

in such detail. But with the examination before them, our students and their successors have insisted on doing them all, and perhaps from their point of view they were right; but the result is wrong. The experiments were designed and described as a short cut to something better.

Nevertheless, the practical work in science, of which the Cavendish Laboratory is typical, furnished demon-

strations not only of experimental physics but also of the University's care for teaching. The example has been followed, expanded, and improved until this term, under the new statutes, the University has recaptured from the colleges the right to teach its students the arts, as well as divinity, law, and medicine, a right which it surrendered in the spacious days of Queen Elizabeth.

### News and Views.

PHOTOGRAPHS of the 'Pithecanthropus skull' recently obtained at Trinil in Java by Dr. Heberlein have now been received by Dr. Dubois of Haarlem. At the time of the discovery it was positively announced to be of the pithecanthropus type; but Prof. Elliot Smith has received a cablegram from Dr. Dubois in which he says, "Photographs received show *caput humeri stegodon*." The second pithecanthropus skull thus turns out to be a pleistocene elephant! Much disappointment will be felt at this pronouncement, which, however, does not come entirely as a surprise. The information received in England from America soon after the first announcement made it clear that the discovery was not likely to prove so important as at first indicated. The more complete statement of the character of the find and the conditions in which it was obtained—it was not found *in situ* as at first stated, but was obtained from the inhabitants of the village, and it was also said not to be a complete skull—pointed to the need for suspending judgment on the importance of the find. The wide publicity given to the discovery serves to emphasise the dangers of over-hasty dissemination of news through the ordinary channels of the press without effective and well-informed supervision such as might be afforded through the medium of a centralised scientific news service.

THE RIGHT HON. NEVILLE CHAMBERLAIN, Minister of Health, presided at the reopening ceremony of the Wellcome Bureau of Scientific Research and the Museum of Medical Science on December 8. In the unavoidable absence abroad of the founder, Mr. Wellcome, Dr. C. M. Wenyon, Director of the Bureau, received the guests. Mr. Chamberlain, in the course of his remarks, dwelt on the great advances made by medical science in the course of the last century, largely due, in his opinion, to the improvement in the means of imparting knowledge to those interested throughout the world. He considered that the motive actuating Mr. Wellcome in founding the Bureau was a conception of the two greatest factors which help mankind to overcome the infirmities to which all, in some degree or other, are subject; these two factors are research and education. Research is carried on not only at the Bureau, but also at the Wellcome Physiological and Chemical Research Laboratories; education is subserved by the Museum of Medical Science, to which all interested are welcomed, where, moreover, teachers are permitted to give demonstrations to their students.

SIR WALTER FLETCHER, Secretary of the Medical Research Council, followed Mr. Chamberlain with an

address on "Research and Citizenship." After referring to the admirable scientific work of the staff of the Bureau, he turned to the consideration of the means by which research has been in the past and is at present financed. Many brilliant investigators have been enabled to pursue their work owing to the accident of possessing private means or owing to the liberality of some friend or private institution. It is only within the last twenty-five years that the State has made grants in aid of research work, with the establishment of such institutions as the National Physical Laboratory in 1900 and the Medical Research Council (then a Committee) in 1913. Business firms have forwarded scientific work in three ways. Private fortunes made in commerce have been devoted to the endowment of research. Manufacturing firms have set up their own research laboratories; and although the investigators are not always free to publish the results of their work, yet the public are indirectly benefited by the increased efficiency of the firms in question. Finally, a few firms have adopted the plan of setting up research laboratories and leaving the workers as free to follow their own line and publish their results as men in any university laboratory. In Great Britain, the Wellcome Bureau is an example of the latter method of endowing research; abroad, the work of Langmuir and Coolidge in America and of Sørensen in Copenhagen has been made possible by similar endowments from commercial firms. The proceedings were terminated by Mr. Chamberlain declaring the Bureau and Museum open, and the guests then accompanied him and Dr. Wenyon on a tour of the halls and laboratories.

