preventive in purpose, and should be performed by properly qualified dentists. They therefore recommended the prohibition of unregistered dentistry, the revision and extension of the Register, and the proper training and qualification of registered dentists.

207. In the spring of 1915, the General Medical Council commenced a revision of the Dental Curriculum, which, owing

* Report of Departmental Committee on the Dentists Act, 1878. Cmd. 33, 1919, p. 17.

† *Ibid., p.* 23.

‡ Annual Report of Chief Medical Officer of Board of Education, 1919. Cmd. 995, pp. 84–87.

to postponement for the Report of the Departmental Committee, was only completed in 1922. The character of the former curriculum had proved unsatisfactory; and the old apprenticeship system, and assistantships to unregistered dentists, had encouraged unqualified practice. These two disadvantages had to be removed whilst the curriculum as a whole was brought up to modern knowledge and requirement. The aim of the Council was to provide "a minimum curriculum without impairing the standard of efficiency." Certain portions of the intermediate sciences were reduced, whilst other practical and dental aspects were amplified. The curriculum as revised is as follows:—

A.—*Preliminary Examination and Registration.*

1. That every Dental Student shall, at the commencement of his studentship, be registered in the manner and under the conditions prescribed for Medical Students.

2. That before registration in the *Dental Students' Register*, every applicant shall be required to have passed, in addition to the examination in General Education, which shall be the same as that required for Medical Students, an examination in Elementary Physics and Elementary Chemistry, conducted or recognized by one of the Licensing Bodies, which shall also be the same as that required for Medical Students.

3. That before registration as a Dental Student every applicant shall produce evidence that he has attained the age of seventeen years.

B.—*Professional Study.*

4. That every candidate for a Degree or Licence in Dentistry or Dental Surgery shall be required before admission to the final or qualifying examination to produce certificates showing:—

(i) That he is at least twenty-one years of age.

(ii) That he has been registered as a Dental Student.

(iii) That he has, subsequently to the date of registration as a Dental Student, been engaged in professional study for at least four years, of which three years at least shall be spent at a school or schools recognized for professional study by one of the Licensing Bodies.

(iv) That, subsequently to the date of registration as a Dental Student, he has attended at a recognized Medical School courses of instruction, which shall be the same as those required for Medical Students, in the following subjects:—

(*a*) Chemistry, and (*b*) Physics, in their application to Medicine;

(*c*) Elementary Biology.

Note.—A student who has diligently attended an approved course of Elementary Biology in a Secondary School or other Teaching Institution recognized by a Licensing Body may be admitted to a Professional Examination in Elementary Biology immediately after his registration as a Dental Student.

That he has attended at a recognized Medical School courses of instruction in the following subjects:—

(*d*) Human Anatomy (with dissections and demonstrations) for three academic terms.

(*e*) Physiology (with laboratory instruction, including practical histology) for two academic terms.

(*f*) General Pathology (including Bacteriology) for two academic terms.

(*g*) Medicine for two academic terms.

(*h*) Surgery for two academic terms.

(*i*) The practice of a recognized General Hospital or Hospitals of not less than eighty beds, with certified instruction in clinical medicine and clinical surgery, for four academic terms.

Note.—The teaching in Anatomy, Physiology, Pathology, Medicine and Surgery should take cognizance of the special needs of Dental Students.

The certificates of teaching at General Hospitals should furnish evidence of the student having acted as Medical Clinical Clerk and Surgical Dresser, and of attendance in the Out-patient or Casualty Departments.

A certificate of clinical instruction in Venereal Disease should be required.

(v) That he has attended at a recognized Dental School courses of instruction in the following special subjects :—

(*a*) Dental Anatomy and Physiology, human and comparative. The course should comprise a minimum of twenty meetings of the class.

(*b*) Practical Dental Histology and Morbid Histology. The course should comprise a minimum of sixteen meetings of the class.

(*c*) Dental Pathology and Surgery. The course should comprise a minimum of twenty meetings of the class.

(*d*) Dental Materia Medica and Therapeutics. The course should comprise a minimum of sixteen meetings of the class.

(*e*) Dental Metallurgy (with practical work and demonstrations). The course should comprise a minimum of twenty meetings of the class.

(*f*) Dental Mechanics (with practical work and demonstrations). The course should comprise a minimum of twenty meetings and twenty demonstrations.

(*g*) A course of instruction in the use of Anæsthetics, general and local, employed in Dental Practice.

(*h*) A course of instruction in Radiology as applied to Dentistry.

Note.—A candidate should produce a certificate of having administered general anæsthetics on at least ten occasions.

(vi) That he has for at least twenty-four calendar months attended, during the ordinary academic terms, the practice of a recognized Dental Hospital or of the recognized Dental Department of a General Hospital.

(vii) That he has received for not less than twenty-four calendar months, or for 2,000 hours, practical instruction in Dental Mechanics.

Note.—No portion of such practical instruction which is taken prior to the date of registration shall be reckoned as a portion of the four years of Professional Study required.

It is recommended that instruction in Dental Mechanics be taken at a recognized Dental Hospital and School. If any part of such instruction be taken by the candidate as a pupil with a registered dentist the time required to be devoted to it shall be at least twice the time required for the corresponding instruction taken at a Dental School.

Where in the foregoing the expression "course" is used, it is not

intended that this should be read as necessarily implying lectures only; the Licensing Bodies and the Schools are left free to arrange their methods of instruction in the manner they find most efficient.*

208. An examination of this curriculum makes clear the principles of a sound dental education. First, it is to be founded on science. The elements of science are relegated to the Secondary School, though applied chemistry and physics are included in the four years' course. The fundamental medical subjects, intermediate and clinical, are included, but they are bent to a special purpose, and this purpose is afforded a setting in biology and comparative anatomy and physiology. Secondly, emphasis is laid upon the necessity of furnishing the student with a thorough and comprehensive technique of his art—mechanics, metallurgy and operative work. Dental mechanics are now to be taught in the dental hospital, and if any such instruction be taken in pupilage with a registered dentist the time to be devoted to it must be at least twice that required for the corresponding instruction in a prescribed dental school. Though apprenticeship is retained, two years of such experience may only be counted as one of the necessary four years of professional study. In a word, the practical work required, hitherto of a miscellaneous nature, is brought under direct supervision and within the equipment of a recognized dental school and the discipline and inspiration of competent teachers. Lastly, the new curriculum makes dentistry the true handmaid of Medicine, a scientific specialism of Medicine and not merely a craft. The new knowledge of bacteriology and infection, anæsthesia, antiseptic surgery, venereal disease, the principles of pathology, and the methods of radiology, are all brought fully into application. Dentistry may now become, for the first time, an organized instrument and means of Preventive Medicine.

209. There can be little doubt of the result of these reforms. They place the dental profession on a new basis; the Register has been extended and now includes 13,000 names; the unregistered dentist is debarred from practice and incompetent workmanship is reduced; the registered dentist is protected in the exercise of his profession under an authorized Dental Board; and the dental student may obtain a sound and comprehensive education.

* Minutes of General Medical Council, 1922, vol. lix., p. 282.

XIII.

PUBLIC HEALTH.

210. The subject of Public Health, or State Medicine, comprises the various applications of Preventive Medicine to national needs. It is concerned with the health and sanitary environment of communities. " Cities die," said Lucian, " like men." As the health of the individual is essential to his life and capacity, so the health of the people as a whole is necessary to the vitality and vigour of the nation, and even of the race. Hence, from the earliest stages of Medicine in the ancient world public medical duties have been discharged by medical practitioners versed in epidemiology and in the health conditions which affect the community. The growth of medical science has demonstrated the truth of the observation that in respect of the common health members of a society or group are " members one of another." There is, from this point of view as from others, community of interest, inter-relationship, interdependence ; " and if one suffers, all suffer with it." To have an attack of infectious disease is not wholly a personal matter, an individual concern ; obviously it affects the whole group. Hence the individual should in his own interest be treated for his malady and must, in the interest of all, be isolated from others. The same principle of community of interest applies in housing, sanitation, food supply, water supply, and so forth—they affect the health of all. Protection from epidemic scourges is also necessary, national and international. Thus it comes about that a more or less complex organization has grown up over the centuries, since nations like individuals must, in order to survive, obey the laws of health. Among the greatest conquests of Medicine are those in the domain of public health. First, there has been a reduction in the ravages of disease—leprosy, black death, sweating sickness and cholera have vanished from Great Britain ; scurvy, typhus, typhoid and small-pox are beginning to disappear ; many other diseases are coming under control ; the tropics are becoming habitable, even for the white man. Fresh air and sunlight in dwellings, sanitation of workshops, a wholesome water and food supply, the removal of nuisances, the isolation of the infectious person, the suppression of the causes of disease, and social amelioration, have had their certain effect. Secondly, and as a result of the reduction of disease, there has been a decline in the mortality rate. Life has been saved, death has been postponed, longevity has increased. In 1922 there were saved in England 39,000 infant lives which would have been lost had the rate of mortality of 1901–10 continued ; the child born to-day has an expectation of twelve years more life than had his grandfather. And, thirdly, this enormous advance in health has led to increased capacity, a larger and a better life. This is good science, but it is also sound national economy.

211. In 1868, the British Medical Association urged the General Medical Council to consider the special qualifications which medical men should possess, and the way they should be specially trained, to fulfil this wider civic or communal function of Medicine The Council deliberated on the matter and consulted the Licensing Bodies, and in the Medical Act of 1886 (Section 21) powers were granted to the Council to recognize and to register, as additional qualifications, special Diplomas in Sanitary Science, Public Health or State Medicine. In the following year the Council resolved to recognize the regulations, which then existed, of the Licensing Bodies for such Diplomas. Then came the Local Government Act of 1888, Section 18 (2) of which required that the Medical Officers of Health of certain large areas should hold such additional diplomas, and the whole question of their general validity was raised. Accordingly, in 1889, the General Medical Council itself drew up and published Rules governing such diplomas as it was prepared to recognize and enter in the Medical Register. The Council required: (*a*) that before a candidate received a registrable diploma in Sanitary Science he must be medically qualified, and a period of not less than twelve months should elapse between the attainment of a first registrable medical qualification and an examination for the D.P.H.; (*b*) that candidates should attend, during six months, practical instruction in a laboratory, and should study the outdoor duties of a medical officer of health of a large district; and (*c*) that the examination should be conducted by Examiners specially qualified, and should comprise laboratory work as well as written and oral examination.* These Rules, made more than thirty years ago, have remained as the basis of the D.P.H. examinations ever since, though amendments were made in 1893 and 1896. In the meantime exceptional advance took place both in the knowledge and practice of sanitary science, and in the duties imposed upon medical officers of health by Acts of Parliament. The growth of knowledge was particularly far-reaching in bacteriology and its applications; the extension of public medical services by the State and by local authorities affected large spheres of the social life of the people in relation to Poor Law, maternity, child welfare, food control, industrial employment, special diseases and so forth, which substantially increased the responsibilities and enlarged the province of the Medical Officer of Health.† " The duties nowadays falling to the Medical Officers

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* Minutes of the General Medical Council, 1889, vol. xxvi., p. 118.

† Since the first D.P.H. Rules of 1889, the following are the more important Public Health Acts of Parliament that have been passed and which have extended the duties of the M.O.H.

1. Public Health Acts, 1890 (Amendment Act), 1891 (London), 1896 (Ports), 1907 (Regulation as to Food), 1913 (Prevention and Treatment of Disease), 1921 (Tuberculosis), 1921 (Officers).
2. Lunacy Act, 1890.
3. Housing of the Working Classes Acts, 1890, 1894, 1900, 1903.

[*See next page.*

of Health are far different from those that fell to them in the 'seventies," writes Dr. D. S. Davies, the Medical Officer of Health of Bristol. " For instance, the Medical Officer of Health of a county borough has now greater need of a wide knowledge of the natural history of disease, of bacteriological and pathological research methods for elucidation of disease, of social questions and of clinical work in many directions, of which children's diseases for school work, and diseases of women and children for maternity and infant clinics, of fevers for control and supervision of isolation hospitals may be cited as examples. *He is therefore a controlling factor in a many-sided office of paramount importance to the State,* and his title of Medical Officer of Health should connote a physician of some experience in many directions, capable of teaching, as well as an epidemiologist skilled in the intimate history of disease, a social student with some initiative in devising methods, as well as an administrator and capable executive officer." Concurrently with these changes there were taking place variations in the content of the ordinary medical curriculum which made necessary and opportune a substantial modification in the content and scope of special sanitary diplomas.

The Principles of the New Rules.

