SCIENCE

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UNIVERSITY EDUCATION IN LONDON[1]

PROBABLY no document of greater importance to medical education, and to university education in general, has appeared in recent years than the report just issued by the Royal Commission. This commission, appointed by Edward Seventh, considered the organization and extension of the various institutions of higher education in London to constitute the new University of London. Its reports and extensive supplements have been published from time to time, and the parts which deal with medical education have been followed with interest by medical men in both Great Britain and America.

The appointment of the Royal Commission was not the beginning of the movement for reform of the educational institutions in London; it was rather the culmination of a long agitation which arose from several motives supported by different bodies and persons. It was only after the failure to secure the support of the university senate and convocation that the alternative course of applying directly to the crown for a charter establishing a new university altogether was adopted. The movement which led to this petition arose from the medical teachers who applied for a charter empowering them to confer degrees. From the point of view of university reform there was not much to be said for a proposal for substituting one examining body for another with the express

[1] Final report. T. Fisher Unwin, London, W. C. 1913. Price 2 shillings. The article was prepared as a review of the report of the commission, but in view of the importance of the subject and its interest to American men of science, it is printed as a leading article.—EDITOR.

object of providing a degree upon easier terms. Teaching and examining for degrees had long been separate functions in London, and it is clear that the Royal Commission deemed it of first importance that these functions be united in a single body, the university faculty.

Now the final report, which is a bulky volume, includes recommendations for the organization of the University of London with nine faculties. After discussing the present organization of the university, the essentials of a university in a great center of population are considered. As to the student, he should be young and should devote his entire time to his studies. A considerable amount of leisure is essential for independent reading, for common life with fellow students and teachers, and above all for the reflective thought necessary to the rather slow process of assimilation. University knowledge should be pursued not merely for the sake of information to be acquired, but for its own extension and always with reference to the attainment of truth. This alters the student's whole attitude of mind. Scientific thought becomes a habit, and almost incidentally intellectual power is developed.

The higher work of the university should be closely connected with the undergraduate work, on the one hand, and with research, on the other. Teaching and research should be combined; the university teacher should be an investigator. The greatest evil which results from the present organization of the university is that now this is not the case, and it is this which is most important to remove in the interest of higher education in London. The commission does not think it possible to get the best men as professors, if they are in any way restricted from doing their highest work, or are prevented from spreading their net wide to catch the best students. Research should not be exploited in the interest of individual capitalists, but should be a part of a great university.

The various independent schools in London, University College, King's College, technical schools, medical schools, etc., are to be blended in the new University of London, administered by various boards, so that they may give automatic rule, as is the case in Edinburgh, Oxford and Cambridge. It is a complex organization, much like that of our national government, and decidedly different from that of our American universities.

The university is to have complete control of everything relating to its work—property, organization, teaching and examinations—as is the case at Harvard, Columbia or Chicago. In its organization the constituent parts fall into faculties and departments, and there will also be schools. No institution should become a constituent college in any faculty unless it is able to provide a full course for the first and higher degrees awarded by that faculty. A university department deals with a single subject or group of studies of less range than a faculty. Its teachers would have the same standing as other university teachers of similar status, and its students would rank with students of a constituent college. Institutions which are independent but which are well equipped for the work they undertake, with a suitable staff of teachers, may become schools of the university.

In a university college or department, the teachers must be of university rank, that is, they must be actively engaged in research and in teaching. This is the key to the entire situation, and is referred to again and again in the report. The teaching should be suited for adults; it should be scientific, detached and impartial in character. It should not fill the minds of

the students with facts and theories, but it should call forth his own individuality and stimulate him to mental effort. He should become accustomed to critical study of leading authorities with occasional reference to first-hand information, and thus implant in his mind a standard of thoroughness and a sense of the value of truth. He then learns to state fairly the position of those whose conclusions he most stoutly opposes. He gains an insight into the conditions under which original research is carried on, which enables him to weigh evidence, follow and criticize argument and put his own value on authorities.

