

attributes. I think any one who knows the facts must acknowledge that the organisation has justified itself not only by what it has done, but also by the outside activities it has set in motion. It is true that with regard to the system of examining school candidates by means of papers sent down from London, the Department was anticipated by the College of Preceptors in 1853, and by Oxford and Cambridge in 1858; but the action of 1861, when Science Classes open to everybody, was copied by Oxford and Cambridge in 1869. The Department's teachers got to work in 1860, but the so-called "University Extension Movement" dates only from 1873, and only quite recently have summer courses been started at Oxford and Cambridge.

The Chemical and Physical Laboratories, small though they were in the Department's schools, were in operation long before any practical work in these subjects was done either at Oxford or Cambridge. When the College laboratories began about 1853, they existed practically alone. From one point of view we should rejoice that they are now third rate. I think it would be wrong of me not to call your attention to the tenacity, the foresight, the skill, the unswerving patience, exhibited by those upon whom has fallen the duty of sailing the good ship "Scientific Instruction," launched as I have stated, out upon a sea which was certain from the history I have brought before you to be full of opposing currents.

I have had a statement prepared showing what the most distinguished of our old students and of those who have succeeded in the Department's examinations are now doing. The statement shows that those who have been responsible for our share in the progress of scientific instruction have no cause to be ashamed.

#### *Conclusion.*

I have referred previously to the questions of Secondary Education and of a true London University, soon, let us hope, to be realised.

Our College will be the first institution to gain from a proper system of Secondary Education, for the reason that scientific studies gain enormously by the results of literary culture, without which we can neither learn so thoroughly nor teach so effectively as one could wish.

To keep a proper mind-balance, engaged as we are here continuously in scientific thought, literature is essential, as essential as bodily exercise, and if I may be permitted to give you a little advice, I should say organise your athletics as students of the College, and organise your literature as individuals. I do not think you will gain so much by studying scientific books when away from here as you will by reading English and foreign classics, including a large number of works of imagination; and study French and German also in your holidays by taking short trips abroad.

With regard to the University. If it be properly organised, in the light of the latest German experience, with complete Science and Technical Faculties of the highest order, it should certainly insist upon annexing the School of Mines portion of our Institution; the past history of the School is so creditable that the new University for its own sake should insist upon such a course. It would be absurd, in the case of a nation which depends so much on mining and metallurgy, if these subjects were not taught in the chief national university, as the University of London must become.

But the London University, like the Paris University, if the little history of Science teaching I have given you is of any value, must leave our Normal College alone, at all events till we have more than trebled our present supply of Science teachers.

But while it would be madness to abolish such an institution as our Normal School, and undesirable if not impossible to graft it on the New University, our School, like its elder sister in Paris, should be enabled to gain

by each increase in the teaching power of the University. The students on the scientific side of the Paris School, in spite of the fact that their studies and researches are looked after by fourteen professors entitled *Maîtres de Conférences*, attend certain of the courses at the Sorbonne and the Collège de France, and this is one of the reasons why many of the men and researches which have enriched French science, hail from the *École Normale*.

One word more. As I have pointed out, the French *École Normale* was the result of a revolution, I may now add that France since Sedan has been doing, and in a tremendous fashion, what, as I have told you, Prussia did after Jena. Let us not wait for disastrous defeats, either on the field of battle or of industry, to develop to the utmost our scientific establishments and so take our proper and complete place among the nations.

J. NORMAN LOCKYER.

#### *FELLOWSHIPS FOR RESEARCH.*

THE foundation of Research Fellowships by the Commissioners of the Exhibition of 1851 was in this country of the nature of an experiment. Many people more or less enamoured of the system in vogue at the universities, whereby a man is carried on from one examination grind to another, until his freshness and originality of mind are in great measure lost, looked at the scheme for Research Fellowships with distrust, and an inclination to foretell their failure. There might, it was said, be an able man here and there who is benefited by holding a Research Fellowship and who does good work while holding it, but, in general, maturity of mind and knowledge, and an accumulated fund of experience are necessary for the success of a scientific or literary investigator. There is truth in this, of course, but the scholastic training of the best men is frequently carried so far that all enthusiasm is killed out by examinations, or the mind has become too critical and fastidious for the work of original production or continuous investigation.