In an address on "International Interests in Raw Materials" to the Royal Society of Arts, which is published in the Society's *Journal* for November 26, Sir Thomas Holland laid stress on the importance, for economic as well as military reasons, of making a precise estimate of the mineral resources of the British Empire. A large number of minerals are essential for the maintenance of civilisation, and many of them cannot be replaced in the functions for which they are used. Minerals are wasting assets, and their consumption is annually accelerating to such an extent that a partial famine for some important substances will confront the next generation. The United States has recently inaugurated a systematic inquiry into its stocks of essential minerals on lines of precision and thoroughness that will leave little doubt as to resources available. For the British Empire the matter is at least of equal importance. The Mineral Resources Bureau collects

figures of production and movement, but that is a small part of the problem. To make a complete or even partially complete survey, private sources of information must be tapped. The specialist in the course of his professional practice must have acquired information which, in the aggregate, would be of immense value even if the results were published only as totals for each considerable section of the British Empire.

ON October 27, Dr. R. J. Tillyard, chief of the Biological Department, Cawthron Institute, Nelson, New Zealand, delivered the Trueman Wood lecture before the Royal Society of Arts, upon "The Progress of Economic Entomology (with special reference to Australia and New Zealand)"; and this is published in the *Journal of the Society for November 12*. Dr. Tillyard points out that the main problem of economic entomology is how to intervene scientifically, in the most successful manner, in order to prevent the huge losses caused by insects to man's food supply and forests. The past thirty years have witnessed an immense development of what we may term the chemical method of attack, and the technique of the latter has been revolutionised during the last few years, particularly in America. Special reference is made to the commercial use of aeroplanes for dusting large areas of vegetation, and Dr. Tillyard expresses the hope that Great Britain will not be long in following, Germany and Russia, which have already conducted promising trials with regard to the possibilities of this new line of attack. He deals very fully with biological control and emphasises the fact that three organisms are involved in the problem, namely, (1) the plant, (2) the insect attacking the plant, and (3) the parasite or predator of that insect. Occasionally we have also to consider secondary or even tertiary parasites of the parasite or predator.

THE possibilities of biological control are being explored in Australia and New Zealand, and the recent very striking success achieved by the introduction of the Chalcid parasite *Aphelinus mali* from North America into New Zealand, for controlling the woolly aphid of apple, is an example of it. The re-exportation of this same parasite into Australia is also proving highly beneficial in the latter country. The biological control of imported weeds which have so far resisted all other means of eradication is also discussed. The possibilities of introducing insect enemies of such weeds from their countries of origin into lands where the weeds have become established are worthy of the fullest exploration. Experiments of this nature, however, need to be carried out with adequate safeguards, under expert guidance, lest such insects turn their attention to cultivated plants and thereby become new evils rather than benefactors as originally intended. The work that is being carried out in Australia on prickly pear control by means of introducing *Opuntia*-feeding insects to prey upon that plant is particularly noteworthy. It appears that this problem is nearer solution than hitherto by means of the biological control exercised by insect enemies on this formidable pest. The importance of attempt-

ing likewise the control of blackberry, gorse, and other noxious weeds in New Zealand through the utilisation of certain insect enemies is also stressed by Dr. Tillyard, and his scheme for meeting the problem is outlined.

THE League of Nations' Committee on Intellectual Co-operation has published an important memorandum by Madame Curie, the eminent physicist, on the question of international scholarships for the advancement of the sciences and the development of laboratories. Madame Curie directs attention to the ever-increasing specialisation in the equipments and programmes of laboratories and the increasingly complex organisations of their staffs, and urges that fellowship and scholarship schemes should be so framed as to fit in with and take advantage of these conditions. To do so they must have due regard to two essential necessities: advanced workers, who have already made their names by scientific work, must be given the means of continuing their work; all candidates anxious to devote themselves for some time to science must be given a chance of developing their talents on the sole condition that they are recommended by their tutors or have obtained satisfactory university degrees.

WITH such a scheme, a complete foundation would accordingly control scholarships of two grades: for research fellows and for probationary scholars (two or three times as many). It would, further, provide grants to laboratories amounting to perhaps a quarter of the amount of the scholarships, to enable them to meet the increase of expenditure resulting from increase in the number of workers. Each probationary scholar would be assigned by the director of the laboratory to one of the research groups in which a vacancy is expected. A research fellow would work independently on a subject chosen by himself with the approval of the director or set for him by the director. The memorandum concludes with proposals, which have been adopted by the committee, for an inquiry into national and post-graduation scholarships and the best means of organising a system of international scholarships. Lord Balfour's research sub-committee of the Imperial Conference might well devise and provide for financing some such scheme for minimising the obstacles in the way of interchange between research workers in different parts of the British Empire and so meeting, to some extent, the competition of the magnificently equipped and endowed laboratories in the United States for the best brains of the Empire.