212. These fundamental expressions of social evolution have not only created the occasion for, but have given the character to,

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[*From previous page.*

4. Local Government Acts, 1894, 1903 (Transfer of Powers), 1913 (Adjustments).
5. Infectious Diseases (Prevention) Act, 1890, 1899 (Notification).
6. Factory and Workshop Acts, 1891, 1901, 1907.
7. Isolation Hospitals Acts, 1893, 1901.
8. Education Acts, 1893 (Blind and Deaf Children), 1899 and 1914 (Defective and Epileptic Children), 1906 and 1914 (Provision of Meals), 1907, 1909, 1914 and 1918 (Medical Inspection and Treatment of Children and Young Persons, etc.), 1921 (Consolidation Act).
9. Cleansing of Persons Act, 1897.
10. Vaccination Acts, 1898, 1907.
11. Midwives Acts, 1902, 1918.
12. Employment of Children Act, 1903.
13. Notification of Births Act, 1907, 1915 (Extension Act).
14. Children Act, 1908.
15. Housing and Town Planning, etc., Acts, 1909, 1914, 1914 (No. 2), 1919.
16. National Insurance Acts, 1911, 1917, 1918, 1919, 1920, 1921.
17. Mental Deficiency Act, 1913.
18. Milk and Dairies Act, 1914, 1915 (Consolidation Act), 1922 (Amendment).
19. Venereal Disease Act, 1917.
20. Maternity and Child Welfare Act, 1918.
21. Ministry of Health Act, 1919.
22. Nurses Registration Act, 1919.
23. Blind Persons Act, 1920.
24. Dangerous Drugs Act, 1920.
25. Dentists Act, 1921.

the recent reforms of the General Medical Council. So imperative is the need that Dr. Bruce Low, in his inspectorial report to the General Medical Council in 1921, advised the Council that "it is of national importance that weak or unsuitable candidates should, as far as is possible, be kept out of the Public Health Service of the country." After full consideration of the whole situation the Council deemed that the time had come for attaching to the D.P.H., as a statutory qualification, an enhanced prestige and authority, and giving it a hall-mark and imprimatur which it had not hitherto possessed. Hundreds of young and newly-qualified medical men were obtaining the diploma who had no intention of seriously devoting their lives to this special and difficult branch of Medicine, but merely desired to add a further titular accomplishment, undoubtedly good in itself, to their medical equipment. But this was neither the historical nor the actual purpose of instituting the diploma, and conferring upon it a statutory authority. For general practitioners to acquire a practical knowledge of preventive medicine is obviously a worthy and indeed an essential matter; but for this excellent object provision should be made, and, as we have seen, is now being made, in the ordinary medical curriculum.

213. What, then, were the principles which seem to have guided the General Medical Council in designing its new Rules? First, the scope of study for the diploma must be enlarged to include the new subjects, or the development of old subjects, in State Medicine that are of immediate importance to medical men directly engaged in this branch of the public service. Pathology and bacteriology, parasitology, immunology, applied chemistry and physics, epidemiology and the etiology of disease (infectious and non-infectious) clearly stand in the front rank; they are closely followed by the practical subjects in which the State has now assumed a direct interest—for example, the physique and diseases of children, maternity and infancy, tuberculosis, venereal disease, mental deficiency, the diseases of occupations and food-borne disease.

214. Secondly, training in sanitary science must be made more practical, especially in its administrative and sociological aspects. A Medical Officer of Health cannot understand his duties merely by having absorbed information at second-hand, any more than a surgeon can become skilled and reliable by reading books or attending lectures. Actual practice and direct experience are necessary; the medical officer must learn, like the surgical dresser, how to *do* his work. He must go and see and learn the practice of the branch of Medicine he has chosen to follow. His patient is the civil community, and the civil community lives in houses and workshops, and not in hospital. One cannot understand the working of a water supply, a sewerage system, a housing scheme, a dairy farm, a workshop, a common lodging-house, a food factory, a school, a meat market, an isolation hospital, a maternity home, a sanitary port, a disinfecting and

cleansing station, a tuberculosis dispensary, a venereal diseases clinic, or a children's clinic by merely reading about it ; one must go and study it, and its varieties, and its objects and working and results. There is an applied science at the back of all these things, concerning which "common knowledge" is apt to be fallacious. They call for expert and continuous study, by which alone reliable experience is acquired. This is, of course, quite obvious. But it has to be stated, because candidates have sat for examination for, and have received, the D.P.H., without this practical and essential knowledge.*

215. Thirdly, the General Medical Council is convinced that the efficient Medical Officer of Health must be a medical man of some maturity and of clinical understanding. His responsibilities in this regard have, it is clear, enormously increased. He may have to act as referee or consultant in fevers, in tuberculosis, in venereal and children's diseases, in obstetrics, and in certain forms of mental defect. He may have on his staff specialists in these subjects and in diseases of the eye, ear, nose and throat, dentists and orthopædists, pathologists and epidemiologists, whose work he is expected to guide and co-ordinate, and in any case he has now been brought by the National Health Insurance Act into close touch with all the medical practitioners of his area. Only as such officers appreciate the scope, opportunity and responsibilities, not to speak of the difficulties, of ordinary medical practice, will they be able to discharge effectually and wisely their own special professional duties. As the duties of the practitioner are enlarged towards the State and become more communal, though without diminution of the individual aspect of his work, so also those of the public health official enlarge towards medical practice, without diminution of the official aspect of his work. There is a close relationship existing, which is likely to become closer. Moreover, the whole science and art of Preventive Medicine is, as we have seen, essentially clinical in origin and purpose. How then can the Medical Officer of Health effectively discharge his public duties if he be not, in training and outlook, a competent clinician ? The answer is, he cannot.

216. This is a most important new point in the course of Public Health study, with which the General Medical Council was called upon to deal. Could it reasonably require, say, five years of general practice preparatory to specialized Public Health study ? Could it insist that each candidate should have held a hospital appointment ? or could it require, for one year, a post-graduate laboratory course, or an apprenticeship under a Medical Officer of Health, or an appointment in a fever hospital, or a children's hospital ? There is much to be said for

* It will be evident that to study military or naval sanitation in the Army or Navy, however valuable, is insufficient for the equipment of a civil Health Officer at home, unless it includes the sanitary science and practice of civil communities in Great Britain. The same applies to the study of tropical sanitation (for which a special diploma is available).

each of these requirements, and a number of competent authorities and Medical Schools are definitely in favour of them; but there seem to be insuperable practical difficulties in prescribing, by general rules, the exact terms which would equitably cover all cases. Different Licen ing Bodies desire a certain freedom in this regard. Hence the Council determined to do no more than require one year of direct experience of medical work in some responsible capacity, in addition to twelve months' specific study of Public Health, before a candidate may be admitted to the final D.P.H. Examination.* He may sit for Part I of the examination as soon as he has completed the prescribed courses of instruction for that Part (say six months after qualifying in medicine), but he cannot sit for Part II (the final) until after the lapse of not less than two years following the date of his obtaining a registrable medical qualification. Thus a candidate may occupy twelve months or twenty-four months in taking the prescribed courses in Public Health. If the former, the remaining twelve months should be spent in clinical work, bearing on some aspect of Preventive Medicine—a house appointment, a hospital post, an intern-officership, a dispensary or clinic or sanatorium appointment, or in general practice or in an assistantship to a Medical Officer of Health or a School Medical Officer, or a ship surgeoncy, or work in a fever or Poor Law hospital—in a word, in some definite kind of clinical work of a responsible nature which will add to his maturity and experience as a practitioner. If he chooses to spend his twenty-four months in the study of public health and sanitary science, he will naturally devote himself to one or other of its special branches, including their clinical aspects.

217. The new Rules of the General Medical Council are briefly as follows :—

Rule 1.—A period of not less than two years shall elapse between the attainment by a candidate of a registrable qualification in Medicine, Surgery, and Midwifery and his admission to the Final Examination for a Diploma or Degree in Sanitary Science, Public Health, or State Medicine.

Rule 2.—The curriculum for a Degree or Diploma in Sanitary Science, Public Health, or State Medicine shall extend over a period of not less than twelve calendar months subsequent to the attainment of a registrable qualification.

PART I.

Rule 3.—Every candidate shall produce evidence of having attended, during a period of not less than five months, at an institution approved by the Licensing Body granting the Diploma or Degree, practical instruction in :—

(*a*) Bacteriology and Parasitology (including Medical Entomology), especially in their relation to diseases of man, and to those

* At Toronto University special provision is made within the six-year medical curriculum for a student to amplify his regular work by special optional studies designed to broaden his general education or enable him to undergo more intensive training. For students proposing to work in the field of public health, economics, statistics, sociology, parasitology, bacteriology and immunology are recommended.

diseases of the lower animals which are transmissible to man (at least 180 hours, of which 150 must be in laboratory work).

(*b*) Chemistry and Physics in relation to Public Health (at least ninety hours, seventy in laboratory).

(*c*) Meteorology and Climatology in relation to Public Health (at least ten hours).

PART II.

Rule 4.—Every candidate shall produce evidence of having received, during not less than eighty hours, at an institution or from teachers approved by the Licensing Body granting the Diploma or Degree, instruction in the following subjects :—

(*a*) The Principles of Public Health and Sanitation (thirty hours).

(*b*) Epidemiology and Vital Statistics (twenty hours).

(*c*) Sanitary Law and Administration (including Public Medical Services) (twenty hours).

(*d*) Sanitary Construction and Planning (ten hours).

Rule 5.—Every candidate shall produce evidence that he has attended for three months on the clinical practice of a recognised Hospital for Infectious Diseases, and has received therein instruction in the methods of administration. At least thirty daily attendances of not less than two hours in each week shall be required.

Rule 6.—Every candidate shall produce evidence that he has, during a period of not less than six months, been engaged in acquiring a practical knowledge of the duties, routine and special, of Public Health Administration under the supervision of a Medical Officer of Health, who shall certify that the candidate has received, from this Officer or other competent Medical Officer, during not less than three hours on each of sixty working days, practical instruction in these duties, and also those relating to :—

(*a*) Maternity and Child Welfare Service ;

(*b*) Health Service for Children of School Age ;

(*c*) Venereal Diseases Service ;

(*d*) Tuberculosis Service ;

(*e*) Industrial Hygiene.

(*f*) Inspection and Control of Food, including meat and milk.

Certificates of having received the prescribed instruction in Public Health Administration must be given by a Medical Officer of Health who devotes his whole time to Public Health work ; or by the Medical Officer of Health of a Sanitary Area having a population of not less than 50,000, or in Ireland the Medical Superintendent Officer of Health of a County or County Borough having a population of not less than 50,000.

218. It will be seen that Part I is analogous to the Intermediate sciences in the medical curriculum, and Part II to the Clinical art of applying these in practice. At present the examinations of the various Licensing Bodies, though their form is prescribed by the Council, may vary somewhat (particularly in Part II) in character and degree ; but it is important that there should be as large a measure of uniformity as possible. Practical Examination in sanitary inspection, in the special subjects of Rule 6, and in the clinical and administrative aspects of infectious diseases is always to be included. A candidate must pass Part I before being admitted to Part II.

219. There are branches of Sanitary Science and Hygiene which are appropriate to other departments of the Public Service,

and for which special training of a different kind is necessary. The Navy, Army and Air and Colonial Services have their own requirements and make special demands on their medical officers. Naval and Military Hygiene, and Tropical Medicine and Hygiene, have already their special schools, and it is proper that special diplomas or certificates corresponding to their curricula should be instituted. But the course of study and examination for them must be differentiated from those for the civil diploma in Public Health, for to the latter a definite status and significance is attached by law, and its curriculum must be equally definite. The curricula for the several diplomas indicated should not be regarded as equivalent or mutually interchangeable, for the training of the Medical Officer of Health is wider and deeper than any special branch of Public Health demands.*

* About a year ago the Rockefeller Foundation offered to provide a sum of two million dollars towards the cost of building and equipping an Imperial and International School of Hygiene (to be affiliated with London University), on the understanding that the British Government accept the responsibility of providing for staffing and maintaining the School when established. The Government forthwith accepted this offer and the condition on which it was made; the Rockefeller Foundation have acquired an admirable site near Gower Street; a detailed consideration of the establishment of the School has been made; plans have been prepared and it is hoped to commence building at an early date. The Departments of the School, for which provision is to be made, include: (i) Applied Physiology and Principles of Hygiene; (ii) Chemistry and Bio-Chemistry; (iii) Immunology and Bacteriology; (iv) Medical Zoology; (v) Epidemiology and Statistics; (vi) The Practice of Preventive Medicine, General Sanitation and Administration; (vii) Tropical Medicine (and Hygiene). The School will provide for the training and equipment of Public Health Officers and for research in the various branches of Preventive Medicine, and its objects will be: (*a*) To make instruction of University standard available in every department of Hygiene, and (*b*) to further the practice of Hygiene not only in this country and the British Empire, but in all parts of the world.

XIV.

CONCLUSION.

220. " At this moment," said Sir Clifford Allbutt in 1919, " it is revealed to us that Medicine has come to a new birth . . . What is then the new birth, this revolution in medicine ? It is nothing less than its enlargement from an art of observation and empiricism to an applied science founded upon research ; from a craft of tradition and sagacity to an applied science of analysis and law ; from a descriptive code of surface phenomena to the discovery of deeper affinities ; from a set of rules and axioms of quality to measurements of quantity."* That is the stage we have reached in the long journey from a thousand years before Hippocrates ; he was followed 500 years later by Galen, a half millenium which belongs to Aristotle and the Ionian Schools ; then came another thousand years, post-Galenic, a long dark time illuminated by the great Arabians and Roger Bacon and Mondini ; and so to the Renaissance. So rich were the fruits of the Renaissance that we are tempted to forget the inspiration of the Greeks, yet to fail to drink at that vital source is, as Keats taught us in *Endymion*, to go athirst :—

> " Who, when this planet's sphering time doth close
> Will be its high remembrancers : who they ?
> The mighty ones who have made eternal day
> For Greece and England."