These prophecies have been falsified in the most conclusive way by the report of the Commissioners. They say that they have received from academic institutions all over the country unanimous testimony to the success of their system of Research Scholarships, and an analysis of the work done by the Research Scholars and their after careers shows that the success has been full and complete. A number of able young men, fairly well trained in theoretical and practical science, have been chosen from the best students of our provincial colleges and given the means of pursuing research, and therefore also higher study of the best kind, for two or three years at approved institutions at home and abroad. The Commissioners most wisely determine that the whole time of the scholars should be given to the research work undertaken, and have steadfastly refused to sanction the employment of their funds to enable students to prepare for University degrees. The scheme and its conditions were the subject of much criticism. It was objected that by spending time in research the prospects in life of such men would be injured, that it would be difficult for them after to find congenial employment. This fear has also proved groundless. Of the large number of young men who have been sent out by the Royal Commissioners nearly all have obtained appointments in which the knowledge, skill, and, above all, resource and self-dependence they have acquired will be of the utmost value. Many have returned to their old colleges to teach, and to encourage among the students rising among them that zeal for the advancement of science they have themselves imbibed, to be an example ever before the eyes of still younger men, and by their association with rising students to create an interest in scientific progress which the studies of the class-room often fail to arouse. Some



have been appointed to important educational posts at home and in the Colonies; others have gone to direct scientific industries and engineering achievements. In spite of the vaticinations of the doubters, the scheme of the Commissioners has succeeded far beyond the expectation of even those who most believed in it, and its remarkable record ought to be widely studied by all interested in the higher education of the country, and especially by those who have the privilege of guiding the policy of our universities.

A similar movement has been started by the youngest of our universities. The University of Wales has now got its curricula into full swing, and has already begun to form its roll of graduates. The question of post-graduate work, and especially of Fellowships for literary and scientific research, was raised at an early period in the discussion of regulations for degrees. There has been no matter before the senate or the court of greater or even approximately equal importance. For upon the decision of the authorities as to whether promising students should after taking their degrees go on to real post-graduate work, or, as is the case at too many places, be encouraged to enter again as undergraduates at some other university, generally either Oxford or Cambridge, rests the whole future of the newer universities as regards the higher learning. If it is regarded as the natural course for a graduate to enter again as a freshman at another university, an important stimulus towards providing the necessary staff and machinery for imparting the best and completest teaching in all subjects will be withdrawn from the colleges. The new universities may do some good to their localities by giving the ordinary education of a professional man, but, under such a policy, they will never become homes of learning and research. In fact these colleges, however well manned, will, as regards the higher work only, take the place of feeding schools for the old universities, and the time and energies of their professors will be occupied with the ignoble task, which might surely be left to the schools and the cramming shops, of striving for the credit of their colleges in the race for a good place in the record of scholarships won or in the list of examinational successes. Already one Oxford college has proposed to give scholarships to be confined to the best Welsh graduates, a plan well calculated to increase the number of First Classes in the schools obtained by that college, but certain, so far as it operates in this direction, to degrade the University of Wales. It is to be hoped that this proposal will receive no official countenance from the University itself.

It will be said that the degrees of the University of Wales have as yet little or no market value, and that the best students must go elsewhere to obtain degrees which have. This may be true; a university, like everything else, must begin; but the question arises, how is the university to form its reputation, and to confer a value on its degrees? Surely not by itself sending its best men to colleges on which their home academic training will only help to shed lustre, and to which not only their academic success, but all the credit of their after life will be attributed. The duty of the university is to itself, and relates not to the present merely, but also to the future. It has no right to imperil or delay any credit or renown there may be a possibility of its attaining; and if there is any lesson to be learned from the history of universities, it is that learning will refuse to grow within academic walls if aims are not high, and if teachers are content to see others doing their highest work.

Also, a new university should pursue this policy of high aims and resolute determination to do all that a university can do for learning and science, from the very beginning. It has a unique opportunity. It is free from the trammels of custom and prejudice, and the claims of vested interests. It can be guided by older institutions,

but the guidance to be obtained from these is almost more often of the nature of warning than of example.

The contention that has been put forward, that this kind of migration to undergraduate work in honours schools elsewhere should be encouraged by the newer, and even some of the older universities of the country, and that they should aid it by the foundation of scholarships and prizes, rests on a confusion of ideas. It may sometimes be a good thing for students who are already graduates to go to Oxford or Cambridge, but the interests served are not those of the parent university, and it is not a thing for the university as such to assist. Funds for such a purpose should be provided by persons interested in the older universities, or in the students to be sent there.

