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West African Development.

I.

THE Hon. W. G. A. Ormsby-Gore, the present Under-Secretary of State for the Colonies, is tireless in his pursuit of truth—so tireless that he might be suspected of regarding the machine-phrased memoranda emanating from local governments dealing with their particular problems in the same light as a member of Parliament regards the average answer to a parliamentary question. He has evidently set himself the task of knowing and making known the potentialities of the peoples and the countries for which Great Britain has assumed responsibility in the tropics. In 1922 he accompanied the present Viceroy of India on his tour of the West Indies and British Guiana. In 1924 he was appointed chairman of the Parliamentary Commission of Inquiry to East Africa. At the beginning of this year he set out on a tour of the four British West African territories, the report on which has just been presented to Parliament (Cmd. 2744; 3*s.* 6*d.* net).

This report, for which Mr. Ormsby-Gore is alone responsible, will commend itself to scientific workers as an objective survey of the facts to be faced and the problems to be solved in regard to the development of tropical Africa. He has the qualities of a statesman rather than those of a successful politician. He shares certain preconceptions with many of us. He has an abiding faith in the capacity of his fellow-countrymen to create an Empire Commonwealth, a belief in the right of the British nation to exercise a tutelage over the backward races until they no longer need our powerful protection to safeguard themselves against themselves or other peoples, or our guidance in conserving and developing their material resources. But he allows neither his preconceptions regarding our mission, nor his political convictions, to warp his judgments.

Faced with the inexorable facts of African native communities, their tribal or communal ownership in land, communal production, communal obligations in respect to essential services, Mr. Ormsby-Gore has the courage to draw logical conclusions. He realises, as Rivers realised and Morel realised, that our meat may be poison to peoples in a less advanced stage of development. "There can be no common definition of progress, no common standard for all mankind." The paths to the highest attainments need not be along parallel lines. Man's special functions in the universal scheme of things must differ with dissimilarities in race, environments, and inherited institutions. In spite of the shrinkage of the world, these dissimilarities persist and must be recognised, particularly by the white race which has been enabled, by its amazing command over material forces, to bend other races to its will. Before

transplanting our laws, our customs, our institutions, our processes, among alien peoples and on alien soil, we should take heed lest we destroy much that is intrinsically valuable. We cannot legislate for every section of humanity as if it were cast in the same mould.

There are tremendous responsibilities implied in our trusteeship of the African native. Our duty to him and to the world does not end by making him a more efficient instrument for the development of the natural resources of his country. We have to safeguard him against the evils arising from a catastrophically sudden contact with our so-called modern civilisation. Our aim should not be to evolve Europeanised Africans, but to enable Africans to build up their own civilisation based upon all that is best in their culture and traditions.

The task confronting our administrators demands much patience, much tact, and a ripe understanding based upon knowledge born of intensive study of the peoples. We cannot afford to send out our administrators like "little children stumbling in the dark." They must be equipped for their task lest they destroy faster than they build. There is now a wealth of accumulated experience and knowledge at our command in our schools of anthropology. It is this which Mr. Ormsby-Gore wishes to enlist in the service of the British administration in tropical Africa.

"If we are to succeed in our duties towards these peoples as rulers or as missionaries, or as instruments for their advance or civilisation, we must study them objectively and base our policy on real understanding acquired not only from personal contact, but from scientific study of their mental and moral characteristics, of native law and customs, of native history, language and traditions. Native methods of agriculture, native arts and crafts, should be examined scientifically before any attempt is made to supersede what we find existing."

The above quotation is a prelude to a delightful chapter on the indigenous population. The rest of the report is dull in comparison. In the small compass of twelve pages are summarised the results of much reading and still more careful observation. In them is to be found more information most attractively presented of the West African natives, their traditional forms of government, their languages, their forms of religion, their special characteristics, than it is usual to find in several volumes. It is almost Wellsian in style. With zest the author repeats the description by a Mohammedan ruler in Northern Nigeria of an English court of law as a place where "two professional liars appear to prevent the judge from ascertaining the truth." If this is the usual conception held of our legal system by Mohammedans, it is obvious that any attempt to supersede theirs, where judicial and executive functions are combined, would lead to considerable friction.

While the East African tribes have so far no aptitude for trading, and consequently are at the mercy of Indian, Arab, and Syrian middlemen, the West Africans have in their midst a negro tribe, the Hausas, who carry on itinerant trading and have created trading centres throughout Nigeria and the Gold Coast. The Yorubas, another negro tribe, have solved the problem of town-dwelling in a way which should commend itself to our own city-dwellers. They are both farmers and townsmen. They live in great towns—Ibadan contains 250,000 people—and go out daily to cultivate their holdings, some so far as ten to twelve miles from the city. None would interfere with his neighbour's crops. They are as sacrosanct as the fruit of the apple trees planted by German municipalities along their main roads.

Just as in East Africa, in the mountain fastnesses, there are remnants of tribes like the Wachagga and the Bagishu scattered among the Bantu and the Nilotic races, so in West Africa there are remnants of the Bauchi tribe, a primitive pagan people—still, it is alleged, addicted to cannibalism—scattered among the virile and intelligent Moslem tribes of Northern Nigeria. The Bauchi have protected themselves against attack by building heavy stockades hedged with the poisonous euphorbia shrub and cactus, and the use of poisoned arrows. They live in isolated communities, each of which has its own dialect, and are not yet accustomed to wearing clothes. Of the Ashantis we are told that they are organised in a quasi-feudal system, and even their land system is strikingly parallel to that which obtained in Britain in medieval times. The king himself, the Omanhene, has not only a council of barons to advise him, and if they consider necessary, to dethrone him, but also his position is rendered more delicate by a council of women headed by the Queen-Mother, who, being elected to the office, exercises parental authority without necessarily having had the responsibility of giving birth to the king. She is almost invariably a political power to be reckoned with.

The existence of an English-speaking African population raises special problems both in their relations with government and with the vast mass of their fellow Africans in the interior. They have sprung up through long contact with European traders on the coast, and by the creation of settlements for freed slaves from the Americas. Unlike the French, who encourage it, we definitely dislike the assimilation of our culture, our outlook, and our social habits by people of a different race; the nearer they approximate to us in these respects the wider becomes the gulf between them and us. Mr. Ormsby-Gore states the problem, but he gives

no indication of a definite policy to be pursued, contenting himself with saying that the relations between the races must be based on mutual respect and understanding. It would be well if we faced the fact that the natives are rapidly becoming suspicious of the motives underlying the social exclusiveness of the English-speaking whites. It is notorious that many of the natives in Northern Rhodesia are forsaking British territory for work in the Belgian Congo, preferring the absence of racial discrimination among the Latin whites to the comparative freedom they enjoy under British rule. We cannot afford to be content with the expression of pious sentiments regarding mutual respect and understanding. We must have a definite policy, one that is intelligible and does not affront the intelligence of the better educated natives, who are capable of exercising considerable sway over their fellow-tribesmen: otherwise we shall create an ever-widening gulf between ourselves and the black races which can never be bridged.