The commission then recommends the formation of faculties of arts, science, technology, economics, medicine, law, theology and music out of the existing institutions in London. Whether this is practicable is not for us to discuss, but their recommendations of necessity include a consideration of the whole university problem, and this they do in a masterful way. The tone of the report is the best, and for this reason it should be considered carefully by all American educators, especially at this time when our universities are under fire. In this review I shall confine myself to the part on medical education—and largely to the clinical side—as it has become the question of first importance in America. One fourth of the report, which is unanimously adopted by the commission, is devoted to medical education. What follows is largely verbatim.

In the case of the faculty of medicine, as in the case of other faculties, the commission considers what steps it is necessary to take in order to place the best teaching upon a real university basis. They can not, however, deal with the faculty of medicine on exactly the same lines they have followed in the case of other faculties, such as those of arts and science. In these faculties the provision for teaching of the highest university standard may be deficient, but the standard itself is not questioned.

In the case of the faculty of medicine there is no test to apply; except as regards pathology and hygiene the university has not attempted to determine which of the teachers of the subjects classed as advanced medical studies are entitled to the status of professors. The university could not do so under its existing regulations for the conferment of those titles, because none of those teachers fulfil the requirements with regard to salary, time and other conditions of employment. What is more significant, it is denied that the university ought to do so. So far as clinical teaching is concerned, another standard has been set up in the past. The university professor, according to the conception of the commission of him, can give instruction of the highest university standard only if he is actively engaged in the systematic advancement of knowledge in his subject. But in the case of medicine it is contended by many physicians that whether for university or other students the best teachers are men who are engaged in the practise of their profession, and have at most only as much time for original research as remains after the demands of their practise have been met.

The teaching of the intermediate subjects, anatomy, physiology and pharmacology, should be of the highest university standard, and should be provided in institutions closely related to the clinical departments.

The question of the reform of clinical teaching was first definitely raised before the commission in the evidence given by Mr. Abraham Flexner. They had received his report on medical education in the United States, and they had been informed

that he was preparing a similar report on medical education in Germany, France and Great Britain. This report received their careful consideration.

The fundamental principle underlying Flexner's argument is that university teaching can be given only by men who are actively and systematically engaged in the advancement of knowledge in the subject they teach. And this, of course, is a principle upon which the commission has insisted strongly in dealing with the general question of the essentials of university teaching, and the position and duties of the university professors.

But what is suggested and insisted on is that if, as is admitted, cooperation is necessary for the practise of medicine at the level of medical science to-day, it is also necessary, even in a higher degree, for the advancement of medical science beyond its present stage; further, that his cooperation does not exist in the hospital medical school, and can not do so as long as the physicians make use of science only to aid them in recognizing and curing disease, and in teaching their students to do so on the basis of existing knowledge. It is maintained that they must give their time to attacking the problems of disease, and that they can not do so alone, but must become members, and controlling and directing members of a group of men working together for a common end—a group in which the subordinate members are selected with a view to the special knowledge required to aid and supplement that of the leading and directing mind. They must devote themselves to original research under the conditions which make it productive in the case of the exceedingly complex problems which medical science has to solve. Finally it is said that the hospital unit is the kind of organization which experience has already shown provides the conditions required; and that it is only when the conditions have been found and established which make research in medical science possible and actual that the true university spirit will inform the teaching, and that the teachers will be the kind of men the commission have spoken of as university professors—men who will do for medicine what other men do for physiology and chemistry, and, indeed, for every subject which is capable of being scientifically treated. If this kind of teaching is essential, it seems to the commission clear that it can not be expected of men who are largely engaged in private practise; not only would the teaching and preparation for it make too great a demand on their time, but it is the kind of teaching which can really be successfully undertaken only by men whose main occupation is original research in the science of their subject.