The foundation of Research Fellowships has been undertaken by universities in America with great success. Witness the youthful vigour of Johns Hopkins, and the great and growing vigour of Harvard and Yale, and others in the United States. The plan has been several times proposed in this country, but never until in the scheme of the Commissioners for the Exhibition of 1851 has it had a practical trial. An important pronouncement in its favour was given a few days ago by Mr. Simon at Manchester, and there is reason to hope that it may be followed by some practical action at Owens College or in the Victoria University. A fund for five years has been subscribed chiefly in the court of the University of Wales, and at a forthcoming meeting an election of a Fellow will probably be made, and we trust that he will prove the first of a long succession of literary and scientific scholars of native growth. In spite of the proverb, there is much in a name, and it seems to us that no better name than Fellow could have been devised. By rigidly refusing to allow undergraduate work to be undertaken, and giving the style of a Research Fellow to the graduate appointed, the university assures three things: that he shall throughout his tenure of the Fellowship at home or abroad be identified with the parent university, that his status shall be clear, and that no one shall be appointed whose merit is not clear and unmistakable. The advantage to the colleges of having a number of young men aspiring to obtain these Fellowships will be immense, especially if, like the Exhibition of 1851 Commissioners, the authorities, where possible, take the successful prosecution of a research as the best evidence of his fitness to hold a Fellowship. Nothing encourages higher work or stimulates a teacher like the presence of young men looking eagerly forward to doing something for the advancement of knowledge. Nothing kills research among teachers like confinement to mere preparation for examinational tests, or is more soul destroying for both teacher and taught than the competition which goes on for the longest list of examination successes.

It has been said that men would be encouraged to begin too soon to do original work. This is surely a strange thing to say in the face of the history of learning and science. Some of the greatest discoverers have had little or no training of the ordinary scholastic kind, and it is doubtful if they would have been so successful if they had spent years in grinding for successive examinations. Surely, when a man has taken his B.A. or B.Sc. degree with, say, first class honours in the subject or subjects he has chosen to specialise in, he ought to be ready to make a beginning of research. It does not follow that his work will be unfruitful because his experience has been brief, or his knowledge lacks the width and depth it will subsequently acquire, and acquire all the more surely and truly, if his mind is fixed on discovery or the advancement of learning instead of on the attainment of merely another first class. Training long continued for examinations has killed much intellect; it has created none. Yet, like many another fetish, the



examination system lingers on, and yearly claims its victims.

The University of Wales is to be congratulated in that so far it has recognised no examinational post-graduate work at other universities as fit work for the graduates sent out to represent it in the academic world. If higher degrees than that of B.A., M.A., or B.Sc. are required by these, there are the degrees of D.Litt., and D.Sc. of their own university, which it is to be hoped will be given solely as a reward for meritorious research.

It is essential for success in research that the man should be started when his mind is fresh, and he has not had time to acquire that morbidly critical habit of mind which residence at some of the universities seems to encourage so much, and which has been so fatal to the performance of real work by many highly gifted men.

Research will encourage resource, and the application of knowledge to real problems will foster a dependence on self which cannot but be of the greatest value to the possessor. Going out into the world of learning in a self-respecting way, received with due recognition of the position he has attained by the university to which he goes to reside, he will gain experience of the world, and be less apt to show that limitation of mental horizon, and that superciliousness of intellect, so characteristic of many, though happily by no means of all, who have taken high honours at the old universities.

But the best answer to the contention that a long and arduous preparation beyond the Bachelor's degree is necessary for successful research is to be found in the fact that already the contrary has been demonstrated at the Welsh colleges. One young man of great promise did most excellent work in Germany in the difficult field of the study of old Celtic manuscripts, another has made his name known in physical research. Both have returned to their college to teach, and their presence has proved a stimulus and inspiration to others. If the example thus set is followed by others in the Welsh University, and the Fellowship system is allowed a patient and fair trial, the results cannot fail to be of the greatest benefit to all concerned. Knowledge will be increased, the University by respecting itself and its students will be respected and its work will be recognised, and its *alumni* will have no cause to complain of the estimation in which the public hold the credentials they have received from their *Alma Mater*.