British policy with regard to the administration of the native races has its parallel in the policy of the average captain of industry in a European industrialised state towards the workers in industry. Every material inducement is offered to enable the workers to produce more and to produce better in order that they may live fuller, more contented lives, yet one thing is lacking: neither rulers abroad nor rulers in industry at home are prepared to share the control which they monopolise; and in denying the peoples concerned a progressive share in the control of the machinery of government or of industry, they are wounding their self-esteem and progressively widening the breach between races and between classes.

So far in Africa, Great Britain has not determined to share the highest authority with members of the subject races. We are prepared to delegate authority; we are perpared to permit and even to bolster up a system of indirect rule under our supreme authority; we are not prepared to relinquish control for guidance. Whatever benefits we may have bestowed upon the Africans, therefore, will be regarded by them as being actuated by no higher motive than self-interest or as more subtle means devised for their exploitation. Every new road, every new railway, every new plant-product introduced, every new process, however necessary they may be if the potential resources of these vast territories are to be developed, increases the complexity of the African's life and sounds the death-knell of many of his institutions, habits, and customs. His needs increase and he has to work harder than ever. The transitory delight in the new gives way rapidly to an infinite regret for the loss of the old. Discontent is the parent of suspicion, and the suspicion can only be allayed by fitting him for the assumption of full responsibility.

Education is the only means by which the natives can be fitted to assume responsibility and adjust themselves deliberately to their special environment, and to adjust the environment itself to the changing conditions brought about by impact with the modern world. Mr. Ormsby-Gore has an abiding faith in the efficacy of education as an instrument of progress. He realises that in West Africa at least there is no possibility of creating an English colony. The personnel of the technical services, therefore, must be largely in the hands of the natives themselves, who look to the Europeans for guidance only in the initial stages of development. The chief needs of the country are education services which must supply well-trained natives for medical, sanitary, veterinary, agricultural, and other technical services. They will also have to meet the growing demand for native administrators. The basis of all education must be the primary school system, and it will be the greatest mistake to limit the provision of education to the favoured few. Mr. Ormsby-Gore is probably right in condemning a large number of the small bush schools which flourish throughout the territories, but it would seem to be a mistaken policy to close down any type of school catering for the native communities and selected by themselves for the satisfaction of their appetite for education, before the governments are in a position to satisfy the needs of the natives by the adequate provision of better schools. Our motives in suppressing the one without creating another to take its place would not be understood.

Mr. Ormsby-Gore's picture of the standard of teaching in the schools in West Africa makes somewhat depressing reading, and is certainly a reflection upon the capacity of the administration, the directors of education, and the missionaries. Where any system exists, education has been subordinated to the task of cramming African children for the Oxford and Cambridge junior and senior local examinations and the University of Durham pass degree. The majority of text-books in use in the various schools he considers to be unsuitable. Some of the elementary English reading books in use have been long obsolete in Great Britain. In respect of text-books and readers the schools in West Africa under British administration fall far short of those in use in the neighbouring French colony. Children had a parrot-like knowledge of the names of places in England, but no knowledge at all of the geography of West Africa. Many of the books used dealt with words and objects entirely outside the experience of the African children.

It is evident from the description of what purports to be an education system in West Africa, that education has been entrusted to people without any conception of

the true purpose of education or any ideas of modern educational methods. Much is hoped for from the newly created Prince of Wales College at Achimota in the Gold Coast Colony, but it is evident that profound changes will have to be made in the personnel of the advisory committees on education and the education staffs themselves if any effective progress is to be made. What is needed are directors of education and staffs who are professionally trained to be alive to the potentialities of education, to the paramount need for elasticity in the treatment of educational problems, to the importance of psychology as a factor in educational training, and to the need for continuous experiment and research in educational method. With ignorance at the helm, education degenerates into mere instruction, its aim is confined to fitting persons for predetermined tasks, and the wider aim is unfulfilled of fitting them to live fully and to accept the responsibilities of citizenship, the basis of which is ungrudging service to the community. Mr. Ormsby-Gore is disappointingly silent on this aspect of education.

Cotton and Food.

The Cotton-Growing Countries, Present and Potential: Production, Trade, Consumption. International Institute of Agriculture, Rome. Pp. xxxvi+317. (London: P. S. King and Son, Ltd., 1926.) 12*s.* 6*d.* net.

STUDENTS of the cotton industry were placed under a lasting obligation to the author of "The World's Cotton Crops" when it was published in 1915, and a grasp of the subject thus became available to any reader. The details of cotton-growing interests collected in that book gave internal evidence of the labour required to make an effective compilation by single-handed effort; the form of the book gave a reality and unity to the subject which a bald compilation must lack. It was too much to expect that Prof. Todd would be able to keep his book up-to-date, so that the action of the International Institute of Agriculture in producing the memoir now before us is doubly welcome, both as an authoritative statement of facts and as a supplementary volume to be shelved for reference beside "The World's Cotton Crops."

The present memoir amplifies an earlier publication on the same subject which the Institute issued in 1922. As its title indicates, the fact of a small production does not exclude a country from its pages, so that unexpected information can be derived from them; several acres of cotton grown successfully near Budapest in 1924 may be cited. It is not the function of such a compilation to balance critically the information derived from one country against that from another; this must be left to those who use the facts provided, in which they are assisted by a useful foreword. Such users will be well advised to bear this limitation of function in mind, for in many countries the full potentiality can never be made commercially effective, on account of such restrictions as are imposed by unevenly distributed rainfall, by the area available for irrigation, or by the irrigation available for the area.

The information given for eighty-one geographical localities, including the United States and Liberia, Egypt and Fiji, India and Barbados, is arranged to show so far as practicable the authorities quoted, data of area and crop, local geography and chronology of the crop, botanical and entomological information, together with merchanting particulars, including local manufactures.

Returning from the details which are the chief constituent of this volume, we may with advantage look more carefully at the interesting foreword. Amongst other things to which it directs attention is the stimulus given to cotton growing of late years by the high prices which resulted from short crops in the United States; this stimulus is very evident in some of the tables, where new countries continually appear from 1922 to 1925. It also directs attention to the probability of a continued fall in price from those stimulating levels, and to the consequent repetition of that vicious circling movement so familiar in cotton supply and demand. The foreword leaves the topic at this stage, for it is by such presentation and discussion of facts as this memoir provides that the radius of the vicious circle may be contracted. It is, nevertheless, quite possible that the ostensible circle is in reality part of a spiral, and that the whole cotton industry is entering upon a transition phase, from which it will emerge as a smaller and more highly specialised producer of high quality goods. The years during which short-time working has lately been practised may not be ephemeral, and the fact of such prolonged short time may not be a mere incidental consequence of post-War disturbances; it may be part of a coming shrinkage. While the significance of the artificial fibres as a cause which has begun to contribute to such shrinkage may be open to discussion, there can be little question that the supply of cotton will very soon be liable to direct competition through the rivalry of food crops.

