

The Universities and Research.¹

By PROF. J. JOLY, F.R.S.

THE argument for research in universities rests upon the broad basis of the value of the intellectual progress of mankind. I think I am correct in saying that most men who have adopted a life of research, or have made research the object of their special interest, have acquired their intellectual ideals in the days of their college life. It is through the university that the young man comes into contact with the investigators of his time, and it is their example and teaching which affect his future life. If his teachers are without interest in research the student learns indeed the text-book, but the enthusiasm to create new knowledge is not implanted in him. Whatever his intellectual capacities may be, he passes from his university but an ordinary member of the educated public. What he might have accomplished, and could have accomplished, had he found himself in a creative atmosphere during his student days remain entirely unknown.

I do not think that any other argument for the cultivation and promotion of research in universities need be stated. If the investigation of Nature is good in itself; if its effects are beneficial to our race; if it is desirable that we should advance in knowledge from generation to generation, then we should see to it that our brilliant young men get the chance of taking up this career in the service of mankind. There is, as I say, no answer to this argument unless we assail its basis and determine that obscurantism is the better thing and enlightenment the worse.

Great universities have done great good. They have also done great harm. Their inertia, their opposition to development, to following the evolutionary changes of their times, constitute their principal offence. Even to-day I hear in my own university surviving voices expressive of distrust in science as an educational subject; doubts as to the propriety of including science as a primary subject in the university curriculum; regrets that the so-called "great" or "fundamental" subjects of education—*i.e.* classics and mathematics—should no longer form the only road to fellowship.

Such views on science are the natural outcome of an upbringing in the traditions of the older educational methods. To attain the forefront of classical criticism or of mathematical advance is a more difficult task than to reach the exploratory front of a branch of modern science. And not only is it more difficult to arrive at the forefront; it is also more difficult, when the forefront is attained, to find work of any probable benefit to mankind. Only the most brilliant scholars and the most original minds can prevail. Compare these conditions with those attending research in any of the newer domains of modern science. No sooner has the student mastered the principles of his subject than he finds himself approaching an unknown territory. Everywhere he sees the words "Not known" written up, and any one of these innumerable avenues to knowledge is for him to tread if he so pleases and is equal to the task.

The contrast is remarkable. The older scholar, who has spent his days turning over the thoughts of others and the time-worn records of past efforts, gradually arrives at the fatal conclusion reached by the wisest of men: "There is nothing new under the sun." He has passed a lifetime of solid work and seen but little come of it. Must not the younger workers be branded by superficiality?

As regards the subject of expense, there is no

¹ From a paper read before the Congress of the Universities of the Empire at Oxford on July 8.

doubt that, contrasted with blackboard and chalk, modern scientific apparatus and scientific laboratories are expensive. It is discouraging to compare British outlay with American outlay upon research in universities. We are supposed to have learned a lesson by the war. Let us hope it will bear fruit when business revives in this country. Meanwhile this lesson has placed a heavy demand upon the universities. For every branch of technology is crying out for research workers, and the universities cannot supply them. The fact must be faced that the day of research has come in all the scientific professions and in every domain where technology or business comes into contact with the natural laws governing production and economy.

The reactionary sitting in senate, council, or board, who would close the university to these demands, may indeed effect economies, but his economies are at the expense of the vitality of his university, of its very existence as part of the living, breathing life around it. It is a cheap road, but it leads to stagnation, decay, and death.

Perhaps the most striking feature of American universities, as viewed by the British visitor, is the prevalence of research and the lavish provisions made for its prosecution. It extends into every branch of university work. Special stress is, however, generally laid upon certain subjects. What these subjects are seems to depend upon the initiative and forcefulness of particular teachers of eminence, either past or present, who have been associated with the university. The great Research School of Education in Chicago, of which Prof. Dewey seems to have been the chief originator, may be cited. Highly organised and carefully staffed elementary and high schools are here attached to the university for research in pedagogy. The Nutrition Laboratory of the University of Illinois, founded by Prof. Grindley, is another instance. The State universities are very often in close touch with agricultural research, and not only benefit agriculture thereby, but also extend the influence of the university over the State by the valuable assistance given to the agriculturist. In our own country there is no class of the community more in need of such university influence than the agricultural. It is—in Ireland—not only ignorant of science, but also strongly anti-scientific. This applies almost as much to the so-called educated classes as to the small farmer.

For research in experimental science and chemistry and natural science extensively equipped departments are provided in all the great American universities and technological institutes. The equipment is on the most lavish scale. Everything possible seems to be done for the student.

There is one subject which I must refer to: the compulsory presentation of Latin or of Latin and Greek by students entering the older universities. I know we are a long way from reform in this matter, but its influence upon the present subject is sufficiently important to necessitate a reference to it.