Further in the opinion of the commission the University of London ought not to be satisfied with the present clinical teaching in the London medical schools. It appears to them beside the point to say, as some witnesses do, that the time for training is not the time for research, that a man has enough to learn then in order to make himself a good doctor, and that the leisure for research comes afterwards when he has taken his degree. It is not suggested that the undergraduate should engage in research in the medical faculty more than in any other, but that is no reason why he should not receive a university education. The commission has made it clear in the earlier part of the report—(*a*) that university education can be given only by university teachers, and (*b*) that it is a necessary condition of the work of university teachers that they should be systematically engaged in original work. Again, it is said that a good deal of scientific teaching is done by the present teachers,

although they are in active practise. Fortunately, there are always exceptional men who succeed in doing things which the conditions of their life and work make difficult for most; but it is necessary to consider what conditions are conducive to the end in view and likely to promote its attainments as the general rule and not as the exception. Having regard to the growing complexity of the subject of medical science, it seems to the commission that it will become more and more difficult as time goes on, for the really scientific teaching in the subject to be given by men whose powers are largely required for the arduous work of medical practise, and whose minds are quite rightly occupied for the most part with exacting claims and daily anxieties of their professional work. It is not conclusive that many eminent British physicians and surgeons have in the past made important contributions to the advancement of knowledge in this subject. It is doubted if it can fairly be claimed that the representatives of British medicine make their proper contributions to the scientific literature of the subject to-day, and although admirable work is still being done, it is all a matter of individual effort, and generally carried out under difficulties. But quite apart from this it makes all the difference in the world to the students of a university whether they have received a purely professional training or a university education in the course of which they will come into contact with the fringe of their subject, and will realize that it is a subject which is growing—that they can even play their part in making it grow.

The above summary from the report shows that the excellent and courageous studies on medical education by Flexner are being considered in Europe as well as in America.

After Flexner testified before the commission a number of eminent clinicians, including Sir William Osler and Professor Friedrich von Müller, gave their opinions on hospital organization and clinical teaching. The conditions prevailing in Munich were fully set forth by Müller, and Osler formulated an ideal plan based largely upon the German clinic. Osler's hospital unit for each of the important clinical branches comprises about sixty beds, various clinical laboratories, an out-patient department, and a director with a suitable staff. The principal teachers in clinical medicine and surgery in all the branches ought to be university professors in the same sense as the principal teachers in chemistry or physiology in a university. Under these conditions Osler thinks that we can expect the professor of medicine to carry out his three-fold duty; namely, curing the sick, studying problems of disease and teaching his students. Thus it is clear that American influences are making themselves felt in England. The recommendations of Flexner and Osler are adopted in practically every detail by the commission. To what extent the clinician should carry on private practise is quite definitely stated by the commission, conforming much more with Flexner's recommendation than with Osler's.

While it is conceded that the medical student should measure up to the university standard, it is also insisted upon that he should be taught by university clinical professors who are active in research.

Another matter to which the commission refers is the question whether, and to what extent, the professor should be prohibited by the terms of his appointment from engaging in private practise. One of the advantages of private practise is said to be that men gain in this way experience of human nature which is of great value in the

cure of the sick. It must be remembered, however, that the university professor of clinical medicine is not the less a physician because he is a man of science, and he acquires much of his knowledge in his treatment of the sick, although it may be admitted that the social range of his experience will be to some extent limited if it is confined to hospital work. The commission is inclined to think that the student whose sympathy is aroused by the condition of the hospital patient, irrespective of his social station, is the man who will work best under the conditions of private practise.

The experience of human nature, valuable though it may be, is not the only or even the chief advantage of private practise. To a limited extent, at any rate, it is said, on good authority, to be of scientific and professional value for the following reasons:

First, it trains the physician to distinguish with great accuracy between serious diseases and trifling ailments. The patients in the wards of a hospital have gone through a sifting process before admission, and the physician may generally assume that an admitted case is a case of serious illness, and his diagnosis is very much influenced by this knowledge. He may have to determine whether a patient is suffering from ulceration of the stomach, let us say, or it may be from cancer; but it does not matter much to the patient at the moment whether it is the one or the other. He is treated as seriously ill, and the treatment is such that even if the true diagnosis is not reached at once no great harm is done. But in private practise the great majority of cases that come before a doctor are cases of trifling ailments, and he is in danger of making fatal mistakes. If nine out of ten patients who complain of frequent internal pain are suffering from indigestion there is danger of failing to diagnose cancer in the tenth case, and the delay resulting from the mistake may be fatal. Experience of this risk leads to more careful observation and finer discrimination of symptoms. Secondly, it is in private practise that a physician has opportunities for the scientific observation of the earlier stages of disease. In the case of most patients admitted to the hospital the earlier stages are past, and the physician only hears the description of a case given by the patient himself, or by the general practitioner who has attended him. In both these cases, however, it is the general practitioner who acquires the kind of experience described, rather than the consulting physician, who is at present the hospital teacher. On the other hand, if the out-patient department of a general hospital is properly and seriously made use of, it affords great opportunities for acquiring this kind of knowledge and experience.