The world's food demands were brought to the notice of the public by Sir Daniel Hall's recent address at the British Association, and there is an admitted probability that these demands will equate to the available known resources within a few generations; the situation will rectify itself, of course, by moving

in the same vicious circle of demand and supply as obtains with cotton, but at the cost of some inconvenience to the world, unless it is anticipated. Such anticipation is not merely a problem for the dim and distant future; indeed, Prof. E. M. East has ventured to date the impact to happen within the life of potential centenarians already born. But long before this date is reached there will be a shouldering-out movement, wherein the textile plant will have to get off the arable earth, unless it can show itself to be irreplaceable by synthetic or forest products.

Another phenomenon which may perhaps be symptomatic of the same process in the making is also mentioned in the foreword. The design of the cord tyre for motor-cars gave the durability of the best cotton an opportunity to assert itself, which the chances of accidental damage had obscured in the old fabric tyre; the tyre-maker's demand for Sakel cotton, still more for Sea Island, outran the supply available at a competitive price, and many tyres are now made to wear well enough with lower quality cotton. But those who combine some knowledge of cotton with an interest in the autocar will be well aware that one firm which persisted in using Sakel won itself enviable reputation. Again the solution seems to lie in specialisation towards producing more good cotton, even if less of ordinary cotton.

We notice that the foreword makes one frank statement of ignorance which it is refreshing to meet. "Quality, in cotton, is a very vague term, and cannot be conveniently or tersely expressed, except in terms of the market price." Though this statement may appear surprising, it is quite true, and the absence of any analytical comprehension of 'quality' has been such a drag on the possible usefulness of botanists and plant breeders to the industry as must have been experienced to be appreciated. The late Mr. J. W. McConnel realised this, and initiated research work on the subject some twelve years ago; a book which summarises our broad conclusions is now in course of preparation, while the fuller details are being patiently dissected out in various textile research institutions. It may be hoped, therefore, that when the next issue of this memoir appears, the editor will be in a position to excise the statement we have quoted, and to extend his useful analysis of the general position accordingly.

The text is commendably free from misprints ("*Neocosmospera vas infecta*" is noted on p. 11), which carries the presumption that the tabulated data are equally correct. Thus, for reasons already given, and for its citation of authorities, this volume should be within reach of all who are interested in cotton supplies, whether industrially or scientifically.

W. LAWRENCE BALLS.

Modern Aspects of Evolution.

Nomogenesis: or Evolution determined by Law. By Prof. Leo S. Berg. Translated from the Russian by J. N. Rostovtsow. Pp. xviii + 477. (London: Constable and Co., Ltd., 1926.) 28*s.* net.

THIS volume represents the mature thought of an accomplished ichthyologist and traveller who speaks from the point of view of a naturalist and field observer and marshals, in the first nine chapters, all the difficulties that have arisen through field observation in the original concept of Darwinism. The title "Nomogenesis" signifies "evolution determined by law" rather than by selection from the accidents of variation. In the opinion of the author and in the language of Prof. D'Arcy Thompson, who writes the introduction, "No place is left for Chance in the manifestation of new characters; the course of evolution is fixed and determined. The same laws are at work in the growth of the individual as operated with like results in former generations; and what we call 'recapitulation' means nothing more."

In the work before us, all the arguments against selection are cited from the works of a list of authors which fairly cover the whole field of literature from Darwin to the present time. A very fair statement is made of the arguments of prominent selectionists, like Poulton and Plate, of the new direction of the selection hypothesis in the work of mutationists, as well as of comparable results reached by palæontologists such as Abel, Dollo, and Osborn. But a large and more valuable part of the work and of the literature cited is that pertaining to field observations of naturalists working in every branch of zoology and botany.

The author's general attitude toward the selection theory is a reaction which, in the reviewer's opinion, carries him much too far in the opposite direction: in endeavouring to undermine the whole doctrine of the selection of chance variations, he undermines the broad selection principle as well, and thereby loses all touch with what may be called the larger concept of Darwin and of Wallace, namely, that evolution is constantly guided and directed by "the preservation of favored races in the struggle for life." Nor is any serious attempt made by the author to formulate the coefficients of living forces which are observed to combine in the formation of new sub-species and species. In this aspect the author is facing what we are all obliged to face—complete ignorance of the underlying causes of the origin of the new adaptations and new species which he sums up in the word 'nomogenesis.'

Prof. Berg is naturally strongest in his own field, namely, in his observations on the geographical

variations of the fresh-water fishes of Europe, among which he notes the following curious circumstance :

" As we move further south the number of species and varieties of fishes, as of other animals, increases. But, at the same time, it becomes evident that variations in genera very widely separated often exhibit a tendency to develop *in one direction*. Thus, in the South European and Caucasian species of Chondrostoma (of the Cyprinidæ), we observe a decrease in the number of the rays of the dorsal and anal fins as compared with what occurs in the North European and Russian representatives of that genus : in the North European *Chondrostoma nasus* the dorsal fin usually contains 9 branched rays, and the anal 10-11 ; in the numerous South European species of the same group there are generally 8-9 branched rays in the dorsal fin, while the number of those rays in the anal falls to 9. Such a decrease in the number of rays is still more pronounced in the South European and Caucasian species, which are grouped about *Chondrostoma toxostoma* : the number of rays in the dorsal and anal fins has in both cases decreased to 7."

Prof. Berg observes a similar diminution of fish rays in other genera of the carp family (Cyprinidae), namely, in bleaks, chubs, and roaches, which are also distinguished as one travels southward by a diminished number of scales, of fin rays, and of vertebræ, and by an abbreviation of the body. He extends this comparison very widely with similar observations by Günther, Jordan, and other ichthyologists, and concludes (p. 268) that " it is highly improbable, and indeed quite incredible, that in all the species named, belonging to separate genera, variations, which have led to the same results in all the species, should have arisen *by chance*."

In Chap. x., " The Formation of New Species," the author extends his comparison to the gudgeon (*Gobio gobio*), and gives his final opinion as follows :

" *In the origination of new geographical forms* (species, sub-species, nationes) *a vast number of individuals inhabiting a certain geographical area are simultaneously involved in the production of new characters.* . . . The trend towards the development of scales on the throat, united with a combination of other characters, is something *primary, occurring in accordance with some law throughout the entire area of distribution of the southern gudgeon.*"

A novel, but we believe thoroughly sound, application of the same directive principle in evolution to new verbal forms in languages is illustrated by Russian and French examples, with the following conclusion by the author :

" In my opinion, the above-mentioned variations of language are determined by modifications in the organs of speech, *i.e.* possess an anatomical basis. These phenomena, consequently, enter into the domain of the naturalist : they are fully homologous to the new formations to which the various forms of organisms have been subject in time (geologically) and in space (geographically)."