As regards research in the physical and natural sciences, there is no doubt that the compulsory study of dead languages is injurious—indeed, seriously injurious. This is so for two reasons. It serves to keep out many from the universities, and it demands of the science student hours of toil which would be better spent on living tongues, which would help him later on to extend his scientific reading. I am every day in contact with brilliant young men whose minds are absorbed in the interests of physical or natural science, but who cannot read a German book, and

read a French one only with difficulty. These young men have spent many school years during which the study of Latin and Greek absorbed about one-third or one-fourth their total available study hours. What have they got for it? They cannot read a Latin author or a Greek author at sight. It is true that without their Latin they would not have attained the degree of the University of Dublin. The pro-classic says their minds are the better for it. Well, I freely admit that much mental training was involved, but I do not admit that a sound study of French and German would not have done for them just as much—nay, more.

The reproach that many students fail as research workers, while it has some foundation in fact, is not a fair one, for it ignores the educational value of even elementary research. I believe the outlook of a student who has carried out one single research of an elementary kind is different from that of one whose outlook is derived solely from the text-book and the examination. He learns first-hand the mental point of view of the investigator. He gets ideas of scientific truth and of the legion of errors which lie in wait around it as may in no other way be acquired. He sees the plausible, *prima facie* conclusion break down under the control experiment or in the light of the inexorable requirements of other participating laws of Nature. A new conception of the use of mathematical analysis and of careful observation is created in his mind. More generally he learns the necessity of "thinking round" his subject.

These things he learns in some degree even if he is only of average capabilities. If he is one of the higher spirits the interest of the work seizes on him and calls out every power, latent and developing, wherewith he is endowed. These higher spirits work out their own destiny. I shall not dwell on the ways of genius, but rather upon research as an instrument in the education of less gifted minds. I turn, therefore, to the interesting question: "Is it possible to teach research successfully?" To teach its methods and its spirit to the average student, whether of science or of the "humanities"?

The answer I would give unhesitatingly is "Yes." I would be careful to define that this does not imply the genesis of an original thinker from ordinary material. But it implies just as much as when we say we can teach students mathematics.

I plead, therefore, for lectures in our universities devoted exclusively to studies in research, and I would admit to these lectures students of both junior and senior standing, *i.e.* the beginners in science as well as those working for the Ph.D. as now instituted in all British universities.

Of course, I am not now referring to systematic lectures in this or that branch of science. These are essential to the training of the average student. I

mean something different. I would define research lectures as mainly relating to the professor's own experience and to that of his assistants and co-workers, each worker contributing one or more lectures to the university course in research. Their subject-matter would relate to the objects aimed at by the research, the difficulties attending the work, and how they were surmounted. Such discourses might be supplemented by others of an historical or retrospective character. These might in some cases be delivered by honours students, and would refer to classic researches of the great masters. For recounting these, experimental illustrations should be given. The inspiration to be derived from such retrospective studies will be known to all who have read the original memoirs of great investigators. There need be no extra call upon the professor's time. He would simply substitute these for part of his existing routine lecture work.

The professor is at present too much tied down by routine courses. There is a sort of idea prevalent that it is not fair to his class that he should tell them of his own work, but that this should rather be kept for the academy and for the outside world. Well, I think it is fair; and I believe that with reasonable usage the best thing he can do for his class is to tell them of his own work. If this were admitted in high quarters it would be more often carried out. I can imagine nothing more stimulating than a few lectures each term on the work progressing in the laboratory of the professor and his co-workers, for not only is the student brought into touch with the making of knowledge, he is also sure to receive the story in the language of fresh and enthusiastic interest.

I am aware that occasionally and at scientific associations within the university such discourses are delivered. I would make them a part of the sessional work of the university. If not legally obligatory on the professor, it should be morally obligatory on him to contribute a few such lectures every term, or at least every session. I do not think it would impose additional labours on him. Fresh from his work, but little rearrangement would be required, and his facts would be ready marshalled in his memory. Nor would the telling of his ideas fail to react upon the lecturer—to his benefit and to the elucidation of his subject.

The one central result aimed at is the presentation of research as something of paramount importance. It should stand for the highest goal of university effort, for, in truth, success in the making of knowledge is the crown of all human endeavour, and as such the student should be taught to regard it. Teach him this one great ethical truth, and whatever else he may accomplish or fail to accomplish in his student days, he will enter on his life's work an enlightened and a valuable citizen, not only of his own country, but also of the world.

International Exploration of the Upper Air.

By C. J. P. CAVE.

A MEETING of the International Commission for the Exploration of the Upper Air was held at Bergen on the invitation of Prof. V. Bjerknes, president of the commission, in the week ending July 30. The commission was appointed by the Meteorological Conference held at Paris in 1919 to continue the work, in connection with the International Meteorological Committee, which was carried on with marked success from 1896 until the beginning of the war, and with which is specially associated the names of the late Teisserenc de Bort, Rotch, and Assmann, under the presidency of Prof. Hergesell.

NO. 2702, VOL. 107]

The following countries were represented at Bergen: Belgium, Denmark, France, Great Britain, Holland and the Dutch East Indies, Italy, Japan, Norway, Spain, Sweden, and Switzerland; and the meetings were also attended by a number of prominent meteorologists from Norway and Sweden. The proceedings opened with a reception by the president and Mrs. Bjerknes at the Meteorological Office of the Geophysical Institute, and with a lecture by J. Bjerknes on recent advances in the study of the Polar front and its relation to a succession of cyclones. It was arranged that the morning sessions should be devoted