A. GRAY.

### NOTES.

THE meetings of the International Conference on Scientific Literature, held last week at the Royal Society, came to an end on Thursday. A list of the delegates appointed to attend the Conference appeared in last week's *NATURE*, with an account of the dinner given by the Royal Society in their honour. We hope shortly to give a report of the questions discussed and the resolutions adopted.

THE annual general meeting of the London Mathematical Society will be held on Thursday, November 10. Lord Kelvin has acceded to the request of the Council, and will be nominated for the office of President. Prof. H. Lamb, F.R.S., will be nominated for a Vice-Presidency. The retiring members are Messrs. Jenkins and G. B. Mathews, F.R.S. The former thus severs his long connection of more than thirty years—he being almost an original member. Prof. Elliott, F.R.S., has been chosen for the subject of his address, "Some secondary needs and opportunities of English mathematicians."

WITH the object of comparing systems of electric traction suitable for use in London, the London County Council have consented to permit the London United Tramways Company to

re-construct one section of their lines in the neighbourhood of Hammersmith on the overhead trolley system of electric traction, on condition that two other sections are laid down on the underground conduit plan.

IN his opening lecture to the engineering students at Cambridge on Friday last, October 14, Prof. Ewing intimated that the crowded state of their lecture-rooms and laboratories would soon be relieved. A gift of 5000*l.* had just been made for the addition of a new wing to the engineering laboratory in memory of the late Dr. John Hopkinson and of his son, John Gustave Hopkinson, who recently lost their lives in the Alps. Dr. Hopkinson's son was to have begun work at this time as a student of engineering at Cambridge. This splendid and welcome gift was made by Mrs. Hopkinson jointly with her son Bertram and her surviving daughter.

THE Harveian Oration was delivered at the Royal College of Physicians on Tuesday by Sir Dyce Duckworth, who, after urging the claims of the college to the consideration of generous benefactors, pointed out that Harvey had definitely charged them to encourage research. The lecturer is reported by the *Times* to have said that what were greatly needed now in England were research laboratories attached to hospital wards and *post-mortem* theatres, and also a select staff of fully trained investigators available for service throughout the Empire. It was surely humiliating that researches were permitted to be made for the public benefit in various parts of British territory by foreigners, while many of their countrymen and countrywomen, owing to ignorance and mawkish sentimentality, were doing their best to debar the training of such men in England. After alluding to the results of recent pathological research in regard to the preventive treatment of tuberculosis, Sir Dyce Duckworth observed that the Röntgen rays had as yet yielded little new information, and their therapeutic influence was not determined, but, according to Rieder, of Munich, the rays emitted from "hard" vacuum tubes killed bacteria. The influence of glycerine in destroying some of the most noxious microbes which gained access to ordinary vaccine lymph was very noteworthy, and he could not but imagine that this agent might yet be found of more extended usefulness as a bactericide. Expressing his private opinion, though he believed it to be shared by the majority of those he addressed, he did not hesitate to stigmatise the recent Vaccination Act as a piece of panic legislation, a lamentable concession to ignorance, fraught with serious peril to the whole community, and unworthy of the duty and dignity of any British Government. He closed with a brief appreciation of Harvey's chief scientific achievements, and of his great guiding principle, devotion to truth.

MR. W. H. PREECE, C.B., F.R.S., will deliver the inaugural address at the new session of the Institution of Civil Engineers, on Tuesday, November 1. The Council of the Institution have made the following awards out of the trust funds at their disposal for the purpose for original papers dealt with during the year 1897-98. The formal presentation will take place on November 1:—Telford medals and premiums—A. H. Preece (London) and H. C. Stanley (Brisbane, Queensland); Watt medals and premiums—H. L. Callendar, F.R.S. (London), and J. T. Nicolson (Montreal, Canada); George Stephenson medals and premiums—Whately Eliot (Plymouth), W. O. E. Meade-King (London), and W. P. Marshall (Birmingham); the Crompton prize—E. W. Anderson (Erith); Telford premiums—L. B. Atkinson (Cardiff), Henry Fowler (Horwich), W. L. Strange (Bombay), F. J. Waring (London), D. W. Brunton (Denver, U.S.), Wilfred Airy (London), E. M. Bryant (Newcastle-on-Tyne), D. B. Butler (London), and H. V. Champion (Victoria); the James Forrest medal—W. L. Brown (London); Miller prizes—C. E. Wolff (Derby), A. D.