Although the reviewer is unable to agree with many of the points of view of the author and to accept the complete antithesis presented (p. 406) between Darwin's conceptions and his own, this volume is welcomed as a thoughtful and, in large part, original contribution to the newer modern aspect of the evolution theory.

HENRY FAIRFIELD OSBORN.

Mind and Matter.

The " Margery " Case. By E. J. Dingwall. *Proceedings of the Society for Psychical Research.* Vol. 36, Part 98, June 1926. Pp. 79-170. (London : Francis Edwards, 1926.) 6*s.* net.

ONE of the best arguments for the utility of a Society for Psychical Research is furnished by a case of apparently well-authenticated telekinesis and ' materialisation ' such as that of the medium known in the United States as ' Margery,' the wife of a highly qualified Boston surgeon.

The test was undertaken by the Society's research officer, Mr. E. J. Dingwall, and its course and result are closely analogous to the case of the ' Goligher Circle,' investigated after the death of Dr. W. J. Crawford. In both cases the investigator was prejudiced in favour of the authenticity of the phenomena and their ' supernormal ' character, but was gradually forced to the opposite conclusion by the consistent failure of every attempt to render the phenomena evidential.

As in the case of Crawford's experiments, the proceedings are controlled by an ' operator,' purporting in this case to be the medium's deceased brother Walter, whose direct voice, apparently independent of the sitters, is heard in the room. The voice prophesies or promises the physical phenomenon, and then, under test conditions, it often happens as stated. But when pressed by suggestions which are distasteful to him, Walter either makes promises which are never fulfilled, or turns the thing into a joke with a series of droll witticisms, at which he is both skilled and highly amusing.

Control was made difficult from the beginning by the stipulation that the medium's husband should have free access to the sittings and should control one of the medium's hands. But Mr. Dingwall thought it best to let the phenomena develop along their own lines in the first instance and to tighten up the control later. He was rewarded by some very remarkable manifestations, including the ringing of an enclosed bell constructed by the *Scientific American* Committee. This was done in a red light, but was preceded by an ' incubation ' period of darkness.

The record of the sittings shows a steady development which appeared to justify the waiting attitude adopted by the investigator. In the course of the ninth sitting (January 9, 1925) a self-luminous cardboard was introduced, and what appeared to be a mass of teleplasm was thrown upon it and underwent certain changes of shape as promised by Walter. One, two, three, four, or five fingers of all shapes were made to grow out from the mass, some slowly, some quickly; then a short coarse thumb, and finally one long projection with a hook on it, in all twelve inches long. Meanwhile Walter kept up almost continual conversation mixed with his characteristic laugh, all heard in between the medium's obvious snores.

A suggestion made by Mr. Dingwall to employ a gauze cage in order to prevent manipulation by the medium was refused, but as a compensation Walter promised to show a materialised head upon the medium's shoulder, and eventually to show the appearance and disappearance of the teleplastic substance from the body of the medium. From what he said it was clear that the extrusion of the substance would resemble a normal birth, as indeed it has been alleged in the case of other mediums. Walter stipulated that a flat piece of wood should be provided projecting in front of the medium's chair in order to support the substance on its emergence. Mr. Dingwall remarks that this proviso is inconsistent with the supposed vitality of the substance. At the twenty-fifth sitting some excellent photographs were taken, and in the course of intermittent illuminations with red light an object was seen on the table resembling a very aged hand. Walter said, "This mass is really blood, the white corpuscles. When it goes back it strikes the heat and dissolves." Mr. Dingwall obtained permission to raise the object from the table. It resembled in shape a hand, but appeared to be a light skinny bag weighing two or three ounces. The medium turned in her chair and the object was pulled out of his hand, crumpling up in the process.

The attempts to show the growth and disappearance of the substance had no evidential value, since a few glimpses of the substance, separated by dark intervals, were only allowed to show successive stages.

Summing up his impressions, Mr. Dingwall says: "The one fact which stands out in favour of the hypothesis of genuineness is undoubtedly the personality and position of Margery and her husband, and the improbability of their engaging in persistent trickery." On the other hand, he considers it possible that a surgeon of rationalistic tendencies might experiment on the gullibility of a presumably expert investigator with the view of its eventual exposure.

The interest of this case lies in the fact that it constitutes, in Mr. Dingwall's opinion, the most advanced example of alleged telekinesis and teleplastics ever investigated by the Society. It is quite arguable that any phenomenon the occurrence of which depends upon the whim of a disembodied entity whose behaviour escapes the application of all human standards is *ipso facto* outside the pale of science; and it is a matter of history that the progress of science has coincided with the elimination of such factors. On this planet, at all events, the controlling mind is the embodied mind of man, and to admit any other to a position of superiority, or even equality, involves the abdication of science.

It is all the more important that alleged phenomena of a 'supernormal' character should be subjected to sympathetic, critical, and competent investigation, and of such investigation Mr. Dingwall's report is a good example.

The Hon. Everard Feilding appends a well-written review of the adverse Hoagland Report on the same medium published in the *Atlantic Monthly* on behalf of a committee of Harvard graduates. He does not regard this highly controversial matter as by any means finally settled. E. E. F. D'A.

Our Bookshelf.

Sarajevo: a Study in the Origins of the Great War. By Dr. R. W. Seton-Watson. Pp. 303. (London: Hutchinson and Co., Ltd., n.d.) 18*s.* net.

THIS important book appears at a very opportune moment. A vigorous and characteristically thorough movement has been going on for some time in Germany, to shift the responsibility for the War from German shoulders, and land it on those of the allies, and in the first place of Russia. Quite recently, the movement has taken hold of a large section of the historians of the United States under the lead of Prof. Barnes, who has been lecturing with great acceptance in Berlin this summer on these lines. They call themselves the 'Revisionist' School, and Prof. Barnes's book is now expected in Great Britain, if indeed it has not already arrived. Now, just before we get it, Dr. Seton-Watson gives us in this compact and well-documented volume an authoritative account of the whole thing from the most important point of view, that is, the relations between the Southern Slavs centred in Serbia and the Austrian Government under Francis Joseph. This was the point of ignition, and the crime of Sarajevo was the spark.

Dr. Seton-Watson has made a life study of the whole Slav question, and his account is obviously impartial and as exhaustive as the published documents permit. These are unusually numerous and full, as the new Succession States have naturally published everything they could. The result is astounding but unquestionable. The assault on Serbia was deliberately engineered with determination, unexampled duplicity, and a complete recklessness of the consequences, by the war

party in Vienna, and above all by the Chancellor Berchtold, who, having secured a free hand from Germany, managed gradually, and in the end by a falsehood, to win over the old Emperor to the declaration of war.

The only satisfaction one can derive from the terrible story is that those have paid most heavily who sinned worst. The old Austrian system which produced such things has been completely swept away—the best and greatest clearance of the War. F. S. MARVIN.