The new day dawned in 1543, when Vesalius published his *Fabrica* at Basel and Copernicus his famous book at Nüremberg on the revolution of the planets round the sun ; and following them came Gesner, Paré, Harvey, Malpighi, Borelli and Sydenham, the stars of their morning. They stood for six epoch-making stages in the advance of Medicine, foundation layers of the modern period ; and if the modern period be thought of as 100 years in length we are almost the neighbours of the men who gave our science and art its new birth. Forbes and Stokes introduced into England Laennec's stethoscope of 1819, thus supplementing Auenbrugger's method of percussion in the physical examination of the patient ; Schwann, Claude Bernard, Müller and Virchow carried on the work of Haller and Morgagni in physiology and pathology ; Morton, Warren and Simpson discovered anæsthesia ; the bacteriologists and protozoologists unveiled the causes of infection, and far-reaching applications, particularly in surgery, became practicable—Darwin, Pasteur, Koch, Lister, Ehrlich, what a galaxy ; the discovery of X-rays

* British Medical Journal, April, 1919, p. 433.

added to a whole armamentarium of instruments of precision which the development of physics and chemistry had made available; and new knowledge came in almost bewildering succession—cell changes, toxins, immunology, asepsis, internal secretion, cardiology. These were the fundamental advances which have provided for applications on the grand scale in all branches of medicine and surgery, and which have played such an amazing part in the social evolution of the world in the last few years. The representatives of medicine and science have thus come to the aid of the nations, to the succour of the human race, and to the fulfilment of the far-off ideals of the Greeks. The medical man may now be, if he will, master of his fate. We who are living in the midst of such a time cannot measure or estimate it. Preoccupied with our engagement, we must leave the judgment to the generations of the future. But even within our own national compass we have recently been the witnesses of four remarkable signs of progress: (*a*) a prodigious advance in Public Medicine—the public health service, sanitation, the care of the mother and the child, industrial hygiene, the health insurance system; (*b*) the systematic organization of medical research; (*c*) an ever-expanding growth of medical and surgical treatment; and (*d*) the steady reform of medical education. Out of these movements, and in general and special practice, has thus come a new birth of Medicine. And it has been born into a new world.

221. Whilst the present memorandum has set out briefly the profound changes which are taking place in Medical Education, it has had regard to that wider setting which alone gives it proportion. The training of the physician is no longer a narrow engagement; it affects the well-being of the State, in both public and private practice. The community is concerned as taxpayer and as patient; and the practitioner's field is the world of men and affairs. For, though his reach is a long one, he exerts his influence from the home and the bedside, the trusted confidant of his patient. On this ground his education and his function must be individualistic.* He must be so trained as to become a practical, well-educated and fully-equipped medical man, enabled to reach the

* The scheme of Health Insurance, now forming an integral part of the health service of the country, brought the private medical practitioner into the national organization of State Medicine. We must not forget that contract practice was its forerunner, and when we consider the insurance scheme we must compare it with the previous contract practice. Hitherto, the practitioner had been in the direct employment of his patient or in the employment of voluntary benevolent institutions or societies acting on behalf of his patient. But by the Insurance scheme he became responsible, as regards this part of his practice, not only to his patients but to the State, and its public representative authorities. Whilst this constitutes a change in the relationship of the practitioner to the community, it does not, as some critics have suggested, "abolish" him, nor yet does it absorb him in a whole-time national service. Neither of these courses is either practicable or desirable. See also *On the State of the Public Health*, 1920. Cd. 1397.

top of his own particular capacity, alert, ready, with an expanding and forward-looking mind, which shall be the dexterous and willing instrument of science and craft and progress, whatsoever be its endeavour or its destination. We have already seen that whilst the new medical curriculum recommended by the General Medical Council—and indeed the Public Health *Rules* also—gives added emphasis to the application of science to the clinical aspects of medical education, the inspiration of reform has been the prevention of disease. The spirit of research and of prevention has,

" forthwith touch'd
The whole enormous matter into life."

Obviously curative medicine and remedial surgery must have immediate priority, but the ultimate goal is prevention. It is not the event of death which we can escape, but the incidence of avoidable invalidity and premature death. It is the enlargement of life and the increase of human capacity, physical and mental, which we seek to ensure. In this great enterprise the primary desideratum is the education of the student, an education in the appreciation of man and his needs, in the knowledge and pursuit of Science, and in skill in craft. " Let us emancipate the student," wrote Sir William Stokes sixty years ago, " and give him time and opportunity for the cultivation of his mind, so that in his pupilage he shall not be a puppet in the hands of others, but rather a self-relying and reflective being. Let us ever foster the general education in preference to the special training, not ignoring the latter, but seeing that it be not thrust upon a mind uncultivated. Let us strive to encourage every means of large and liberal education in the true sense of the term."

222. As one reviews the available data and turns the matter over in one's mind, the future of Medical Education in England seems to depend upon an effective co-ordination of the science and art of the several subjects of the medical curriculum, upon sound clinical technique and apprehension, upon a discerning examination system, and upon continued education after graduation, and at the back of all these must be love of truth, keenness in its pursuit and wisdom in its application. A concluding word must be said on each of these requirements :—

(*a*) The necessity of integration of chemistry and physics into physiology and pathology, of physiology and pathology into medicine, surgery and obstetrics, of the laboratory into clinical study, of the science into the art—that each of these aspects shall be taught in principle and not overburdened with detail in such a way as to allow the student to reflect and comprehend and grow—this is the first and fundamental requirement. To reach this purpose we must bear in mind the essential things in student and

teacher alike. The student is only capable of acquiring and understanding a limited amount of knowledge. Its quality and quantity are therefore of the first importance. The greater the detail commended to him the less may he really apprehend the principle; and in any case medical education, within the curriculum, cannot provide him with complete knowledge, at best it can but give him some foundation and the tools of learning. Let us make no mistake, the burdensomeness of his course hitherto has been due, in large measure, to the nature of its organization, its duplication, its insistence on unnecessary detail, the memorizing of formulæ for examination purposes, its apparently endless series of systematic lectures (most of which are now no longer necessary), and its over-specialization of certain subjects by enthusiastic teachers. But a pint pot cannot hold a quart of material, and attempts to make it do so end in spoil and waste. Much of the solution of the problem depends upon the teacher of medicine, in any of its branches, being an *educationalist.* Too often in the past he has undertaken to teach without either knowledge or experience of the principles and methods of education. The result has been that he has proved, in spite of medical competency, an indifferent instructor and not a true educator or comprehender of the capacity of his pupil.

(*b*) Secondly, clinical study must remain the sheet anchor of English medical education and must be strengthened both in technique and understanding. The student must be so trained as to be able to stand alone in clinical skill and judgment. Instruments of precision, apparatus and the laboratory should be supplementary to the use of his own eyes and ears and hands in elucidating the truth of his patient's condition—the life history of the patient, subjective symptoms, physical signs, supplementary tests, after-care—for only thus are we educating his mind to analyse, estimate and measure the deeper affinities. The final judgment must always depend upon the acumen and competence of the practitioner, not upon his instruments.

(*c*) The oppressive load of the examination system calls for reconsideration by the Examining Bodies. At present, in spite of the reasonableness, high competency and good-will of the Examiners, the system remains a shackle upon medical education. So heavy has the student's burden become that he is driven to standardize his effort, in degree and kind, by the prescription of the Examining Body—not the love of learning, not

what he requires for life, not even his technical skill and experience, but what will answer the questions on the day of examination is the student's criterion. Inevitably the occasion is subject to chance, superficiality, brevity and hazard. Yet in Medicine at least it should be sure and certain, and the unready and incompetent candidate should be rejected. There seems to be a general consensus of opinion in all the Medical Schools that what is required is an examination which shall be reasonably uniform, which shall follow and not lead the education provided, which shall be severely practical and clinical as well as theoretical, and which shall include a record of the work done by the student and how it was done. In 1922, the General Medical Council amended its Recommendations in regard to professional examinations, and suggested ways and means of improvement and standardization. Resolution 11 reads as follows :—

> " In the regulations for the several examinations it should be provided that Examiners, in assessing marks, be empowered to take into account the duly attested records of the work done by the candidate throughout his course of study in the subject of the Examination."*

In Midwifery, where a clinical examination may prove impracticable, such a course is particularly recommended. Thus authoritative sanction has now been given to an examination reform, the value of which has already been proved in America, in Edinburgh, Dublin, London, Sheffield and elsewhere. Undoubtedly, with a little organization and foresight, this method is capable of wide application. It will go a long way to place the examination on a sound footing, to encourage regular attendance and thorough workmanship during pupilage, and to remove the occasion for " cramming."

(*d*) Lastly, the rapid growth of medical knowledge and its application make necessary the organization of post-graduate courses for advanced or special studies, or for " refresher " courses. Many facilities already exist in London, under the Fellowship of Medicine established in 1918, and at Edinburgh, Glasgow, Bristol and elsewhere.† Indeed, most of the British Medical Schools make provision for post-graduate study for their own students. What is needed is a central scheme in London which shall bring together the graduates of all the twelve London Schools and also accommodate medical men from other Universities, the Dominions, the United States and foreign

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* Minutes of General Medical Council, 1922, vol. lix, p 300.

† See Report of Post-Graduate Medical Committee, 1921.

countries. Such a scheme should comprise an administrative office, a central general hospital equipped with out-patient departments and research laboratories, and having approved special hospitals associated with it. On the staff of such a post-graduate school should be the best teachers available, and under its auspices could be arranged special lectures and demonstrations by representative authorities from Great Britain and other countries. Such an organization, which seems needed, would exert a powerful influence throughout the world, for it would serve as an international centre and "clearing house," especially among English-speaking peoples. In respect of medical education, Great Britain has much to give and much to receive. In some ways its system of education has led, and still leads, other nations; on the other hand, it has much to learn from Europe and America, and a continuous interchange of ideas and of practice would be mutually advantageous. Some of the Medical Schools of the United States are better equipped than anything we have in Britain, and this gives them larger facilities for internship, for private and special wards, for laboratory work, for the keeping of records, and for research; their students are usually senior to ours in age and learning; their total course of training is generally longer; and in certain departments of surgery they claim to be ahead of us. We have much to learn from their vision, capacity and energy, and it is probable that we possess characteristics and traditions of service to them. Insularity and isolation are of little count in this cosmopolitan age. The world is rapidly becoming unified, and the spacious Republic of Medicine is for the healing of nations and the welfare of mankind.

223. Our immediate task in Britain is clear. We have still much to learn and design in the preparatory department of Secondary Education; we must move onward in physiology, pharmacology and pathology, where great things await us; we must provide for growth, change and development in the forms and methods of clinical study; we must correlate Medicine and Surgery, and bring prevention into the routine practice of both. Experience seems particularly to indicate that clinical education of University standard, of whatever name or method, demands our uninterrupted attention.

224. It is of vital importance to the State that Medicine should be well and soundly practised, for upon the effective discharge of its duties depends the extension of the frontiers of life. Yet this cannot be rendered apart from efficient medical education, which in its turn cannot be furnished exclusively out of students'

fees or University endowments. There can, I think, be no doubt that financial assistance from the Treasury is justified, and the present Memorandum contains evidence of the wise and economic use to which the subsidies hitherto sanctioned have been placed. Whilst it is inappropriate to state in detail the purpose to which the Exchequer Grants have been devoted by the respective authorities, the Deans of a number of Medical Schools have been good enough to indicate something of their value and the direction of their expenditure, and their evidence will be found in the Appendix.

225. As I said five years ago, the present reform movement in Medicine is only at its beginning. For whilst, happily, we need not anticipate frequent revision of the curriculum, nor changes in medical polity so rapid and arresting as those of recent years, there is a tide of new life and aspiration passing through men's minds, of far-reaching possibility and capable of escaping imprisonment, of which we cannot now measure either the power or the end. There is a sense, I think, in which it is true to say, that our homing instinct has been quickened, and, leaping two thousand years, calls back to the Greeks. If that be so, we may renew our hope. For it was they who taught us in the Western world the song of man's inheritance, of his bodily endowment, of his unconquerable mind, of his source and destiny. It was they who believed that of this manifold, beautiful and growing world he might, by search and labour, yet win the secret, and know himself.

G. N.

APPENDIX A.

REVISED MEDICAL CURRICULUM OF THE GENERAL MEDICAL COUNCIL.

In operation as from 1st January, 1923.

Every Medical Student at the commencement of his studies should be registered in the *Medical Students' Register*, in the manner and under the conditions prescribed by the Council.

Pre-registration Examinations in Chemistry and Physics.

Before registration as a student or commencement of the regular Medical Curriculum every person shall be required to pass, in addition to an approved examination in general education, an examination or examinations, conducted or approved by one of the Licensing Bodies, in the following subjects :—

(1) *Physics* (theoretical and practical), including the elementary Mechanics of solids and fluids, the elements of Heat, Light, Sound, Electricity and Magnetism. (This course should not include Bio-physics or the clinical applications of Physics, which are to be taken in the Medical Curriculum.)

(2) *Chemistry* (theoretical and practical).—The elements of the science. (This course should not include Bio-chemistry, Pharmacological Chemistry, or the clinical applications of Chemistry, which are to be taken in the Medical Curriculum.)

Medical Curriculum.

With regard to the Course of Study and Examinations which persons desirous of qualifying for the Medical Profession shall go through in order that they may become possessed of the knowledge and skill requisite for the efficient practice of Medicine, Surgery, and Midwifery, the Council recommends as follows, viz. :—

The period of Professional Study, between the date of registration as a Medical Student and the date of the Final Examination for any Diploma which entitles its holder to be registered under the *Medical Acts*, should be a period of certified study during not less than five academic years, in the last three years of which clinical subjects shall be studied.

In every Course of Professional Study and Examinations the following subjects should be included :—

(i) *Elements of General Biology.*—A course of instruction, including practical work, in the fundamental facts of Vegetable and Animal structure, life history, and function ; and an introduction to the study of Embryology. (The course of instruction may be taken before registration.)

(ii) *Chemistry, Physics and Biology.*—Instruction in these subjects in their application to Medicine.

(iii) *Human Anatomy and Human Physiology.*—These Courses should include :—

(*a*) Dissection of the entire body ;
(*b*) Histology ;
(*c*) Elements of Human Embryology ;
(*d*) Bio-chemistry and Bio-physics.

(iv) *Elementary Bacteriology.*—A course in this subject should be taken before the student undertakes his regular clinical appointments ((viii) 2 ; (ix) 2).

(v) *Pathology*.—Courses of instruction in (*a*) General and Special Pathology and Morbid Anatomy ; (*b*) Clinical Pathology. Each student should be required to have received practical instruction in the conduct of autopsies and to have acted as a post-mortem clerk in at least ten cases.