IT is surprising that, notwithstanding the advances made in recent years in the study of phonetics and the methods of recording spoken sounds, there is still no agreement as to the form of script to be used in recording the spoken languages of India, although the question has often been discussed. With the example of America before us, it should be possible for something to be done. In the United States a script has been evolved adequate to meet all the needs of recording a group of languages of considerable phonetic difficulty. The languages of India should

present far fewer stumbling-blocks. This question is again raised with special reference to the Munda group of languages by Mr. P. O. Bodding in the *Journal and Proceedings of the Asiatic Society of Bengal*, vol. 25, part 1, where he insists upon its urgency, now that changing conditions are beginning to affect the habits of the people. He quotes a number of errors which, as a matter of practice, arise through an imperfect method of recording the language, while from the scientific point of view the importance of an accurate method of recording the spoken sounds has been greatly enhanced by the extension of the comparative study of linguistics. A question of such moment as this would seem to call for action on the part of some influential body, such as the Asiatic Society of Bengal, before it is too late and these languages have been profoundly modified by contact with the outer world.

IN many physical theories—as, for example, in the atomic theory of gases or in J. J. Thomson's corpuscular theory of light—the theory of probability plays a leading part. In a paper read by Mr. G. F. O'dell on December 2 to the Institution of Electrical Engineers on certain aspects of automatic telephone working, this theory is also largely used when discussing purely technical matters. The problems considered were those arising when provision has to be made for more than one telephone call at one time. In automatic exchange working, when the caller removes his receiver, his 'preselector' hunts for a disengaged first selector. On his dialling the first digit, the first selector steps up to the corresponding level and then hunts until it finds an idle second selector. On the receipt of the second digit, the second selector rises and searches for an idle final selector, which in turn responds to the third and fourth digits. In addition to the subscriber being actually engaged, there are three places in this chain of events at which the call may be 'lost' or delayed. In order to discuss the theory, telephone engineers find it convenient to define a 'telephone traffic unit.' This unit is the average number of calls in progress simultaneously during a specified period. It is simply a number and has no physical dimensions. One of the problems discussed by Mr. O'dell was the best method of arranging switching plant to the best advantage. This necessitates using the theory of probability. Another problem the solution of which forms the basis of the design curves in common use in the United States is to find the grade of the service. This is measured by finding the proportion of the traffic lost when a given volume of traffic, measured in traffic units, is offered to a definite group of switches. Mr. O'dell showed that telephone engineers fully realise the help that an advanced knowledge of mathematics can be to them. He also developed an analogy between 'trunking' problems and those which arise when discussing the performance of heat engines. It is thus shown how one branch of applied theory can help another.

THE present year marks the centenary of the founding of *Crelles Journal für die reine und angewandte Mathe-*

*matik* or Crelle's Journal, the oldest organ of mathematical research in Germany surviving to the present day. Of earlier mathematical journals, only the French *Journal de l'École Polytechnique*, founded in 1794, has enjoyed a longer period of continuous publication. The earlier volumes of Crelle were enriched by papers from Gauss, Abel, Jacobi, and Steiner, while many of the more distinguished Continental mathematicians have contributed to its pages in more recent years. Among Englishmen, Cayley, with eighty papers, was the most frequent contributor. It is the intention of the editors to celebrate the centenary worthily by issuing two commemoration volumes (157 and 158) in which will be shown, in the true perspective of distance, the part played by this journal in developing the science of mathematics during the last hundred years.

PROF. J. H. PRIESTLEY, of the department of botany, University of Leeds, is to give a course of post-graduate lectures and demonstrations to students of the departments of botany and bio-chemistry of the University of Berkeley, California, during the spring of next year. Prof. Priestley will deal with the subject of developmental anatomy. His lectures will include some account of the work done in the botanical department at Leeds upon the structure, function, and distribution of the endodermis; the structural features associated with the phenomena of etiolation; and the problem of phototropism. Prof. H. H. Dixon, of Trinity College, Dublin, has similarly been invited to lecture at the University of Berkeley in the summer months of 1927.