The Natural History of Wicken Fen. Edited by Prof. J. Stanley Gardiner. Part 3. Pp. 173-266. (Cambridge: Bowes and Bowes, 1926.) 5*s*. net.

THE acquisition of Wicken Fen by the National Trust has afforded Prof. Stanley Gardiner and his colleagues an opportunity of carrying out a type of natural history investigation which British zoologists have been inclined to neglect, although it promises valuable results. In the British Isles, collecting has tended to diffuseness: the entomologist flits from one area to another where good collections are likely to be made; other local lists owe their existence to the chance presence of enthusiasts, but seldom is a single limited area worked to the bone as regards all its content. Part 3 of the "Natural History of Wicken Fen" continues the results of the intensive study of natural groups, ranging from Oligochæta and Mollusca to several insect orders, and including a flora list and a historical note on changes in the fen during the last forty years, all valuable contributions.

The biological aspect is notably prominent in the papers by Prof. Balfour-Browne, Miss Pickford, and Mr. Hutchinson, and a perfect foundation is being laid for an ecological study which will trace the fluctuations of the animal groups in relation to each other and to the vegetational and soil changes from season to season and from year to year. Zoology has lagged far behind botany in ecological study, but we trust that before this series is completed, the editor may be able to arrange a symposium which will make up some of the leeway. J. R.

Naturforscher und Erfinder: Biographische Miniaturen. Von Prof. Dr. Ludwig Darmstaedter. Pp. vii+182+16 Tafeln. (Bielefeld und Leipzig: Velhagen und Klasing, 1926.) n.p.

THIS charming book consists of thumb-nail sketches of the lives of famous men of science, and is well illustrated with portraits and with facsimiles of autograph letters. Physicians, physicists, chemists, and others all find a place, and the true internationalism of science is reflected in the catholic nature of Prof. Darmstaedter's gallery. Biographical details have a perennial interest, and in the present instance many of them are new, or at least not generally known. One of the most interesting sections deals with the men who were responsible for "the error of phlogiston and its overthrow," namely, Stahl, Black, Marggraf, Priestley, Scheele, and Lavoisier, though microscopists will derive equal enjoyment from the sketches of Leeuwenhoek, Redi, and Ehrenberg, and physicists from the sympathetic insight into the minds of Gilbert, Guericke, von Kleist, Galvani, Volta, and Ohm. Prof. Darmstaedter says that the compilation of this book has brightened his life during the last two years, and he may be assured that the wish he expresses—that his readers may get as much enjoyment from it as he has done—will be fulfilled. If we ourselves may express a wish, it is that he may live long and give us more books of the same kind.

The Whalers of Akutan: an Account of Modern Whaling in the Aleutian Islands. By Knut B. Birkeland. Pp. vi+171+16 plates. (New Haven, Conn.: Yale University Press; London: Oxford University Press, 1926.) 14*s*. net.

MODERN whaling with explosive harpoons has spread to all parts of the world, generally through Norwegian enterprise. This book describes vividly the life and methods in a whaling station in Akutan in the Aleutian Islands, where blue whales and sperms were the chief catch. It dwells not only on the adventure and incidents of the life, but also contains a great deal of information about the commercial side of the industry, the preparation of the oil, the utilisation of the débris for fertiliser and whale meat as human food. Since the author, at nearly sixty years of age, was new to whaling when called upon to manage the station, he describes many minor matters that an experienced whaler would be likely to pass by as unworthy of mention. This adds to the interest of the book; but unfortunately he had little opportunity to see much of the Aleutian Islands beyond the station, and has relatively little of value to say about the natives, and nothing about the geography and natural history of these little-known islands.

Methoden der angewandten Geophysik. Von Dr. Richard Ambronn. (Wissenschaftliche Forschungsberichte, Naturwissenschaftliche Reihe, Band 15.) Pp. xii+258. (Dresden und Leipzig: Theodor Steinkopff, 1926.) 15 gold marks.

As the title indicates, this book is largely influenced by the economic aspect of geophysics. Prominence is given to the discovery of ores and salt deposits by means of the Eötvös torsion balance, and by seismological and magnetic methods. Most of the book deals, however, with the purely scientific parts of the subject. It contains a bibliography of about 1700 references, but unfortunately there are signs that they have not all been verified, and the author seldom gives much information himself, referring the reader instead to original sources, with little indication of what is to be found there. H. J.

Description du ciel. Par André Danjon. (Bibliothèque générale illustrée, 2.) Pp. 80+59 planches. (Paris: F. Rieder et Cie, 1926.) 15 francs.

THIS pleasantly written and well-printed booklet gives in eighty pages a brief but wide survey of present-day astronomy. It can be recommended to English readers of the French language who desire acquaintance with modern views and problems in astronomy, rather than a knowledge of the detailed facts. The fifty-nine plates, each occupying a page, are reproductions, good on the whole, of photographs of observatories and telescopes, the sun and moon, the planets, comets, stellar spectra, the Milky Way, clusters, and nebulæ.

Letters to the Editor.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, nor to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Recurrence of Magnetic Storms.

CE journal a publié le 4 Septembre dernier une lettre du Dr. Chree intitulée : "The Recurrence of Magnetic Storms." Le Dr. Chree présente un examen critique de plusieurs communications que j'ai faites récemment à l'Académie des Sciences de Paris (voir *Comptes rendus* 182, 1926, p. 296, 669, 733, 1301, et 183, 1926, p. 153), et qui annoncent la répétition des orages magnétiques à des intervalles égaux à iT/6 ; i étant un nombre entier et T la durée moyenne de rotation synodique des taches solaires.

Or les travaux antérieurs de Chree sur la succession de ces orages (*Phil. Trans.*, 1912, A, vol. 112, p. 78, et 1913, vol. 213, p. 245) font bien ressortir leur tendance à revenir à des intervalles qui sont des multiples de la période T, mais non d'une période plus petite. Aussi le Dr. Chree, sans condamner absolument mes résultats, émet des doutes sur leur validité.

Je suis conduit à présenter quelques remarques sur les recherches de Chree et les miennes. Je montrerai brièvement que les méthodes employées par les deux auteurs sont très différentes, et que les résultats obtenus pouvent ne pas être exactement les mêmes.

I. Le Dr. Chree, dans sa note du 4 Septembre, rappelle les bases principales et les conclusions de son étude déjà ancienne des perturbations magnétiques. Il s'appuie sur le nombre, appelé caractère magnétique, 0 (calme) ou 1 (modérément troublé) ou 2 (fortement troublé), qui est adopté chaque jour dans les observatoires magnétiques pour représenter les variations de l'aiguille aimantée pendant les 24 heures. Dans chaque mois d'une longue période de 11 années, il choisit les cinq jours les plus troublés ; ce qui fait en tout 660 jours troublés ; et il prend la moyenne de leurs caractères magnétiques, moyenne qui, dans une première série de 11 années, a été 1·51. Puis il considère les 3 jours qui précèdent et les 35 jours qui suivent chacun des 660 jours troublés, et il prend encore la moyenne de leurs caractères magnétiques. Le rapprochement de ces 39 moyennes conduit à plusieurs propriétés intéressantes, et, en particulier, aux résultats ci-dessus résumés.