However, private practise has a tendency to make the physician consider the patient more than the disease, and for this reason it is of benefit to the teacher of medicine, and therefore he should not be prohibited from engaging in it to a certain extent. The amount of private practise would be limited by the work he had to do in the hospital together with the claims on his time by his own research if he were the right sort of a man. Of course there would be urgent cases which might be difficult to disregard. The commission meets this difficulty as follows:

One way of dealing with a call of this kind is to attend it only if the case appears to be one in which the professor is specially qualified to be of use, and then to accept no fee. This may sound a hard condition, and it would be so if externally imposed, but so powerful is the attraction of scientific work that we understand this is a self-imposed condition in the case of some ex-

isting professors. We think the conditions of a professor's employment are a matter which must be left to the university to determine; but in our opinion it is not necessary or advisable to prohibit private practise altogether.

Thus the duties of the clinical teachers in a medical school are defined. They certainly do correspond well with the opinions of some of our leading educators. Enough has been said to show the trend of the report, the full meaning of which can not be had without studying all of the pages of this excellent document. At any rate it is clear that there are far-sighted reformers on both sides of the Atlantic.

Whether or not a great hospital should conduct pay wards is not discussed. However, it is stated that in a hospital which has no end in view but medical education and the advancement of medical science, the public interest must be considered, and the question of the privilege of access to the great London hospitals can not be treated as a matter of private right or decided as if it were the private property of the existing medical schools.

FRANKLIN P. MALL

THE OPTICAL ACTIVITY OF PETROLEUM AND ITS SIGNIFICANCE[1]

THE wide distribution of deposits of bitumen, in its various forms, is attested in the very earliest writings, both sacred and profane. In the book of Genesis we learn that slime was used for mortar, and in the second book of the Maccabees we are told that

> Neemias commanded the priests to sprinkle the sacrifices with the thick water . . . and when this was done . . . there was a great fire kindled, so that every man marvelled.

Herodotus gives us the following description of the manner of its collection:

> At Ardericca is a well which produces three different substances, for asphalt, salt and oil are drawn up from it in the following manner: It is pumped up by means of a swipe, and, instead of a bucket, half a wine skin is attached to it. Having dipped down with this, a man draws it up, and then pours the contents into a reservoir, and, being poured from this into another, it assumes these different forms: the asphalt and the salt immediately become solid, but the oil they collect, and the Persians call it rhadinance. It is black and emits a strong odor.[2]

For more than 2,500 years the disciples of Zoroaster have worshiped the "eternal fires" in the neighborhood of Baku, Russia, and not until recently have their temples been replaced by oil reservoirs and refineries.

Within the last half century a new shrine has been set up in oildom, and our modern devotees have shown such zeal and activity that it may again well be said "that every man marveled." But the marvelous development of the petroleum industry has been rendered possible only by reason of the gigantic strides which have been made in the fields of natural science and technology. We may look for even greater things in the future, for science is still in its infancy. I have chosen for my subject to-night what I consider to be one of the infant industries of science.

In the year 1835 Jean Baptiste Biot published his memoir on the circular polarization of light and its application to organic chemistry,[3] which contains a table giving polarimetric data regarding essential oils. This includes a sample of "naphte" rectified by distillation, which, examined by red light gave a rotation to the left equivalent

[1] Address of the retiring president of the Kansas Academy of Science. Read December 23, 1912, at Topeka, Kansas.

[2] "Petroleum and its Products," S. F. Peckham, 1882, p. 1.

[3] *Mem. de l'Acad. de Sciences*, 13: 39, 1835. See also "Die Polarimetrie der Erdöle," M. A. Rakusin, Berlin, Wien, p. 6, 1910.