(vi) *Pharmacology and Materia Medica*, including Pharmacological Chemistry.—A course, including practical work, should be taken concurrently with courses of clinical instruction.

(vii) *Forensic Medicine, Hygiene and Public Health*.—Courses of instruction in these subjects should be taken concurrently with the later stages of clinical instruction.

(viii) *Medicine*, including *Applied Anatomy* and *Physiology*, *Clinical Pathology*, and *Therapeutics*, comprising :—

1. A course of systematic instruction in the principles and practice of Medicine.
2. A medical Clinical Clerkship for a period of six months, of which at least three months must have been spent in the Hospital Wards.
3. Lectures or Demonstrations in Clinical Medicine, and attendance on general In-patient and Out-patient Medical Practice, during seven terms, which may be concurrent with the terms prescribed under (ix) 4.
4. Instruction in Applied Anatomy and Physiology and in Clinical Pathology.
5. Instruction in Therapeutics and Prescribing, including Pharmacological and Physical Therapeutics and the Methods of Treatment by Vaccines and Sera.
6. Instruction in the following subjects, viz. :—
   (*a*) Children's Diseases ;
   (*b*) Acute infectious Diseases ("Fevers") ;
   (*c*) Tuberculosis ;
   (*d*) Mental Diseases ;
   (*e*) Diseases of the Skin ;
   (*f*) Theory and Practice of Vaccination.

(ix) *Surgery*, including *Applied Anatomy* and *Physiology* and *Clinical Pathology*, comprising :—

1. A course of systematic instruction in the principles and practice of Surgery.
2. A Surgical Dressership for a period of six months, of which at least three months must have been spent in the Hospital Wards.
3. Practical instruction in Surgical Methods, including Mechano-Therapeutics.
4. Lectures or Demonstrations in Clinical Surgery, and attendance on general In-patient and Out-patient Surgical Practice, during seven terms, which may be concurrent with the terms prescribed under (viii) 3.
5. Instruction in the Administration of Anæsthetics, the candidate being certified to have administered Anæsthetics on at least ten occasions.
6. A course of instruction in Operative Surgery.
7. Instruction in Applied Anatomy and Physiology and Clinical Pathology.
8. Instruction in the following subjects, viz. :—
   (*a*) Diseases of the Eye : Refraction ; use of Ophthalmoscope ;
   (*b*) Diseases of the Ear, Throat, and Nose : use of Otoscope, Laryngoscope and Rhinoscope ;
   (*c*) Radiology ;
   (*d*) Venereal Diseases ;

(*e*) Orthopædics, if this is not included in the Course of Surgery or of Surgical Methods.

(x) *Midwifery and Diseases of Women.*—Instruction during a period of at least two terms, comprising :—

1. Courses of systematic instruction in the principles and practice of Obstetrics and Gynæcology.
2. Lectures or Demonstrations in Clinical Obstetrics and Gynæcology, and attendance on In-patient and Out-patient Gynæcological Practice.
3. Instruction in the following subjects, viz. :—
   (*a*) Ante-natal conditions ;
   (*b*) Infant Hygiene.
4. Every student should, after attending the courses of systematic instruction in the principles and practice of Surgery and of Obstetrics, give continuous attendance on Obstetrical Hospital Practice, under the supervision of a competent officer, for a period of three months, during one month of which, at least, he should perform the duties of an intern student in a Lying-in Hospital or Ward. He should attend during the period twenty cases of Labour under adequate supervision. Extern or District Maternity work should not be taken until the student has personally delivered at least five cases in the Lying-in Hospital or Ward, to the satisfaction of his teacher.

A certificate of having attended twenty cases of Labour should state that the student has personally attended each case during the course of Labour, making the necessary abdominal and other examinations, under the supervision of the certifying officer, who should describe his official position and state how many of the twenty cases were conducted in Hospital.

Additional Resolutions.

(*a*) That throughout the whole period of study the attention of the student should be directed by his teachers to the importance of the preventive aspects of Medicine.

(*b*) That each Licensing Body should make adequate arrangements for the effective correlation of the several subjects of study throughout its curriculum.

(*c*) That the teaching of Anatomy and Physiology should include as a regular part of the courses the demonstration on the living human body of structure and function.

(*d*) That the Curriculum should be so arranged that a minimum period of three years shall in every case be available for study after the completion by the student of the Professional Examinations in Anatomy and Physiology held at the close of the second year.

(*e*) That the Curriculum should be so framed as to afford sufficient opportunities for the study, during the last three years of the course, of Physics, Chemistry, Biology, Anatomy, and Physiology, in their practical applications to Medicine, Surgery, and Midwifery, and that the student's knowledge of these applications should be subject to test in the Final Examination.

(*f*) That before the student is admitted to his clinical appointments he should have received practical instruction in clinical methods and in the recognition and interpretation of physical signs.

(*g*) That instruction should be given, in the courses of Forensic Medicine and Public Health or otherwise, on the duties which devolve upon Practitioners in their relation to the State, and on the generally recognized rules of Medical Ethics. Attention should be called to all *Notices* on these subjects issued by the General Medical Council.

APPENDIX B.

REGULATIONS OF THE CONJOINT EXAMINATION BOARD IN ENGLAND.

Before admission to the final examination for M.R.C.S. and L.R.C.P., candidates will be required to produce evidence that they have completed the following courses of study after passing Section I (Anatomy and Physiology) of the First Professional Examination):—

1. Of having attended at a recognized Medical School and Hospital—
   (*a*) A course of Pathology, including Morbid Anatomy and Histology; (*b*) A course of instruction in the performance of Post-Mortem Examinations. (Candidates will be required to produce evidence that they themselves have performed post-mortem examinations); (*c*) A course of Clinical Pathology; (*d*) A course of Bacteriology.
   (*e*) A course of practical instruction on Clinical Medicine; (*f*) A course of Practical Surgery, including Mechano-therapeutics.
   (*g*) A course of instruction in Forensic Medicine; (*h*) A course of instruction in Mental Diseases; (*i*) A course of instruction in Public Health, including Preventive Medicine and Hygiene, with practical demonstrations; (*j*) A course of instruction in administration of Anæsthetics, the certificate to include evidence that the Candidate himself has administered anæsthetics under supervision.
   (*k*) A course of instruction in Midwifery, and Gynæcology.
   (*l*) Instruction in Applied Anatomy and Applied Physiology; (*m*) A course of operative surgery.
2. Of having attended at a recognized hospital—
   (*a*) General Out-patient and In-patient Hospital Practice, including Clinical Lectures during twenty-one months; (*b*) Six months' Medical Clinical Clerkship, of which not less than three months shall have been in the Wards; (*c*) Six months' Surgical Dressership, of which not less than three months shall have been in the Wards; (*d*) Three months' Gynæcological Clerkship.
3. Of having attended five Labours conducted by a teacher or Member of the Staff of an approved Hospital, and of having subsequently conducted fifteen other Labours.
4. Of having received instruction in Children's Diseases and in the care of Infants for a period of three months at a recognized General Hospital or at a Children's Hospital recognized by the Examining Board in England for the purpose.
5. Of having attended for three months in each of the following Special Departments of recognized General Hospitals or at Special Hospitals recognized for the purpose:—
   (*a*) Eye.
   (*b*) Throat, Nose and Ear.
   (*c*) Skin.
6. Of having received instruction in Venereal Diseases at a recognized Hospital.
7. Of having received instruction in Radiology at a recognized Hospital.
8. Of having attended a course of instruction, including Clinical Demonstrations, at a recognized Fever Hospital.
9. Of having attended a course of instruction, including Clinical Demonstrations, at a recognised Mental Hospital.
10. Of having received instruction in Vaccination. The Certificate must be such as will qualify its holder to contract as a Public Vaccinator under the Regulations, at the time in force, of the Ministry of Health.

APPENDIX C.

ABSTRACTS OF THE ORGANIZATION OF THE UNIVERSITY CLINICS.

St. Bartholomew's Hospital : Medicine.

1. *Staff.*

Director ..	Professor FRANCIS R. FRASER, M.D., F.R.C.P. (Edin.).	Whole time.
Assistant Director ..	GEOFFREY EVANS, M.D., F.R.C.P.	Part time.
Chief Assistants	(i) GEORGE GRAHAM, M.D., F.R.C.P.	Part time.
	(ii) C. H. ANDREWES, M.D., M.R.C.P.	Part time.

and two House Physicians, of whom one is resident.

2. *Beds.*—56.

3. *Out-patient Department.*

On two days a week Director and Assistants attend in charge of Out-patient Department for teaching purposes and to see the cases discharged from the wards who continue as out-patients.

4. *Laboratories.*

(*a*) Small suite of laboratories close to wards shared with Surgical Clinic (Bio-chemical investigations, Clinical—Pathological, Bacteriological investigations).

(*b*) Larger laboratories now being provided by the aid of the " Dunn Bequest."

5. *Equipment.*

Ordinary laboratory equipment. Special apparatus for :—

(*a*) Basal metabolic rate determinations and blood gas analysis.

(*b*) School library, museum and special departments of hospital are available for the Clinic.

6. *Post Mortems.*

Examinations of all cases from wards of Clinic are made by the Chief Assistants and are carried out in Pathological Department of Hospital.

Histological examinations are carried out by the Staff of the Pathological Department, but the Chief Assistants of the Clinic are responsible ; also for reporting results.

A.—*Methods of Teaching.*

(i) *Ward Work.*—Examination and records of patients by Clinical Clerks during morning under the supervision of the Assistant Director, aided by unpaid advanced graduate students attached temporarily whilst working for higher examinations.

(ii) *Demonstrations.*—Four afternoons a week in the wards.

(iii) *Lectures.*—Courses of lectures are arranged (one is given weekly by Medical and Surgical Clinics on subjects of wide interest—*e.g.*, Tuberculosis, Syphilis, Diseases of the Liver, etc.). Other members of Hospital Staff and outside authorities are invited to take part.

(iv) *Keeping of Records.*—Card Indexes of diseases and names are kept in the office of the Clinic, Dr. Graham, as Registrar, being responsible. Records are kept in the Hospital Bureau, and are continuous :—Out-patient —ward ; out-patient—Special Department, etc.

B.—*Co-ordination.*

(i) *Pathological.*—Sir F. Andrewes (head of Pathological Department) takes ward demonstrations from time to time ; Dr. C. H. Andrewes acts as " liaison " and consults Pathological Department in difficult cases ; Dr. Gordon (Bacteriologist to the Hospital) visits the Clinic wards once

a week with the Director. Dr. Evans is conducting research in the Pathological Department.

(ii) *Anatomy and Physiology.*—Professor of Physiology visits the wards of the Clinic once a week with the Director; also he is writing on subjects associated with dyspnœa and is in close contact with the research on this subject in the Clinic.

Dr. Evans and Dr. Hume, of the Anatomy Department, are making investigations on the minute anatomy of the aorta.

(iii) *Clinical.*—Co-ordination between Medical and Surgical Clinics.

Staff of Clinic undertake a course of instruction in physical examination and history-taking for all the Clinical Clerks.

C.—*Research.*

(i) *General Lines.*—Each member of the staff of the Clinic (individually or in association with others) under the general supervision of the Director is encouraged to work out research problems for which he is specially trained. Volunteer assistants or special research appointments are attached to the Clinic.

Patients of junior members of Hospital or College Staff admitted to the wards of the Clinic for research purposes on request. Various researches undertaken and papers published.

Graduates working for theses are accommodated.

St. Bartholomew's Hospital: Surgery.

1. *Staff.*

Director ..	Professor G. E. Gask, C.M.G., D.S.O., F.R.C.S.	Whole time.
Assistant Director :	Mr. T. P. Dunhill, C.M.G., M.B.	Part time.
Assistants ..	(i) Mr. R. O. Ward, D.S.O., M.C., F.R.C.S.	Part time.
	(ii) Mr. G. L. Keynes, M.D. (Cantab.). F.R.C.S.	Part time.

2. *Beds.*—60.

3. *Out-patient Department.*

Out-patient Department attached to the Clinic; also the Clinic takes its share of the emergency work of the Hospital.

The teaching is shared by the Director and the Assistant Director.

4. *Laboratories.*

Small separate laboratory for use of Medical and Surgical Clinics, being enlarged with aid of "Dunn Bequest."

5. *Equipment.*

(*a*) Necessary apparatus for demonstrations of bacteriology and histology.

(*b*) The X-ray work is done in the X-ray Department.

(*c*) The general School Library and the Museum are available for Clinic students.

6. *Post Mortems.*

The Clinic does its own post mortems with the aid of the Lecturer on Morbid Anatomy.

A.—*Methods of Teaching.*

(i) *Ward Work.*—Students brought into intimate contact with patients. Teaching partly individual and partly in ward rounds.

(ii) *Demonstrations.*—Groups of cases illustrating diseased processes, followed by visits to the museum and laboratory.

(iii) *Lectures.*—Joint lectures (of the two Clinics) give large bodies

of students a broad grasp of certain subjects :—Disorders of the Stomach, Disorders of the Kidney and Urinary Tract, Disorders of the Liver, Problems of Tuberculosis, Syphilis.

(iv) *Keeping of Records.*—Card Index System employed. " Follow Up " Department provides valuable record of results of treatment.

Teaching is carried out in the Operating Theatre—observation of morbid living anatomy.

B.—*Co-ordination.*

(i) *Pathological.*—One Assistant responsible for pathology in close co-operation with the members of the Pathological Institute. Pathological Clerks—old dressers—actually do all the routine pathology. Pathology and Surgery are taught concurrently.

(ii) *Anatomy and Physiology.*—The Director goes into the Anatomical Department and the Demonstrators, *vice versa*, to give demonstrations.