D'autre part, l'Observatoire de Meudon que je dirige, et qui est consacré spécialement à l'étude du soleil, enregistre depuis 1922 la déclinaison magnétique sur un papier sensible qui noircit sans développement et est placé dans la salle même de notre grand spectrohéliographe. L'observateur du soleil peut, en soulevant un simple voile, avoir sous les yeux la courbe magnétique des 48 dernières heures, et il est prévenu par une sonnerie, lorsque la perturbation est forte. Le papier se déroule avec une faible vitesse (40^{mm} en 24 heures) et est relevé seulement toutes les semaines. L'appareil est surtout avertisseur, et il enregistre toutes les variations un peu notables, en assurant leur comparaison très facile.

Or, dans les premiers mois de 1926, à Meudon où les aurores boréales sont rares, nous avons observé quatre fois ce curieux phénomène, accompagné d'un bel orage magnétique, les 26 Janvier, 23 Février, 5 et 9 Mars. J'ai noté que les deux derniers orages étaient séparés par un intervalle très voisin de T/6, et que, en ajoutant les orages plus faibles des 13, 18, et 23 Janvier, que les 7 orages ont entre eux des différences qui sont des multiples de T/6. Puis, en remontant à l'année 1925, et en examinant les mois de Mars à Août 1926, je trouve encore des orages qui ont entre eux les mêmes différences, et d'autres orages reliés aux précédents d'une manière simple. Finalement les conclusions sont les suivantes : Plusieurs orages, qui sont en général les plus forts, ont entre eux des intervalles qui sont des multiples de T/6 ; d'autres orages, en général moins forts, occupent à peu près le milieu des intervalles précédents, les différences étant des multiples de T/12. Enfin, au milieu des intervalles de la 2ème série, on distingue des perturbations plus faibles, qui correspondent aux multiples de T/24. De Janvier 1925 à Août 1926, toutes les perturbations un peu notables sont comprises dans ces trois séries.

Störmer a mis récemment hors de doute que les aurores et les orages magnétiques sont dus à un rayonnement corpusculaire émané du soleil et formé le plus souvent de particules négatives. Les points de forte émission corpusculaire, qui, dans le soleil, sont de véritables volcans, ont donc une distribution régulière ; ils occupent des méridiens dont les différences en longitude sont des multiples de 60°, 30°, et 15°. Comme cette division spéciale est celle des corps à symétrie circulaire qui se refroidissent, les faits précédents conduisent à admettre, tous les onze ans, des brisures régulières dans trois couches solaires, qui, placées sous la surface, rejettent au dehors par intermittences leur matière fortement ionisée ou radioactive. Ils conduisent aussi à une explication simple des variations undécennales du soleil (voir les mémoires originaux).

En fait les orages magnétiques sont rapprochés et comparés tout autrement que dans le travail antérieur de Chree. J'ai noté non la durée de l'orage, comme l'ont fait la plupart des auteurs, mais l'heure de sa pointe caractéristique, de sa pointe maxima, ou, ce qui revient au même, la longitude correspondante du centre du soleil. Les orages les plus frappants sont les orages S de Maunder, à commencement brusque, qui sont en général les plus forts ; et j'ai vérifié la loi d'abord sur les orages S de 1925–1926, puis de 1882–1883, qui sont les uns et les autres un peu avant un maximum de taches. Le tableau suivant permet de juger l'accord des orages S de 1882–1883 avec la loi posée. Les longitudes sont celles de Maunder et se rapportent à la première pointe de l'orage.

PERTURBATIONS MAGNÉTIQUES.

Dates et particularités.	Longitude du centre du soleil.	Différence avec 93°.	Différence avec 51°2.
1882. Avril 16·98 G. S. . .	93°	0	..
,, 20·15 G. S. . .	51·2	..	0
Juin 15·13 M. S. . .	30·9	+62°1	..
Août 4·65 A. S. . .	82	..	−30°8
Sept. 12·12 A. S. . .	293·9	..	−242·7
Oct. 2·40 G. S. . .	26·3	..	+24·9
Nov. 16·35 M. S. . .	153·5	−60·5	..
,, 17·43 G. S. . .	139·2	..	−88
,, 25·68 A. S. . .	30·4	+62·6	..
1883. Fév. 24·57 V. S. . .	273·4	−180·4	..
Avril 3·37 V. S. . .	135	..	−82·8
Juill. 8·62 M. S. . .	302·3	−209·3	..
,, 11·72 M. S. . .	261·4	..	−210·2
,, 29·99 V. S. . .	19·9	..	+31·3
1882. Oct. 5·75 A. . .	342·1	−219·1	..
1883. Fév. 1·75 A. . .	213·9	−120·7	..

On distingue les deux séries à intervalles de 60° et de 30°. A noter que la deuxième série n'occupe pas

exactement les intervalles de la première ; les orages nous arrivent avec un certain retard, ce qui peut tenir à la vitesse plus faible des particules (voir le mémoire original).

Les orages ordinaires non S de 1925–1926, plus nombreux que les orages S, rentrent aussi dans la loi précédente ; ils sont représentés par leur pointe la plus élevée, la variation diurne de l'aiguille étant défalquée. Parfois on hésite pour décider si un orage est S ou non S, ou hésite entre deux longitudes ; mais le cas est rare et il arrive que les deux longitudes peuvent se rattacher à la loi qui est seulement approchée.

Enfin, fait curieux, les petites perturbations (entre 10′ et 2′ d'écart en déclinaison) qui se détachent nettement sur une courbe calme ou peu agitée, satisfont aussi à la loi posée ; et, dans les tableaux publiés, ces petites perturbations sont les plus nombreuses (voir le mémoire original).

Par contre je n'ai pas considéré les parties, d'étendue souvent grande en longitude, où l'agitation est continue, après un fort orage ou en dehors d'un orage. Les pointes sont alors petites, nombreuses et très rapprochées, sans offrir de maximum bien net. L'émission correspondante du soleil n'est plus limitée, comme dans les orages S, à une région étroite de l'astre avec des particules plus ou moins rapides ; elle s'étend sur les côtés en longitude, étant en même temps plus faible. Ce mode particulier d'émission sera l'objet d'une étude spéciale.

En résumé, tous les maxima bien nets, grands ou petits, des courbes ont la distribution régulière qui est annoncée ; mais, et il faut insister sur ce point, il y a des lacunes dans leur succession, l'émission solaire étant intermittente, comme l'émission de nos volcans.