A SERIES of violent earth-shakes disturbed the Rand on the morning of December 7, and in the Wolhuter gold mine there were two rock-bursts which caused the death of four persons. The earth-shakes seem to be due to the collapse of the surface-rocks over disused mining tunnels. In the early days of the mines, no earthquakes were noticed in the Rand, but in 1905 they began to occur and soon increased so much in frequency that in 1910 a seismograph was erected in the Johannesburg observatory. During the next fourteen years, 5427 local shocks were recorded. It was noticed that they occurred in series, and most frequently in the dry season. This led to greater care being used in timbering and re-filling abandoned tunnels, and during the last two years local shocks have decreased in number (*Volcano Letter*, October 31, 1926, issued by the Hawaiian Volcano Research Association).

THE seventeenth annual Exhibition of the Physical Society and the Optical Society to be held on Tuesday, Wednesday, and Thursday, January 4, 5, and 6, at the Imperial College of Science and Technology, Imperial Institute Road, South Kensington, will be open in the afternoon from 3 P.M. to 6 P.M. and in the evening from 7 P.M. to 10 P.M. On January 4 at 8 P.M. Prof. E. N. da C. Andrade will reproduce with contemporary apparatus a physical lecture of the early eighteenth century. On January 5 at 8 P.M. Dr. C. V. Drysdale will lecture on "Progress in Electrical Instrument Design and Construction,"

and on January 6 at 8 P.M. Mr. J. L. Baird will give a lecture on "Television." Some seventy firms are exhibiting apparatus, and in addition there will be a group of non-commercial exhibits, including demonstrations of famous historical experiments in physics, recent research and effective lecture experiments. Tickets, which can be obtained from the secretaries of related scientific societies or direct from Prof. A. O. Rankine, Imperial College of Science and Technology, South Kensington, S.W.7., are required for January 4 and 5, but on January 6 the Exhibition will be open to the general public without tickets.

THE issue for November 15 of *Power Plant Engineering* contains a short illustrated account of the remarkable high-voltage laboratory erected at Stanford University, California. The laboratory has been erected by the University with the aid of some of the big electrical firms to ensure the continuance of the research work of Dr. Harris J. Ryan. The main building of the laboratory is 173 feet long, 60 feet wide, and 65 feet high, and in this are installed the six specially designed transformers, each of which is rated at 350,000 volts high tension, 2300 volts low tension, and each of which weighs 22 tons. These have been constructed so that they may be used in every manner of connexion for the whole range of voltages single-phase or three-phase, up to 2,100,000 volts single-phase and 1,200,000 volts three-phase. The work of the laboratory was inaugurated on September 17, when before an assemblage of men of science a 2,100,000 volt spark was discharged between points 20 feet 1 inch apart.

WE much regret to record the death, on December 11, of Sir William Tilden, F.R.S. Sir William, who was formerly professor of chemistry and dean of the Royal College of Science, London, and emeritus professor in the Imperial College of Science and Technology, South Kensington, had reached the age of eighty-four years.

LORD D'ABERNON has accepted the chairmanship of the Industrial Fatigue Research Board, to which he has been appointed by the Medical Research Council. Mr. William Graham has relinquished the chairmanship of the Board under the pressure of other public work, but will remain a member of the Board.

It is stated in *Science* that Prof. J. J. Abel, professor of pharmacology at Johns Hopkins University, is to receive the Willard Gibbs gold medal for 1926 awarded by the Chicago section of the American Chemical Society. Prof. Abel's work has been largely in the field of glandular extracts; he isolated epinephrin as a pure crystalline body from the suprarenals, and recently he has announced the preparation of insulin in crystalline form.

It has now been decided to close the fund raised to signalise the long services of Prof. A. G. Perkin to science and to the University of Leeds. Prof. A. G. Perkin, it will be remembered, has recently retired from the chair of colour chemistry and dyeing. Those who desire to be associated with the purpose of the fund are asked to send their subscriptions to Prof. A. F. Barker, The University, Leeds, at an early date.