(iii) *Clinical.*—Free inter-communication with all the other firms, both Medical and Surgical. The Staff of the Medical and Surgical Clinics have ready access to the other wards and are, in fact, constantly in communication with the other wards and are often asked to see other firms' cases. If the Clinic wants cases from other firms there is no difficulty.

(iv) *Affiliation with other Hospitals.*—Mental diseases, fevers, venereal diseases.

C.—*Research.*

General Aim.—To imbue the student with the spirit of investigation, showing the needs of the patients and illustrating, by example, how research may be combined with treatment.

All members of the Clinic are engaged in one piece of collective investigation ; in addition each member has a particular and individual piece of work.

Various researches undertaken and papers published.

London Hospital : Medicine.

1. *Staff.*

Director	..	C. H. Miller, C.B.E., M.D., F.R.C.P. Part time.*
Assistants	..	(i) Arthur W. M. Ellis, O.B.E., M.B., M.R.C.P. .. .. Whole time.
		(ii) George Riddoch, M.D., M.R.C.P. Part time.
		(iii) A. G. Maitland Jones, M.C., M.D., M.R.C.P. .. .. Whole time.
		(iv) Resident House Physician.
		(v) Non-resident Assistant House Physician.

* Practically whole time.

2. *Beds.*—70.

3. *Out-patient Department.*
Two afternoons, general.
One morning, children.

4. *Laboratories.*
In process of construction—" Dunn Trust." Clinical Laboratory of the Hospital at present being used.

5. *Equipment.*
(*a*) General Hospital equipment available.
(*b*) Library : Medical School Library available.
(*c*) Museum : Medical School Museum available, together with Professor Turnbull's specimens.

6. *Post Mortems.*
Conducted by Professor Turnbull (pathologist to hospital).

A.—*Methods of Teaching.*

(i) *Ward Work.*—Individual teachers to small groups or single students every day.

(ii) *Demonstrations.*—In the wards three times a week; in the Out-patient Department three times a week.

(iii) *Lectures.*—Arranged by the Medical School:—

(*a*) Routine, in which the Clinic takes no part.

(*b*) Special, in which the Clinic takes a part.

(iv) *Keeping of Records.*—By card index summaries and special notes (kept in the Clinic Office).

House Physician's notes kept by the Hospital Registrar for Hospital records.

B.—*Co-ordination.*

(i) *Pathological.*—With Professor Turnbull and Dr. Panton, the Director of the Hale Clinical Laboratory, on various researches and all routine work.

Combined Surgical, Medical, Laboratory and Radiological Gastric Research.

(ii) *Clinical.*—Co-operation as regards teaching and the furnishing of cases to the Clinic for investigation.

(iii) *Radiology, etc.*—Complete co-operation over all routine work.

C.—*Research.*

Various researches, clinical investigation chiefly undertaken, and papers published.

London Hospital : Surgery.

1. *Staff.*

Director	..	Mr. H. S. Souttar, F.R.C.S. ..	.. Part time.
Assistants	..	(i) Mr. A. C. Perry, F.R.C.S.	.. Whole time.
		(ii) Mr. H. W. B. Cairns, F.R.C.S.	.. Whole time.
		(iii) Miss Maitland-Jones, M.R.C.S. (Anæsthetist)	.. Part time.

2. *Beds.*
61 general; 36 septic.

3. *Out-patient Department.*
Regular duty on two afternoons a week.
"Follow-through" Department one morning a week.

4. *Laboratories.*
Experimental Mechanical Laboratory and Clinical Laboratory of Hospital.

5. *Equipment.*
(*a*) Fully-equipped theatre.
(*b*) Fully-equipped workshop where any experimental apparatus can be made; full-time mechanic.
(*c*) Library: Access to a wide range of surgical and experimental literature in the library of the Medical College and of the Clinical Pathological Department of the Hospital.
(*d*) Museum: Mr. Cairns is producing a series of large thick sections showing the naked eye pathology of a large number of surgical conditions. The convenience of handling these sections renders them invaluable for purposes of demonstration. The pathological material of the Clinic is reserved for use in the various demonstrations.

6. *Post Mortems.*

Carried out by Professor Turnbull. The members of the Clinic make a point of seeing their own cases.

A.—*Methods of Teaching.*

(i) *Ward Work.*—The whole of the students of the hospital receive bedside teaching and instruction in elementary surgical technique during their first three months as Dressers in the Hospital. In addition, Dressers are attached to the Unit in the same way as to other firms.

(ii) *Demonstrations.*—The Director gives a Ward Demonstration every Tuesday morning, which is attended by a large number of senior students. It is followed by a demonstration of pathological material bearing on cases shown. Two ward demonstrations in the week are given by the assistants. A special demonstration on the Surgery of Septic Cases is given by Mr. Perry every Saturday morning.

(iii) *Lectures.*—Lectures for senior and post-graduate students are arranged by the Director and given by Members of the Surgical Staff of the Hospital.

(iv) *Keeping of Records.*—In addition to the regular hospital notes, a full record of each patient is entered in a Card Index. Notes are kept in special schedules of all Gastric Cases and another special schedule is used for acute Abdominals. In addition to these, full descriptive notes are kept of Cerebral and other cases of special interest.

B.—*Co-ordination.*

Close co-ordination : one of the Clinic Assistants frequently acts as demonstrator in one of the other Departments (pathological, anatomical, physiological, electro-therapeutic).

C.—*Research.*

The very thorough system of examination and note-taking is regarded as chief contribution to research. In conjunction with the Medical Clinic special attention is being directed to an investigation on chronic gastric ulcer. Various researches undertaken and papers published.

St. Mary's Hospital : Medicine.

1. *Staff.*

Director	.. Professor F. S. Langmead, M.D., F.R.C.P.	Whole time.
Assistants	.. (i) C. M. Wilson, M.D., M.R.C.P. ..	Part time.
	(ii) A. C. Alport, M.D., M.R.C.P. ..	Part time.*
	(iii) E. G. B. Calvert, M.D., M.R.C.P.	Part time.*

* Practically whole time.

2. *Beds.*

111 : 35, St. Mary's Hospital ; 76, Paddington Hospital (Infirmary).

3. *Out-patient Department.*—Three half-days weekly, one taken by Director and two by First Assistant.

Special session weekly for discharged in-patients for whom continued observation considered of value—taken by Director and Second Assistant.

The children's and infants' clinic is under the control of the Director.

4. *Laboratories.*

(*a*) One at St. Mary's shared with Surgical Clinic.

(*b*) One at Paddington Hospital.

5. *Equipment.*—In addition to the usual apparatus for Clinical Medicine in the Wards, full equipment is available for Bio-chemical routine work

and research ; also essentials for other Pathological work or Bacteriology, which could be developed as necessary. The X-ray Department of the Hospital is available for the Clinic. There is a dark room, photographic apparatus and lantern.

The Medical School Library and Museum are available.

A Clinical Theatre has been provided for the use of the Medical and Surgical Clinics.

6. *Post Mortems.*

Director of the Clinic uses the Hospital Post Mortems for demonstration on the clinical aspects of the cases. The Pathologist demonstrates on the findings.

A.—*Methods of Teaching.*

(i) *Ward Work.*—Intimate instruction of the Clerks in the Wards on several days a week in methods and inferences.

(ii) *Demonstrations.*—Two demonstrations weekly, one hour, on selected cases open to all students. The Demonstrations are illustrated by cases, museum specimens, microscopic slides, radiograms, etc. There are also sets of demonstrations to junior students about to become Clinical Clerks.

(iii) *Lectures.*—Occasional lectures by the honorary staff of the Hospital on special subjects.

(iv) *Keeping of Records.*—Notes written by the clerks supervised by the House Physician and Director, who writes a critical survey of each case. Card Index is kept of (*a*) names of patients ; (*b*) diseases. The dossier of each case includes special reports—bacteriological, post-mortem, blood reports, radiological, etc.

B.—*Co-ordination.*

(i) *Pathological.*—Bio-chemical examinations of the Clinic done by members of the Clinic itself ; also a considerable part of the blood histology. There is close co-operation with the Institute of Pathology, which willingly furnishes, as desired, reports on pathological specimens, provides illustrative material, carries out special investigations in particular cases and gives opinions and help in immunological problems.

(ii) *Anatomy and Physiology.*—Professors of Anatomy and Physiology pay regular visits to the Clinic Wards. The Professor of Anatomy demonstrates upon the anatomical features of clinical cases at the demonstrations of the Clinic. He also gives a short series of demonstrations on applied anatomy.

(iii) *Clinical.*—The Physicians to the Hospital give occasional demonstrations on special subjects. They also assist in the usual consultations on cases.

(iv) *Radiology, etc.*—Radiological Department is fully utilized. Radiologist willingly screens any patient for the instruction of the Clerks at the request of the Director.

(v) *Affiliation with other Hospitals.*—In addition to affiliation of the School with the Paddington Green Children's Hospital, Maida Vale Hospital for Nervous Diseases, Female Lock Hospital, and the Queen Charlotte's Lying-in Hospital, there is affiliation with the Paddington Hospital (Infirmary), in which seventy-six of the Clinic's beds are situated. The Clinic's patients in this Infirmary are under the direct medical care of the First Assistant. Records are kept by special Clerks attached to the Clinic and are supervised and indexed by the Third Assistant. The teaching is done by the First Assistant, who gives also demonstrations there on one afternoon a week, open to all students of the School.

C.—*Research. General Lines.*

(i) *Clinical Research.*—Each case is examined by the newer laboratory

methods ; a critical survey is made and accurate notes are kept. This method should, in time, provide ample material for original papers.

(ii) *Laboratory Research.*—(With clinical material) : Two chief lines are being followed—(*a*) Bio-chemical ; (*b*) Blood and blood-forming organs.

St. Mary's Hospital : Surgery.

1. *Staff.*

Director	..	Professor CHARLES A. PANNETT, M.D., F.R.C.S.	Whole time.
Assistants	..	(i) Mr. R. M. HANDFIELD-JONES, M.S., F.R.C.S.	Part time.
		(ii) Mr. A. COMPTON, M.B., D.Sc. ..	Whole time.
		(iii) House Surgeon.	

2. *Beds.*
39+74 at Paddington Infirmary (37 male, 37 female).

3. *Out-patient Department.*
Two half-days a week—one taken by Director, one by Assistant Director.

4. *Laboratories.*
Clinical Laboratory shared with the Medical Clinic.
The Laboratories of the Physiology Department and of the Pathological Institute are available.

5. *Equipment.*
(*a*) Special Laboratory apparatus for research has been acquired by the Clinic.
(*b*) A well-equipped Clinical Theatre.

6. *Post Mortems.*
These are performed by students under the supervision of the Pathologist to the Hospital, who also supervises the routine section-cutting, etc. It is considered a retrograde step to place these matters in the hands of men who are primarily Clinicians.

A.—*Methods of Teaching.*

(i) *Ward Work.*—One ward-round for Senior students and one for Junior students take place weekly.

(ii) *Demonstrations.*—Three Clinical demonstrations in the Clinical Theatre take place weekly ; also one practical class in minor surgery, in which the students make plasters, apply extensions, do lumbar puncture on the cadaver, etc.

(iii) *Lectures.*—No systematic lectures are undertaken by the Clinic.

(iv) *Keeping of Records.*—The Clinic's records are filed separately (Card Index system). They are also included in the general Hospital system. A Clinic Secretary looks after the keeping of the Records.

B.—*Co-ordination.*

(i) *Pathological.*—Lessons to be learned from a consideration of altered structure as seen by the Pathologist in the Post Mortem Room and in tissues removed by operation are demonstrated by the pure pathologist.

(ii) *Anatomy and Physiology.*—Professor of Anatomy gives demonstrations on patients in the Clinic Wards from an anatomical standpoint.

(iii) *Clinical.*—There is the usual intercourse between members of the staff. At times, patients are lent for demonstration purposes to the Clinic. Special examinations such as esophagoscopy are done for the Clinic by other members of the staff. Sometimes the Clinic does examinations for them (*e.g.*, pyelography, etc.).

(iv) *Affiliation with other Hospitals.*—Maida Vale Nerve Hospital, Paddington Green Children's Hospital, Paddington Infirmary.

The surgical teaching at the Paddington Green Hospital is done by the staff of that Hospital. At the Paddington Infirmary there are two special male surgical wards of thirty-seven beds and one female of thirty-seven. In addition, the rest of the Infirmary is available for teaching purposes, and the Director is Consulting Surgeon to the Infirmary.

There is a modern operating block at this Infirmary, and the students receive clinical demonstrations on cases on one afternoon a week.

St. Thomas's Hospital : Medicine.

1. *Staff.*

Director	..	Professor HUGH MACLEAN, M.D., D.Sc., M.R.C.P. .. .. Whole time.
Assistants	..	(i) ISAAC JONES, M.D., M.R.C.P. .. Whole time
		(ii) KENNETH AIKMAN, M.D. .. .. Whole time.
		(iii) One House Physician.

Pathologist (S. C. DYKE, M.B., B.Ch., D.P.H.), share with Surgical.

2. *Beds.*

Sixty in two Wards (One male and one female) ; General Medicine.

3. *Out-patient Department.*

General use of Hospital Out-patient Department one day a week.

4. *Laboratories.*

(*a*) Hut Laboratory.

(*b*) Bacteriological Laboratory.

(*c*) Chemical Laboratory.

(*d*) Basal Metabolism.

(*e*) New Research Laboratory, consisting of five large rooms, now almost complete.

5. *Equipment.*

Library.

Small Unit Museum being gradually built up.

All the laboratories in use are fully equipped. It is hoped that the new laboratory will also be fully equipped in the near future.

6. *Post Mortems.*

General use of Post Mortem arrangements for own cases.

A.—*Methods of Teaching.*

Ward work, demonstrations, lectures, clerking, case-taking.

B. *Co-ordination.*

(i) *Pathological.*—Close correlation (Dudgeon and Urquhart).