Après ces explications, on comprend pourquoi les maxima iT/6, spécialement examinés par le Dr. Chree, n'apparaissent pas dans ses calculs ; les moyennes adoptées ont l'inconvénient de masquer les inégalités périodiques dont l'intensité est très variable. Seule la période T émerge ; ce qui indique qu'elle est la plus fréquente et qu'elle est attachée à des orages forts ; et ce résultat est certes fort important. D'autre part le caractère magnétique sur lequel s'appuie le Dr. Chree, représente incomplètement l'état des choses, et a été déjà vivement critiqué. La division rigide en tranches de 24 heures, qui convient certes pour l'étude de la variation diurne, est beaucoup moins indiquée pour les orages proprement dits. Pour faire ressortir les périodes T/6 et T/12, il faudrait prendre dans chaque mois non pas 5, mais 14 jours. Enfin mon étude porte seulement sur 18 mois et celle de Dr. Chree sur les onze années d'une période solaire.

Que le Dr. Chree veuille bien étudier séparément, comme je l'ai fait, chaque perturbation, puis la comparer directement aux autres, et son opinion sera modifiée.

II. Il reste ensuite à reconnaître dans le soleil les points d'émission corpusculaire dont la distribution régulière est annoncée par notre aiguille aimantée. On a d'abord pensé aux taches, puis aux facules, et je me suis rallie à cette dernière opinion. Depuis longtemps j'ai l'idée que les points actifs du soleil correspondent surtout aux parties de la facule qui présentent la raie D_3 de l'hélium noire, que la facule soit avec tache ou sans tache. La proportion de gaz helium y est plus grande et donc aussi la proportion de corps radioactifs. L'Observatoire de Meudon s'organise pour enregistrer d'une manière aussi continue que possible ces portions spéciales des facules, et d'Azambuja, astronome de Meudon, a commencé la recherche depuis plusieurs mois.

Le mois dernier, l'astronome anglais A. A. Buss m'a signalé une note publiée par lui en 1915 dans *The Observatory* et intitulée : "A possible Systematic Distribution of Solar Activity Areas in Longitude." Sur 57 taches relevées de 1912 à 1914 dans une phase de minimum, Buss en note 10 dont les différences en longitude sont très voisines de 60° ou de multiples de 60° ; et il suggère que cette régularité pourra se retrouver dans les orages magnétiques. L'intérêt du fait annoncé est manifeste ; et on peut s'étonner que l'auteur n'ait pas poussé plus loin cette première étude. Les 10 taches signalées n'étaient pas toutes parmi les plus fortes ; il faudra rechercher si les autres taches de 1912–1914 ont entre elles des différences qui soient des multiples de 30° et de 15°. Il faudra aussi étendre la recherche aux facules avec taches ou sans taches et aux perturbations magnétiques d'une période solaire tout entière.

III. Le rayonnement corpusculaire du soleil a été jusqu'ici plutôt négligé ; or il a une très grande importance et s'annonce comme étant la cause première de la plupart des grandes variations que subissent le soleil et ses dépendances dans la période undécennale. Le phénomène toujours mystérieux des champs magnétiques intenses, reconnus au Mont Wilson sur plusieurs points de l'astre, est dû peut-être à ce rayonnement. Une propriété remarquable des particules électrisées est ici à rappeler : lorsque ces particules ont traversé une certaine quantité de matière, elles ont une trajectoire hélicoïdale (Wilson, Rutherford). Si les hélices ont des rotations de même sens sur une portion un peu notable de la surface, il en résulte un champ magnétique, à composantes horizontale et verticale, très semblable à ceux du soleil. On peut aussi, avec ce rayonnement corpusculaire négatif et positif, expliquer en grande partie les facules, les taches avec leurs deux polarités, les protubérances et filaments : et on s'accorde déjà pour lui attribuer les formes caractéristiques de la couronne solaire.

H. DESLANDRES.
(Directeur.)
Observatoire d'Astronomie physique,
Meudon, le 20 Septembre.

Science and Psychical Research.

NICKNAMES are seldom exhilarating or welcome, especially when intended to be contemptuous, so the question raised on p. 553 (NATURE, October 16), whether Prof. Richet can rightly be bracketed with Crookes and Lodge as a 'spiritist,' seems a barren one, but it may be used as a peg for some general remarks.

None of the three would like the term ; all would prefer to be regarded as explorers or gropers in a tangled region off the obvious track, but only one of the three would resent the term as definitely erroneous.

I suppose it is generally admitted that there are facts requiring explanation. If the facts are all explicable in terms of human duplicity, the only branch of science to which they can be of the smallest interest will be anthropology or abnormal psychology or psychiatry. But if any of the facts are what we may call for brevity 'real,' they are bound to be sooner or later of importance—even of great importance—not only to psychology but to physiology also, and perhaps to humanity at large. All three of the above-mentioned protagonists have gradually come to believe that that is so, in opposition to many of their colleagues who are still labouring under the delusion of undiluted fraud.

May I assume for the moment that some of the unpalatable or undigested facts are real, in the sense

that when understood they will lead to an extension of natural knowledge. We now require a working hypothesis wherewith to tackle them. The particular hypothesis employed as a tentative clue is comparatively of small importance; and if any onlookers are unwise enough to elevate such vague notions to the rank of a theory, they can scarcely be aware of the high status required of a scientific theory. A working hypothesis is an elastic thing, or rather a living and growing thing; parts can be shed, parts may become consolidated, while other parts may shoot out new growths and bud amazingly, but all are variable; and various hypotheses may be favoured at different times and by different people.

Of the hypotheses so far tried to account for strange happenings, one group of scientific men ejaculate 'fraud'; another set try what they can do with 'ectoplasm'; while a small group, in sympathy with these last, try to go further, and postulate unrecognised intelligences; so this last group may be represented as murmuring 'spirit.' But none of these hypotheses is an explanation: indeed, only the first class imagine that they have an explanation, though if they press it with care and patience they will find if often does not work. Let us give the other two a moment's chance.

By ectoplasm, Richet and his group mean a mass of protoplasmic material, emanating under exceptional conditions from the human body, and endowed with singular and unexpected properties; no more astonishing in themselves than the properties exhibited by an egg, or indeed any other form of living tissue, but unusual in location and also unusual in the apparently temporary character of the result. Like muscle, ectoplasm is controlled by intelligence and can exert force, but unlike muscle it extrudes itself beyond the normal periphery of the familiar organism. Like a placenta or an egg or a pupa, it exhibits a formative power, being able to manipulate itself or other substances into organised forms; but, unlike the forms to which we have grown accustomed, these are singularly evanescent. Nevertheless, while they last they act in an intelligent way, and are as subservient to control as, let us say, a dog. Such are among the facts testified to by Richet, Schrenck-Notzing, Morselli, and other continental investigators.