NO. 2981, VOL. 118]

THE twenty-fifth anniversary of the historic wireless experiments conducted by Senatore Marconi between the Poldhu wireless station in Cornwall and St. John's, Newfoundland, which resulted in the transmission and reception of wireless signals between the old and the new worlds for the first time, fell on Sunday, December 12. Senatore Marconi's achievement in 1901, only six years after his earliest experiments at his father's house in Bologna, Italy, marked an epoch in the development of wireless communication and firmly laid the foundations of the long-distance wireless communication which to-day covers the whole world.

THE following lecture arrangements at the Royal Institution before Easter next year have been announced. The Christmas Course of six lectures for juveniles will be delivered by Prof. A. V. Hill, on "Nerves and Muscles: How we Feel and Move," commencing on December 28 at 3 P.M. On Tuesdays, at 5.15 P.M., beginning on January 18, there will be two lectures by Prof. R. Whytlaw-Gray on smokes as aerial disperse systems, six by Prof. Julian Huxley on problems of animal growth and development, two by Dr. G. Shearer on X-rays and the chemical molecule, and two by Prof. J. W. Cobb on some properties of coke. Thursday afternoon lectures, at the same hour, include three lectures by Sir William Bragg on acoustical problems treated by Lord Rayleigh; three by Prof. John Garstang on the progress of Hittite studies; two by Mr. J. Guild on colour measurement and standardisation; and two by Mr. Harold J. E. Peake on the beginnings and early spread of agriculture. Saturday afternoon lectures at 3 P.M. include four by Sir Ernest Rutherford on the  $\alpha$ -rays and their application to atomic structure. The Friday evening meetings will begin on January 21, when Sir William Bragg will deliver a discourse on Tyndall's experiments on magne-crystalline action. Succeeding discourses will probably be given by Prof. E. P. Cathcart, Mr. T. L. Eckersley, Dr. Ernest Law, Sir Josiah Stamp, Prof. D'Arcy Thompson, Sir Herbert Jackson, Dr. George Macdonald, Mr. E. Hatschek, Prof. C. T. R. Wilson, Sir Ernest Rutherford, and other gentlemen.

WE have received the annual report of the Laboratory of the Joint Board of Research for Mental Disease, City and University of Birmingham, of which the late Sir Frederick Mott was honorary director. Determinations of the iodine content of the thyroid gland have been made in various conditions, and show that septic infection and tuberculosis cause considerable variation. Investigations have been pursued on basal metabolism in conditions of conscious and unconscious contraction and relaxation of muscles, on changes in the central nervous system as a result of the administration of hypnotic drugs, and on the permeability of the membranes of the brain to the bromine ion after administration of sodium bromide.

THE topographical survey of the colony of Sierra Leone is at length to be put in hand. Up to the present no satisfactory map of this part of British

Africa has been available. A year ago the financial position of the country justified the formation of a new survey department, of which the first annual report has now appeared. It has been decided to aim at a one-inch scale for the whole colony, which will entail 111 sheets. A start is to be made in the central and southern parts of the Northern Province. A school for training native surveyors has been started, but in order not to delay the work, trained surveyors have been temporarily transferred from the Gold Coast. A large scale cadastral survey of Freetown is in hand and well advanced.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A research student at St. Mary's Hospital Institute of Pathology and Research—The Secretary of the Institute, St. Mary's Hospital, Paddington, W.2 (December 20). A research assistant in the Department of Pharmacology of the University of Sheffield, to help in an investigation on cancer, and a laboratory attendant with experience of physiological or pathological and chemical technique for the same institu-

tion—Prof. E. Mellanby, The University, Sheffield (December 22). A demonstrator in chemistry at Guy's Hospital Medical School—The Dean, Guy's Hospital Medical School, London Bridge, S.E.1 (December 29). An adviser in agricultural chemistry in the University of Manchester, under the scheme of the Ministry of Agriculture and Fisheries—The Registrar, The University, Manchester (January 20). Lecturers in organic chemistry, physical chemistry, and biochemistry at the Indian Institute of Science, Bangalore, India—The Director (January 30). A professor of physiology in the University of the Witwatersrand, Johannesburg—The Secretary, Office of the High Commissioner for the Union of South Africa, Trafalgar Square, W.C.2 (January 31). A senior lecturer in philosophy in the Transvaal University College, Pretoria—The Registrar, Transvaal University College, Pretoria (January 31). A professor of anatomy in the University College of South Wales and Monmouthshire—The Registrar, University College, Cardiff (February 26). A professor of philosophy at Armstrong College—The Registrar, Armstrong College, Newcastle-upon-Tyne (March 12).