(ii) *Anatomy and Physiology.*—Director has taught physiology for six years, and Deputy-Director has made a special study of Anatomy and taught it for years, so we are able to give the necessary amount of these subjects in the Unit.

For anatomical teaching we make a good deal of use of the post-mortem room.

(iii) *Radiology, etc.*—Close correlation with Mr. Timberg and Mr. Mennell (Electrical and Massage). Also Dr. Cassidy on Cardiac Staff, Sir Archibald Reid (Radiology) and Dr. Buzzard (Neurology).

St. Thomas's Hospital : Surgery.

1. *Staff.*

Director	.. Sir CUTHBERT WALLACE, K.C.M.G., C.B., F.R.C.S.	Part time.
Assistants	(i) Mr. B. C. MAYBURY, F.R.C.S. ..	Part time.
	(ii) Mr. B. W. WILLIAMS, , M.B., B.Ch. (Oxon)	Whole time.
	(iii) Mr. S. C. DYKE, M.B., D.P.H. (Oxon)	Whole time.
House Surgeon	Mr. N. S. MACPHERSON, M.R.C.S. ..	Whole time.

2. *Beds.*
Sixty-nine.

3. *Out-patient Department.*
Held by Director, Assistants, House Surgeon and Dressers in the Casualty Waiting-Rooms, both for new cases and for cases that have been through the wards.
Records kept by Card Index.

4. *Laboratories* (Common to the two Units).
(*a*) Small laboratory for the Pathological Assistant with Media Room adjoining.
(*b*) Large pathological laboratory for students.
(*c*) Chemical laboratory, consisting of (i) preparation room, (ii) students' laboratory.
(*d*) Animal operating room in the Medical School.
(*e*) Office, classroom and library fitted for lantern demonstrations, etc.

5. *Equipment.*
(*a*) The laboratories are well-equipped for research and demonstrations. A projection apparatus now being added for better demonstrations of microscopic specimens.
(*b*) Good library in the School for text-books and periodicals. Small Surgical and Pathological Library being provided for the Clinic.
(*c*) Museum under the care of Mr. Shattock ; ground floor given up to type specimens, allowing the student to study his clinical cases by means of the specimens ; students encouraged to work in the museum by themselves. They are aided by a specially arranged descriptive catalogue.

6. *Post Mortems.*
The " Clinic " attends Post Mortems ; they are performed in the Pathological Department of the School, the material taken and examined in the Clinic Laboratory for demonstration purposes. The official record is the work of the Pathological Department.

A.—*Methods of Teaching.*
(i) *Ward Work.*—Director, Assistants and House Surgeon go round the wards of the two Clinics on certain days.
(ii) *Operations.*—Shared by Director and Assistants. The students assist, and cases, operative findings and material are demonstrated and notes dictated.
(iii) *Demonstrations.*—Clinical Pathological demonstrations of the material obtained during the week are taken by the Director and his assistants.
(iv) *Lectures.*—The Clinic takes part in the lectures arranged by the School Council for all students. They take the form of a scheme of lectures on the different " Systems."
(v) *Keeping of Records.*—The Hospital forms are used. Notes, including Clinic notes, throughout the Hospital are supervised by the Surgical Registrar, and are classified under diseases and not under any particular Surgeon. The Clinic keeps a Card Index giving an abstract of

each case. This is used on the Thursday afternoon in the Out-patient Department and a record of the patient's progress is thus obtained. The Clinic also has special forms for certain cases; at present, stomach cases. Reference is also kept to the microscopic section pertaining to any case.

B.—*Co-ordination.*

(i) *Pathological.*—The Pathological lectures and demonstrations are correlated to the Clinical teaching. The student is also taught chemical investigation while in the Clinic and the histology of tumours and morbid products.

(ii) *Anatomy and Physiology.*—The Junior Surgeons always take part in the anatomical teaching. In addition, Mr. Maybury teaches throughout the year surgical anatomy by means of the living model, dissections and the dead body. There is always close co-operation with the Anatomist and the Physiologist—*e.g.*, Mr. Swainson, Demonstrator of Anatomy, is preparing some specimens illustrating surgical points in the anatomy of the knee-joint.

(iii) *Clinical.*—Relations between different members of the staff have always been such that any special knowledge possessed by one man is available for all.

(iv) *Radiology.*—Students attend in the Radiological Department and get every possible assistance and help that they want. Recently, one man has been comparing the radiological appearances with the Clinical and operative findings in gastric cases.

(v) *Affiliation with other Hospitals.*—No special arrangements with other Hospitals except in the case of fevers and mental diseases.

C.—*Research.*

Various researches undertaken and papers published.

University College Hospital: Medicine.*

1. *Staff.*

Director	.. Professor T. R. Elliott, D.S.O., M.D., F.R.C.P., F.R.S.	Whole time.
Assistants	.. (i) C. H. Kellaway, M.D., M.R.C.P.	Whole time.
	(ii) J. W. McNee, D.S.O., M.D., M.R.C.P.	Part time.
	(iii) F. M. R. Walshe, M.D., F.R.C.P. (Neurology)	Part time.
	(iv) K. S. Hetzel, M.B., M.R.C.P. ..	Whole time.
	(v) Charles Singer, M.D., F.R.C.P. (History of Medicine)	Part time.

2. *Beds.*
Thirty-four beds (also an additional twenty for clerking).

3. *Out-patient Department.*
Two half-days a week.

4. *Laboratories.*
A room in the Medical School for each Assistant; also a large general Research Laboratory with a Bacteriological attendant, and a Histologist shared with the Surgical Clinic.

Laboratory accommodation near the wards to be provided in two years' time.

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* The University Clinics at University College have received munificent help from the Rockefeller Foundation.

5. *Equipment.*

Apparatus and equipment are bought as required.

Library : A special departmental library of the chief reference books is maintained in the Director's room for workers in the laboratories. There is also the Graham Research Library for the Medical School.

Museum : Students make good use of the museum facilities provided for the School.

6. *Post Mortems.*

Performed by the Hospital Pathologist. All material from Clinic cases is also investigated in the Clinic's laboratories and microscopic slides are prepared.

A.—*Methods of Teaching.*

(i) *Ward Work.*—In addition to the routine teaching, there is a special staff round once a week at which the Professor of Pharmacology is also present.

(ii) *Lectures.*—Systematic lectures have not been discarded. Medical lectures and teaching in the Hospital and Medical Schools are arranged by the Director. They are shared by honorary physicians and the Clinic staff.

(iii) *Keeping of Records.*—The general records are poor, because they are made by the Clerks under the House Physician's direction ; but the system is good for the Clerks. Special types of diseases have special and better records and their history is followed up.

B.—*Co-ordination.*

The Medical Clinic works in close co-operation with all other Medical Departments of the Hospital.

(i) *Pathological.*—The Laboratory rooms of the Clinic are adjacent to those of the Professor of Pathology in the School. The Director of the Clinic, with the assistance of Sir Thomas Lewis, is re-writing and re-arranging the descriptions of medical specimens in the Pathological Museum in such a way that all shall be easily available to students. A clinical history for each specimen is always given fully, as well as the pathological description.

(ii) *Affiliation with other Hospitals.*—National Dental Hospital and the Royal Ear Hospital are affiliated to University College Hospital. General arrangements exist whereby any student who desires to do so may clerk in the final year without further payment at Queen Square Hospital for Nervous Diseases, and at the Great Ormond Street Hospital for Sick Children, but these opportunities are not often utilized by students.

C.—*Research.*

Various researches undertaken and papers published.

University College Hospital : Surgery.

1. *Staff.*

Director	.. Mr. C. C. Choyce, C.M.G., C.B.E., F.R.C.S.	Whole time.
Assistants	.. (i) Mr. E. K. Martin, M.S., F.R.C.S.	Part time.
	(ii) Mr. F. J. F. Barrington, M.S., F.R.C.S.	Part time.
	(iii) Mr. J. B. Hunter, F.R.C.S. ..	Whole time.
	(iv) Mr. A. G. Timbrell Fisher, F.R.C.S.	Part time.
	(v) Mr. C. C. Elliott, F.R.C.S.E. ..	Whole time.

2. *Beds.*

Forty-one (including six cots).

This number is to be increased when the new buildings are finished.

3. *Out-patient Department.*

Out-patient Clinics are taken on three afternoons a week; old Ward cases are also seen on these afternoons as well as new Out-patients.

4. *Laboratories.*

(*a*) Clinic laboratory in Medical School.

(*b*) Two workers in another laboratory lent by the Pathological Department until the Clinic's own laboratories are rebuilt.

(*c*) A new wing of the Medical School is being built which will free the whole of the existing top floor for further laboratories for the Surgical Clinic.

(*d*) One large and two small Surgical Laboratories in the Hospital itself are to be built within the next two years on the site of one of the present operating theatres and close to the Clinic's Wards.

5. *Equipment.*

(*a*) In addition to the Laboratory equipment of the School generally and of the other departments to which the Clinic has free access, the Clinic possesses microtomes, a centrifuge, incubator, etc., and six microscopes are reserved for the Clinic's own use. The sum of £1,000 has been earmarked for additional equipment to be provided as soon as the new laboratories are open.

(*b*) *Library* :—

(i) Large general library in the Medical School.
(ii) Graham Library available for teachers and researchers.
(iii) Collection of books and journals in the Director's room.
(iv) Lewis's Library (subscription for fourteen volumes).

(*c*) *Museum.*—Specimens of definite teaching value are well arranged and are accompanied by a description of the Morbid Anatomy, a statement of the microscopic appearance and usually a résumé of the clinical history. The Clinic has now commenced to place lantern slides, etc., in association with its specimens.

6. *Post Mortems.*

These are done by one of the Staff of the Pathological Department. At least one member of the Surgical Clinic attends at all Post Mortems of surgical interest. In cases that have passed through the Clinic's Wards the whole of the Clinic's staff attends, and during the progress of the autopsy one of its members discusses the case from the clinical point of view.

A.—*Methods of Teaching.* The Unit Staff is responsible for :—

(i) *Ward Work.*—At least one (generally three) of the Clinic's staff spends each morning in the Wards with the Dressers and House Surgeon.

(ii) *Demonstrations* :—

(*a*) Clinical demonstration once a week of new cases and of results of operations performed (with morbid specimens and microscopic sections of the operative material of the week).
(*b*) Out-patient demonstrations as above.
(*c*) Surgical Pathology.
(*d*) Junior practical Surgery, including aseptic methods, bandaging, plasters, catheters, simple splints, etc.
(*e*) Senior practical Surgery, chiefly fractures and dislocations.
(*f*) Operative Surgery on the cadaver twice a year for a month at a time.
(*g*) Junior Clinical Surgery Class twice a week (half an hour's lecture followed by an hour's demonstration on cases in the Wards). For this purpose the Clinic has free access to all cases in the Hospital.

(iii) *Lectures.*—Three lectures each week. During this winter session these cover :—General principles of surgery and general diseases; diseases of the breast; genito-urinary surgery.

(iv) *Keeping of Records.*—Records are kept in the Director's Office and are filed in serial number. Indexing is carried out by card indexes as follows :—

(*a*) Name of patient.
(*b*) Disease of patient.
(*c*) Points of special interest and complications.
(*d*) Cases to be followed up each month for estimation of progress.

B.—*Co-ordination.*

(i) *Pathological.*—

(*a*) Close co-operation with the Professor of Pathology.

(*b*) Clinical Pathologist to the Hospital at present does the Clinical Pathological examinations with his students who have recently been dressers in the Clinic.

(*c*) Sections of morbid specimens and operative exhibits are cut and examined and filed in the Clinic's laboratories.

(ii) *Anatomy and Physiology.*—Frequent intercourse with the members of Professor Elliott Smith's staff, one of whom takes the class in Surgical Anatomy after consultation with the Director as to type of teaching, etc. Members of the Clinic staff also take every opportunity of teaching the anatomy of the part involved during clinical demonstrations, operative surgery and other classes.

(iii) *Clinical.*—Consultations held with other firms, both surgical and medical.

(iv) *Radiology, etc.*—Done for the Clinic by the Radiographic, Electrical, Physico-therapeutic and Balneological Departments of the Hospital.

(v) *Affiliation with other Hospitals.*—National Dental Hospital; Royal Ear, Nose and Throat Hospital; National Hospital for Paralysis and Epilepsy; Hospital for Sick Children.

C.—*Research.*

Various researches undertaken and papers published.

London School of Medicine for Women: Obstetrics and Gynæcology.

1. *Staff.*

Director	.. Professor A. Louise McIlroy, M.D., D.Sc.	Whole time.
Assistants	.. (i) Miss Gertrude Dearnly, M.D. .. (ii) Miss Charlotte Houlton, M.D.	Whole time.
Registrar and Clinical Pathologist : Miss Hall, M.D.		Whole time.

One Laboratory girl.
One Laboratory Assistant (for research work, paid by Medical Research Council).
Three House Surgeons :—
(i) Royal Free Hospital;
(ii) Marlborough Maternity Section;
(iii) District.

2. *Beds.*

69 = 11 Obstetrical (Royal Free Hospital).
23 Gynæcological (Royal Free Hospital).
26 Obstetrical (Marlborough Maternity Section).
2 Isolation Beds (Marlborough Maternity Section).
5 V.D. Obstetrical cases (Marlborough Maternity Section).
2 Emergency Beds (Marlborough Maternity Section).

3. *Out-patient Department.*

Rooms reserved for the use of the Clinic—

Gynæcological	...	Two days weekly.
Ante-natal	...	Four days weekly.
Post-natal	...	One day weekly.

The Indoor Ante-natal cases are accommodated in whatever beds of the Clinic are available at the time.

4. *Laboratories.*

Small clinical laboratory for the examination of ward specimens and bacteriological and histological research.

The chemical examinations are carried out in laboratories in the School of Medicine.

The routine pathological work is carried out by staff of Pathological Department of the Hospital.

5. *Equipment.*

An operating theatre and a labour ward (two beds) in the Royal Free Hospital.

An examination room for the In-patients.

An operating theatre and two labour wards in Marlborough Maternity Section.

A Demonstration Room for operative obstetrics and tutorials is provided for the Clinic, and opening out of the Hospital Lecture Room where the Systematic Lectures are given.

Phantoms, instruments, etc., are provided for the use of the students.

Library.—A small library is being collected for the use of the Clinic and grants of books are given by the School of Medicine.

Museum.—All specimens for permanent preservation are kept in the General Pathological Department.

6. *Post Mortems.*

Performed in the General Pathological Department of the Hospital.

A.—*Methods of Teaching.*

(i) *Ward Work.*—Daily rounds with the students. Examination of patients in the examination room.

(ii) *Operations.*—Three times a week in Gynæcological Department. Eight gynæcological clerks take duty for three months.

Five Junior Obstetrical Clerks in rotation for one month in the Marlborough Section, then one month as Seniors in the Royal Free Hospital and District Obstetrical Department.

About sixty students are provided with twenty obstetrical cases in the year.

(iii) *Demonstrations.*—Are given by the Senior Staff on normal and abnormal obstetrical cases as they occur. The resident House Surgeons supervise every case of labour undertaken by the students in hospital, and visit later those in the District where emergency help is not required. The House Surgeon supervises personally the first two cases of labour taken by the students in the District.

Demonstrations of specimens are given at intervals by the Senior Staff. The Clinical Pathologist gives two demonstrations weekly on specimens or slides.

(iv) *Lectures.*—A course of systematic lectures for Senior students is given once a week in the Autumn and Spring terms by the Director, and also a course of Operative Obstetrics once a week throughout the year.

A tutorial in midwifery and gynæcology is given for Senior students once a week by each Assistant.

A Preparatory Class in Obstetrics is given by a member of the Senior Staff in rotation each term for students enrolling in the Clinic.

B.—*Co-ordination.*

Co-operation between the Clinic and the Infant Welfare Department and the V.D. Department; treatment of indoor V.D. patients other than that requiring obstetrical knowledge is undertaken by Director of the V.D. Department of the Hospital.

The Ante-natal patients attend the Dental Department as a routine.

X-ray Department of the Hospital carries out examinations and treatment for the Clinic.

Welsh National School (Cardiff): Medicine.

1. *Staff.*

Director	..	Professor A. M. KENNEDY, M.D.	.. Whole time.
Assistants (Temporary)—			
		(i) IVOR J. DAVIES, M.D., M.R.C.P.	.. Part time.
		(ii) HERBERT T. EVANS, M.A., M.D., M.R.C.P.	.. Part time.

2. *Beds.*
Seventeen and two cots.

3. *Out-patient Department.*
Two afternoons a week, conducted by the two Assistants.

4. *Laboratories.*
Unused Operating Theatre (provisional).

5. *Equipment.*
Microscopes, hæmocytometers, hæmoglobinometers, spectroscopes, sphygmomanometers and equipment for blood work. Torsion and other balances. Apparatus for urinary analysis. Polygraph and sphygmograph, etc.

6. *Post Mortems.*
Done by the Pathologists.

A.—*Methods of Teaching.*

(i) *Ward Work.*—Daily, 10 to 12 noon.

(ii) *Demonstrations.*—Clinical Lecture Demonstrations on selected cases, instruction in clinical methods and chemical laboratory work, including hæmatology, urine analysis, etc., are given throughout each term, and special demonstrations on microscopical preparations, charts, tracings, instruments, etc., and macroscopical specimens of medical interest are arranged weekly. Students grouped in sections—senior and junior.

(iii) *Lectures.*—Daily.

(iv) *Keeping of Records.*—All cases reported by Senior students. Reports written first in note-books and after correction by Professor are copied on to case sheets. Cases noted at intervals.

B.—*Co-ordination.*

Clinical Pathology and Anatomy and Physiology as applied to Clinical Medicine taught to students in the Clinic.

Special Hospitals.—Cardiff City Mental Hospital.

Poor Law Infirmaries, etc.—Cardiff Board of Guardians (City Lodge).

The Professor of Medicine is Hon. Consulting Physician and may teach in City Lodge.

Welsh National School (Cardiff : Surgery.

1. *Staff.*

Director	.. Professor A. W. SHEEN, M.S., Lond., F.R.C.S.	Whole time.
Assistants	.. (i) J. W. GEARY GRANT, F.R.C.S. ..	Part time.
	(ii) T. E. HAMMOND, F.R.C.S. ..	Part time.
	(iii) J. B. HAYCRAFT, Ch.B. (Edin.), F.R.C.S.	Part time.

Lecturer in Ophthalmology.—F. P. S. CRESWELL, B.S. Lond., F.R.C.S. (Assisted in practical work by two other Ophthalmic Surgeons).

Lecturer in Oto-Rhino-Laryngology.—D. R. PATERSON, M.D. (Edin.).

Lecturer in Anæsthetics.—H. GORDON GREAVES, M.B. (Cantab.).

(The staff will be added to by further special teachers when the sixth year begins).

2. *Beds.*

Forty fixed—isolation and extra-emergency beds often bring number up to nearly fifty. Twenty Eye and twenty Ear, Nose and Throat beds available.

3. *Out-patient Department.*

Once weekly. Minor operations and minor surgical procedures twice weekly. Casualty Department attended.

4. *Laboratories.*

Clinical Laboratory near Wards for morbid histology, bacteriology and some blood work. Also research.

5. *Equipment.*

Clinic equipment being gradually acquired, the School being a new one ; hospital equipment is available for teaching and includes X-ray, Radium, Diathermy and Physico-therapy.

Library.—A departmental library with surgical works and current surgical periodicals.

Museum.—Central museum used. Rough specimens for demonstration and a collection of slides kept in Clinic Laboratory.

6. *Post Mortems.*

Carried on in Pathological Department. Students attend.

A.—*Methods of Teaching.*

(i) *Ward Work.*—Professor visits twice weekly and other times when necessary. Assistants visit every week-day.

(ii) *Demonstrations.*—Practical surgery twice weekly. Ward demonstrations : operations twice weekly.

(iii) *Lectures.*—Systematic lectures thrice weekly (two terms). Clinical lectures once weekly usually.

(iv) *Keeping of Records.*—Clinic keeps elaborate records of all work, using card indexes. A " follow-up " system is in operation.

B.—*Co-ordination.*

Pathological :—

(*a*) The Clinic Laboratory obtains help from the Central Pathological Laboratory.

(*b*) Students attend Post Mortems in Central Pathological Department.

(*c*) Central Pathological Department Museum specimens are used for clinical teaching in Clinic.

(*d*) Generally there is close co-ordination between Clinic and Central Pathological Departments.

Anatomy and Physiology :—

(*a*) Arrangements being made for Anatomy students to attend surgical demonstrations.

(*b*) Surgical applied Anatomy taught in the Anatomy Department continuing a previous arrangement.

Clinical :—

(*a*) Clinical teaching by Hospital Surgical Staff.

(*b*) Liaison between Medical and Surgical Clinic.

(*c*) Liaison between Surgical Clinic and X-ray, Physico-therapy, Venereal and other Hospital Departments.

Radiology, etc.—The Unit uses the general X-ray and Physico-therapy Departments of the Hospital and utilizes the radium on loan from the Medical Research Council.

C.—*Research.*

The only general lines of research at present followed relate to genito-urinary surgery.

Welsh National School (Cardiff) : Obstetrics and Gynæcology.

1. *Staff.*

Director	..	Professor Ewen J. Maclean, M.D., F.R.C.P. .. .. Part time.
Assistants	..	(i) Gilbert I. Strachan, M.D., M.R.C.P., F.R.C.S. .. .. .. Part time.
		(ii) B. K. Tenison Collins, M.A., M.D., B.C., Cantab., F.R.C.S.E. .. Part time.

2. *Beds.*

Twenty-four Gynæcological and thirty-one Obstetrical at King Edward VII Hospital. Twelve to twenty Gynæcological and twenty Obstetrical at the Poor Law Infirmary.

3. *Out-patient Department.*

Two half-days weekly.

4. *Laboratories.*

Well-equipped Clinic Laboratory now under construction in Maternity Department; routine investigations conducted by the Professor of Pathology and Bacteriology.

5. *Equipment.*

Teaching models, wall diagrams, microscopes, lantern slides, etc., are provided. X-ray and Radiological Department of the Hospital is available for the Clinic.

Library.—About fifty standard works. Various journals.

Museum.—The specimens will be housed in the Departmental Museum when completed.

6. *Post Mortems.*

Conducted by the Professor of Pathology.

A.—*Methods of Teaching.*

(i) *Ward Work.*—Three months' clerking in Gynæcological Ward and three months' daily attendance at Maternity Department, of which one month is in residence. Clinical lectures.

(ii) *Demonstrations.*—Frequent demonstrations on particular subjects, particularly those clinically illustrated at the time.

(iii) *Lectures* :—

Summer Term : Short elementary course (twenty lectures and demonstrations) in Obstetrics and Gynæcology preparatory to " clerking."

Michaelmas and Lent Terms: Course of fifty to sixty lectures in Obstetrics and Gynæcology, with specimens, microscopic slides, etc.

(iv) *Keeping of Records.*—Full clinical records kept and filed in the case record library.

B.—*Co-ordination.*

(i) *Anatomy and Physiology.*—Professor of Anatomy gives lectures on the related embryology and anatomy of the subjects.

(ii) *Clinical.*—Consultations take place in the presence of the students on cases with a gynæcological or obstetrical factor occurring in the Medical or Surgical Clinics, and *vice versa.*

(iii) *Radiology, etc.*—An investigation now proceeding, under Research Council, into treatment of carcinoma of uterus by radium.

(iv) *Affiliation with other Hospitals.*—The Board of Guardians permits the entry of medical students to the Union Hospital for clinical tuition, clerking, operations, etc., gynæcological and obstetrical, and the Professor of Obstetrics and Gynæcology is on the staff of the Institution.

It will be convenient to compare these University Clinics with the Surgical Unit at Edinburgh. The Professorship of Clinical Surgery at Edinburgh was first established in 1803 (before which time the teaching of Surgery had been imposed upon the Professor of Anatomy) but Sir Harold Stiles, the present occupier of the Chair, has re-organized its work, and for purposes of comparison the principal facts may be set out as follows :—

University Clinic, Edinburgh : Surgery.

1. *Staff.*

Director	..	Professor Sir HAROLD STILES, K.B.E., LL.D., D.Sc., M.B., C.M., F.R.C.S. (Edin). .. .. Part time.
Assistants	..	(i) Mr. D. P. D. WILKIE, O.B.E., M.B., F.R.C.S. .. .. Part time.
		(ii) Mr. W. A. COCHRANE, M.B., Ch.B. Whole time.
		(iii) House Surgeon.
		(iv) Three senior students who share the duties of a Junior House Surgeon.

2. *Beds.*

Forty-five beds ; four cribs.

3. *Out-patient Department.*

One day a week a special clinic demonstration held for students from 11 a.m. to 12 noon on the new cases. They may also be shown the progress of some of the old cases.

On Tuesday mornings the Director gives special demonstration from 11 a.m. to 1 p.m. on Out-patients recommended to the Wards of the Clinic. Each student examines the case in turn, makes a diagnosis and suggests treatment. After discussion the class is told what will be the gist of the reply to the doctor sending the case. This is one of the most valuable teaching days in the week's programme.

4. *Laboratories.*

Behind the Operating Theatre in the Surgical Clinic there is a Pathological Laboratory fully equipped for histological and bacteriological work. There is also a photographic department, including microphotographic apparatus.

5. *Equipment.*

(*a*) *Lantern.*—Anatomical Charts, etc., in addition to full ordinary equipment.

(*b*) *Library.*—Small library of standard works on Surgery, Anatomy

and Pathology kept in the Department. The University also has a circulating library.

(*c*) *Museum.*—A Clinical Surgical Museum is maintained by the Clinic.

6. *Post Mortems.*

Performed in the Post Mortem Department of the Hospital and attended by one or all of the teaching staff and by the students. The material for teaching or for further investigation transferred to the Clinical Surgery Laboratory of the Clinic.

A.—*Methods of Teaching.*

(i) *Ward Work.*—Clerking from 10 a.m. to 1 p.m. and from 7 to 8 p.m. Work supervised by the House Surgeon and by the Clinical Tutor, who assists the students in taking the cases and especially in making a further physical examination.

Ward visits three times a week.

(ii) *Demonstrations.*—Evening demonstrations and tutorials are conducted twice weekly by the Clinical Tutor on the use of surgical instruments and appliances; surgical pathology; microscopic and lantern slides of material obtained in the Clinic.

(iii) *Lectures.*—Two Clinical lectures a week. Teaching carried out at operations.

(iv) *Keeping of Records.*—Patients are allotted to the students and full case records are taken; they are adjudicated by the Clinical Tutor and filed with the House Surgeon's record. Assessment of merit of case records entered on the card index for reference at final examination.

All the more important specimens obtained from the operating theatre are carefully mounted and placed in the museum adjacent to the Laboratory. Microscopic preparations are, of course, also made and carefully stored and indexed. Each student gets a microscopic section of anything removed from his own case. These records are constantly made use of during clinical teaching, as they are so readily available. All the House Surgeons' notes are typed by a lady clerk who also has charge of the specimens.

B.—*Co-ordination.*

(i) *Pathological.*—Pathological investigations are carried on within the Clinic, thus giving the most intimate co-ordination between the clinical features and the pathological findings.