### Our Astronomical Column.

THE COMET GRIGG-SKJELLERUP.—Mr. G. Merton read a paper on this comet at the meeting of the Royal Astronomical Society on December 10. The identity of the comet found by Skjellerup in 1922 with that found by Grigg in 1902 was first suggested by Crawford and Meyer. Mr. Merton has made it a practical certainty. He gets practically the same mean motion in 1922 from the observations in that year alone (they extended over three months, so the value is trustworthy) as by combination with those of 1902. The comet is due to return to perihelion on May 10, 1927; Mr. Knox Shaw is now searching for it with the large reflector at Helwan. It may be expected to be found not later than February. It approaches within 17 million miles of the earth in June; Comet Pons-Winnecke makes a still nearer approach (some 4 million miles) near the end of June.

INTERNATIONAL LONGITUDE DETERMINATIONS.—Dr. J. Jackson gives in the *Observatory* for November an interesting account of the extensive scheme of longitude determination by radio signals which has been in progress during October and November.

The observatories of Algiers, Shanghai, and San Diego (California) form the principal chain, but some fifty other observatories are co-operating. The use of travelling wire micrometers practically eliminates personal equation, and enables longitude differences to be determined without interchange of observers. Dr. Jackson obtained star observations on seventeen nights between September 27 and November 1, the transit instrument being reversed on each star to eliminate collimation. The Shortt clock has such a regular rate that its error can be interpolated for days without star observations. Thirty-four series of time signals are sent out daily from five stations; all except Saigon were regularly received at Greenwich.

THEORY OF SUNSPOTS.—An important contribution to the theory of sunspots and the sun's general circulation is made by Prof. V. Bjerknes in the *Astrophysical Journal*, September 1926, under the title "Solar Hydrodynamics." For the details of the theory reference must be made to the paper in question, but a short outline of the main points may be

given as follows. On the assumption that a sunspot is a vortex decreasing in intensity from the photosphere downwards, their low temperatures are explained from general hydrodynamical and thermodynamical principles.

The results deduced are in accordance with the accepted temperatures of sunspots and the probable velocities of the gases involved in the vortex. A preliminary account of this part of Bjerknes' investigation was given in *NATURE*, March 27, p. 463. The well-known properties of sunspots (their usual occurrence in pairs having opposite magnetic polarities, the progression of the spot zones towards the equator during the 11-year cycle, the magnetic-polarity cycle of 22 years, etc.) are explained by making the following suppositions. In each of the sun's hemispheres, northern and southern, there are two zonal vortices, having opposite rotations and surrounding the sun approximately as parallels. Wherever part of either vortex rises and cuts the photosphere, a typical bipolar pair of sunspots makes its appearance. As part of a scheme of general circulation, these two zonal vortices revolve around each other in a period of 22 years, being brought alternately near to the surface of the photosphere in latitudes about 40°, progressing equatorwards in the course of 11 years, and descending again into the interior near the sun's equator. The scheme of general circulation is one demanding a condition of what is known as stratified circulation.

Renewed investigations are required on the part of observers to determine any possible systematic movements which may be shown by sunspots, faculae, calcium and hydrogen flocculi, and prominences. The systematic drifts suggested by the theory are apparently too slow to be observed spectroscopically (cf. *Astrophysical Journal*, 32, 80, 1910, where St. John compares the mean wave-length of  $K_2$  and  $K_3$  near the sun's poles and at the equator for detection of systematic movements).

Prof. Bjerknes' paper is also discussed, together with remarks bearing on the question of observed systematic motions of spots and faculae, by 'W. M. H. G.' and 'H. W. N.' in the *Observatory* for December.