(ii) *Anatomy and Physiology.*—A particular feature is the demonstration of living Anatomy at Clinics and at operations. The anatomy of every operation is carefully described. Surgical anatomy and operative surgery are therefore taught in the operating theatre on the living subject.

(iii) *Clinical.*—Constant co-operation with the departments of internal medicine, the biological laboratory and the special departments for Ear, Nose and Eye work.

(iv) *Radiology.*—Carried out in the X-ray Department. X-rays demonstrated in their clinical bearings.

(v) *Affiliation with other Hospitals.*

(*a*) Children's Hospital.—Special Course (compulsory).

(*b*) City Dispensaries.—Students attend for six months: examine and treat out-patients and visit patients at their homes.

C.—*Research.*

(1) Accumulation of accurate records of certain groups of clinical cases.

(2) Bacteriological, histopathological and anatomical investigation of various surgical conditions.

In Clinical Medicine a whole-time professorship was created in 1921, and the Chair is occupied by Professor Meakins. He has forty-five beds, an out-patient clinic and laboratory. He is also Professor of Therapeutics in the University.

APPENDIX D.

STATEMENTS BY THE DEANS OF CERTAIN MEDICAL SCHOOLS AS TO GRANT-IN-AID.

I.

One might summarize the use of the Block Grant by saying that we use it to bridge the increasing gap between the income obtainable from students in fees, and the expenditure necessary to provide them with an education in Medicine of University type, and to ensure to their teachers adequate conditions for carrying forward knowledge in their subject, and reasonable incomes. During the five years 1918–1922 inclusive, the School has been dealing with a larger number of students than had ever been the case in the previous forty-four years of its existence.

(*a*) In 1919, a whole-time Pathologist and Director of Pathological Studies was appointed in place of a part-time officer. A new step has been taken in conjunction with the Hospital by making the posts of Medical, Surgical and Gynæcological Registrar, each whole time. An additional laboratory for Pathological work has been provided, and the Museum has been re-organized.

(*b*) The clinical experience of our students has been widened by arranging for senior students to work at other hospitals as well as our own.

(*c*) Of the Grant earmarked for the Unit one might very shortly put it that it is wholly devoted to securing teachers paid directly for teaching and to providing them with facilities for such teaching and for research. But such summary would give no idea of the real value of the Grant either in money or stimulus to the work of the School.

II.

The expenditure incurred by this Medical School is chiefly along three definite lines :—

1. Preliminary and Intermediate teaching.
2. Clinical instruction.
3. Repairs and renewals to, and maintenance of, laboratories and their equipment.

In each of these directions the Grant has been of the utmost value to this Medical School.

1. It has enabled the School—

   To allow salaries, commensurate with their position, to the Teachers of Preliminary and Intermediate subjects.

2. (*a*) It has enabled the School to make some payment to the Clinical Officers of the Hospital for Lectures and Clinical Lectures.
   (*b*) To increase and improve the teaching of Pathology by the payment of a whole-time Lecturer at a suitable salary.
   (*c*) To remunerate a whole-time officer in the X-ray Department for teaching in that subject.

3. It has enabled the School to make much needed improvements in the equipment of the Departments of Biology, Chemistry, Physiology and Pathology.

Lastly—and this is a most important consideration—it has enabled the School to keep the fees paid by students down to a reasonable amount. Apart from the Grant, the only source of income in the case of this Medical School is students' fees, and these are totally inadequate for the maintenance of a large Medical School.

III.

The Grant has enabled us to carry on the School with increased efficiency and has further enabled us to meet the greatly increased expenditure in the last few years.

1. We have been able to increase the salaries paid to the administrative staff consequent upon the increased cost of living.
2. We have been enabled adequately to remunerate those members of our Staff who do systematic teaching in the Medical School, and the salaries of the Assistants in the Pathological Department have been at last put upon a satisfactory basis—the total increase amounting to £1,700 per annum.
3. We are now in a position to make an adequate grant towards the expense of the Museum; to keep the General Library in a state of efficiency; to pay a properly trained Librarian, and to maintain a Research Library for the use of research workers.
4. The Grant enables us to accommodate research workers, and to meet the expenses attendant thereon, and to charge them purely nominal rents for the accommodation and facilities we afford them.
5. We have been able to cope adequately with the large increase in the number of students attending the Pharmacology Class and to buy the necessary equipment required.
6. We have also been able to buy certain expensive apparatus, including demonstration lantern and photographic apparatus, for use in the School, and also to carry through a scheme for adequately lighting both the Pathological Museum and one of the Lecture Theatres, so as greatly to increase the usefulness of both.

And lastly, by means of the Grant, we have been able to meet the greatly increased expense of running a Medical School at the present time.

I need not point out to you that in the absence of such grants this School—like many of the other Medical Schools in London—would be quite unable to carry on, and we should long ago have been in a bankrupt condition, for while in the old days, when expenses were not nearly so heavy as they are now, it was possible to carry on by either not paying, or entirely inadequately paying, both the administrative staff and the teaching staff, even if we were to pay no fees to teachers at the present time we should still have a large balance on the wrong side.

IV.

On the conclusion of the difficult war period, during which the Grant was instrumental in enabling the Medical College to be carried on without seriously impaired efficiency, the problems of reconstruction and reorganization had to be faced.

The Medical College has been able to raise the salaries of all the whole-time Professors, Lecturers and Demonstrators, and particularly in the Departments of Chemistry, Physics, Biology, Anatomy, Physiology and Pathology. The most striking developments have taken place in the Department of Pathology, where, in addition to a Professor, the College has been able to appoint Lecturers in the special branches of Morbid Anatomy and Histology, Bacteriology and Chemical Pathology, as well as to rearrange and increase the Staff of Demonstrators.

A Lectureship in Clinical Applied Anatomy has been established.

The staff of part-time Lecturers and Demonstrators in every Department has been increased and their salaries raised.

The greatly increased cost of apparatus and higher wages of laboratory service has been adequately met.

In addition to the grant for general purposes, which has helped the College in the foregoing improvements, the College has received, since 1919, a special grant for the Medical and Surgical Clinical Units. The Units system was essentially an experiment, and in the first year of their existence there was much work and organization to be carried out. The results of the first three years of the system amply justified the expenditure. Arrangements are made whereby all students at the commencement of their clinical course receive instruction from the Staff of the Units in the methods of physical diagnosis. The Lectures organized by the Units are open to all students, and candidates for the House Appointments are expected to have clerked or dressed in the Wards and Out-patient Departments of the Units.

Apart from their actual work, and the research which they conduct, the influence of the Units is felt in the organization of the clinics of the other Physicians and Surgeons, and thus the standard of teaching and work throughout the clinical side of the College is being influenced by them. In each Medical and Surgical and in the Gynæcological Clinics a part-time Chief Assistant is appointed with duties similar to those of the Assistants in the Professors' Units, and the College has provided salaries for them jointly with the Hospital.

V.

There is no question that the financial assistance from the Treasury has so stabilized the income of the School as to bring other financial support and allow the Council to embark on expenditure for the improvement of the Institution which would otherwise not have been warranted.

The first aim of the Council, after receiving Treasury assistance, was to make all the Laboratory Departments of the School of the highest University standard in accordance with the recommendations of the Report of 1918 to the Board of Education. With this end in view, the Council sought the co-operation of the University of London in making teaching appointments, and University Professorships have been instituted in Chemistry, Physics, Anatomy, Physiology, Pathology and Experimental Pathology.

In addition, a University Readership in Biology has been established, and an entirely new and complete Department of Bio-Chemistry has been opened.

The salaries of Demonstrators have also been stabilized, and all members of the Staff who intend to continue to hold whole-time posts for teaching, or research, are included in the Federated Superannuation System for Universities.

The improvements are even more marked than is indicated above, because, at the time the Grant was received, Chemistry and Physics were both under the direction of one Lecturer; while the subjects of Physiology and Biology were under the direction of one Lecturer who was not a whole-time officer.

In addition to the general improvement in the status and remuneration of teachers, we have been able to carry out large improvements in the equipment of the Laboratories, particularly in Physiology, Biology and Bio-Chemistry.

In the Physiological Department much new scientific apparatus, including two Kymographs, has been installed, and separate rooms for research purposes and additional rooms for the general accommodation of the Department have been added.

In the Department of Bio-Chemistry two new research Laboratories and a large completely equipped teaching laboratory have been added.

In Biology, new research and teaching laboratories have been built,

together with a small museum of Comparative Anatomy. These will be opened at the beginning of next year.

We have also been able to provide Clinical Teachers with further whole-time assistants; and we are at present considering a scheme to increase the number of these assistants, and to improve their facilities for doing scientific work.

The number of these Assistants or Registrars has already been increased by one additional officer, a Surgical Pathological Registrar, and we now propose to appoint two further additional Registrars. These officers will be relieved of clerical work, which used to absorb much of their time, and will thus be able to devote the whole of their time to the Scientific work of their appointments, and to give more attention to teaching and research. Moreover, their headquarters, instead of being as heretofore in a Registrar's Office, will be in the Pathological Laboratories. These officers will carry out Clinical and Laboratory investigations at the direction of the Physicians and Surgeons to whom they are attached. They will also prepare material for demonstrations, and serve as liaison officers between the wards and special departments of the Hospital and Pathological Institute.

Further financial assistance is required to bring to the highest development the system of Clinical teaching which has established the high reputation of medical education in England, and I do not think I can do better than to call your attention to the last paragraph of my letter of May 6th, 1921, addressed to the Secretary of the University Grants Committee at the request of the School Council :—

> " The Council still venture to hope that in giving further financial support to the improvement of Clinical teaching in London, the University Grants Committee will not confine their grants to the establishment of clinical units with whole-time Professors, but will give favourable consideration to a scheme such as that submitted by this Institution."

VI.

The following is a brief summary of the changes made :—

The Senior Physician has been made responsible for the direction of the teaching of Medicine, the Senior Surgeon for the direction of the teaching of Surgery, and the Senior Gynæcological Surgeon for the direction of the teaching of Gynæcology and Midwifery. The above Directorships are all honorary.

A whole-time (five days per week) teacher of Practical Medicine and Medical Tutor, who also teaches Morbid Anatomy and is Curator of the Museum, has been appointed.

A whole-time (five days per week) Junior Surgeon, teacher of Clinical Surgery and Surgical Tutor, who is also the teacher of Operative Surgery, has been appointed.

A whole-time resident Obstetric Tutor has been appointed.

A new *Students'* Laboratory was opened in April, 1921.

A whole-time Pathological Tutor is in charge.

The Pathological Museum has been re-organized.

VII.

So far as this Medical School is concerned the Government Grant has been spent as follows :—

1. In increasing the number of its teachers.
2. In improving the equipment of teaching in the College and at the Infirmary.
3. In meeting the greatly increased cost of maintenance and upkeep.
4. In paying the teachers adequate salaries.

5. In contributing to the Superannuation of its whole-time Professors and Assistants.

6. The re-organization of the Museum and the preparation of a descriptive catalogue of its contents.

VIII.

I give below a statement of the various changes that have been carried out in the Medical Faculty since 1918, and towards which the Government Grants have been used.

1. The salaries of all full-time and visiting professors have been increased and placed on a more liberal footing, with a fixed minimum below which they should not go.

2. By taking possession of new premises and by adapting these, valuable increased accommodation has been acquired for the Medical School (Pathological Museum, Tutorial Class-rooms, extension of Dissecting Room, etc.).

3. Improvements in the teaching of practical Forensic Medicine and Toxicology.

4. The Clinical Board has been able to obtain apparatus and equipment for clinical teaching.

5. The stipends of Clinical teachers in Medicine and in Dentistry have been increased.

IX.

By means of the Government Grants the University has been enabled to progress as follows :—

1. The Staff of the Physiological Department has been almost doubled in number to enable it to deal adequately with students and with the subject. Additional laboratories have been adapted and equipped for research and the work of advanced students. Concurrently, there has been a marked increase in the individual work of students outside the class hours in the laboratories, and there is a steady stream of men taking the B.Sc. (Hons.) in Physiology as a foundation for clinical work. The subject of experimental pharmacology has been added to the department. The increase of staff and laboratories enables the department to co-operate in clinical investigations.

2. The department of Pathology and Bacteriology has been reconstructed.

   A new suite of rooms was adapted for Bacteriology, which encouraged the City to give strong material and moral support, and a generous local donor provided endowment for a Chair of Bacteriology (£10,000).

   The Staff of the Department is closely associated with the work of a number of institutions and with various departments of the University.

3. On the Clinical side the University converted the part-time clinical tutorships into full-time posts, and added one to the previous two, and was able with great difficulty to set aside a small annual sum for the increase of machinery for teaching and research.

   This proved a great stimulus to the efforts of the honorary hospital staff and the Hospital. The Hospital immediately converted part of the building into a teaching block at considerable expense, and the clinical staff voluntarily con-

tributed the cost of equipment and furniture. The Hospital also made arrangements to give these University officers excellent facilities for actual clinical experience.

4. In the Maternity Hospital a tutor in clinical obstetrics was appointed, and was given quarters and maintenance by the Hospital. Considerable progress has been made in the facilities for teaching obstetrics, but here the inability to carry out an extension of the scheme is felt acutely.

5. On the dental side the accommodation for the School in the Public Dispensary was completely outrun. The University was able to assist the School to move its quarters to the General Hospital, by whose active and generous co-operation the great influx of students was met. Without the support of the University the Dental School and Hospital must have ceased to exist.

Where there is a large clinical field the University can do a great deal to arrange co-operation for teaching and research, provided it has a financial instrument. In cases where the University has been able to offer some advantage there has been an immediate response to amplify the scheme in order that institutions may profit by the quality of work which is inevitably associated with teaching activities. There is ample room for progression in arrangements to meet the growing desire for the continued education of the profession after graduation, and for the organization of a School of Hygiene.

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