If we grant all or any of this, merely for the sake of the discussion—for facts are not established by citation of authority—the question arises, What is the control? Is it the unconscious mind of the person from whom the substance emanates—naturally the first and easiest idea—or does it represent the intervention and activity of some intelligence not obviously and in perceptible form present? The three men mentioned above, though sometimes bracketed together, might take different views. I venture to say that their views, whatever they are, must at the present stage be so crude as to be scientifically almost negligible. The facts alone are important; it is those that, granted their genuineness, need far more investigation. In that opinion they all agree. Time enough for a theory when we know more.

In fairness, however, let me go on to excuse, and in some sort justify by an analogy, the third kind of working hypothesis here briefly labelled spirit. Consider the reaction of a race of secluded but intelligent aborigines to whom there comes a rumour, from one or two of their number, about things quite inconceivable and absurd—X-rays, let us say, or telephones, or radio telegraphy. At first utterly sceptical, they may denounce and expel the heretic; but if, nevertheless, the rumour is persisted in by successive generations, and supported by some whose observations are generally treated with respect, some working hypothesis becomes necessary. Delusion is the simplest notion; the idea of corporeal emanations and vibrations is more troublesome, but may be made to look impressive and materialistic; while the hypothesis of the existence of a hitherto unsuspected race of white men, to whose activity the phenomena are due, would probably be stigmatised as a degrading superstition. Whatever it is, it is certainly not a theory of X-rays or of telegraphy; and yet the suggested clue that these incredible things are the work of unknown intelligent operators has, in this case, an element of something that would ultimately lead to an explanation. It may be sneered at as superstitious, but cannot rationally be stigmatised as false.

So also the hypothesis popularly associated with the term 'spirit,' though it is not a theory of either apparitions or telepathy or telekinesis, yet in so far as it contains any element of truth—that is the crux—it may be the beginning of what will ultimately constitute a new branch of science. It may be only the first rung of a ladder; yet if we follow our leaders and begin to climb, who knows what unearthly region may be ultimately scaled! Science is young: the human race may reasonably be expected to continue on this planet for several million years; so it would be rather dull, as well as unlikely, if man's outlook on the universe, and his realm of natural knowledge, should always conform to the orthodoxy of A.D. 1926.

OLIVER LODGE.

The Naming of Wild Hybrid Swarms.

ONE of the most important developments of botanical research in New Zealand of recent years, since it concerns not only taxonomy but also the question of evolution, is that of the study of wild hybrids. Evidence has rapidly accumulated as to the prevalence of polymorphic swarms of wild hybrids in several sections of the flora. Whereas (*Trans. N.Z. Inst.*, 44, 1912, 30) Cockayne stated, "Hardly anything is known as to the occurrence of wild hybrids in New Zealand," he was able later (*New Phytol.*, 22, 1923, 124) to list 130 certain or extremely probable groups of interspecific hybrids. The number has since been considerably augmented, and now stands well above 200. The following table is illuminating, taking only the monocotyledons and dicotyledons.

Classes of Genera.	Number of Genera.	Number possessing Hybrids.	Percentage.
Genera with 2-5 species .	125	42	34
Genera with 6-10 species .	33	17	52
Genera with 11-20 species	15	13	87
Genera with over 20 species	16	16	100

All genera containing 14 or more species are known to show hybridism. Remembering that many species are so isolated that hybridism is difficult or impossible, that species in close proximity may bloom at different seasons, and that many groups have not been critically examined in the field, but the vague term 'variation' has been used to explain polymorphy, these figures speak for themselves.

Now this wealth of wild hybrids raises many important questions, not the least of which, as a necessary preliminary to further progress, is the matter of suitable nomenclature. The formular treatment allowed by the "International Rules of Botanical Nomenclature" is too cumbrous for general and field

studies. Nor do the "Rules" have in view the existence of the highly polymorphic hybrid swarms—in no few cases hundreds or probably thousands of distinct individuals—that are now known to exist. In the absence of any recognised method of procedure suited to our needs as field ecologists, we have been forced to draw up our own rules. Elsewhere we are publishing a more detailed statement of our case, but it seems well to place the essence of the matter before the wider audience available in the columns of NATURE.

For the whole diverse group arising from the crossing of two species we construct a name formed by the combination, suitably abbreviated, and with the ending appropriately modified, of the specific names of the parents. Thus to the great group *Hebe elliptica* × *salicifolia* we give the name × *Hebe ellipsala*, and so for *Hebe Astoni* × *laevis* the name × *Hebe laevastoni*, preferring euphony to strict adherence to alphabetical order. Where one of the names is quite short it may be used entire, *e.g.* × *Melicope ter-simplex* = *M. simplex* × *ternata*. This idea is derived from names given to horticultural hybrids, *e.g.* × *Iris monspur* = *I. Monnieri* × *spuria*. Where a specific name has been given to a smaller group within the swarm, as has often happened, especially for forms about midway between the parents, we may adopt this name for the minor group. Thus × *Melicope Mantellii* is the name we propose for that small group of hybrids "intermediate" between *M. simplex* and *M. ternata*.

To us it seems most inappropriate to widen the conception of such names to include the whole group, as not only have we no warrant for doing so, but also confusion would inevitably result. Moreover, our method provides for the placing of forms still undiscovered, or those certain to arise later. A hybrid swarm is a totally different biological group from that of a species. In the latter case there can be a "type"; in the former a "type" is impossible. Further, species deal with definite, static groups, but hybrid swarms with indefinite dynamic groups, for the hybrids of to-day are being replaced before our eyes by other forms, yet for these the group name will serve. The name *Nothofagus Blairii* is that of an extremely small group of the vast swarm *N. cliffortioides* × *fusca* (× *N. cliffusca*), but were the name *N. Blairii* used for the whole swarm its original conception would vanish, for it would include forms having no characters in common with *N. Blairii*, as originally described, and possessing characters not known previously in the genus, *e.g.* almost circular leaves with blistered surfaces.

The procedure outlined above seems to us adequate, of easy application, and helpful in revealing the parentage and history of the hybrids, whereas an arbitrary name reveals little or nothing. To one versed in the names of New Zealand plants, × *Aristotelia fruserrata* at once tells the group is *Aristotelia fruticosa* × *serrata*, whereas to apply the name × *A. Colensoi* to the group not simply tells nothing, but also actually misleads, insomuch as the 'species' *Aristotelia Colensoi* was based on a non-flowering specimen taken from a shrub some seventy years ago that is almost certain to have died some time back, and could not now be matched by any living plant.

Another matter to be considered is the citation of authors' names for hybrids, this not being fully provided for in the "Rules." Thus, if for any reason we still maintain Cheeseman's name *Ranunculus Matthewsii*—it was based on two specimens taken most likely from one individual—for a very limited portion of the large polymorphic group *R. Buchanani* × *Lyallii* we should cite it as × *Ranunculus Matthewsii* (Cheesem.) Ckn. et Allan as hyb., but by the "Rules" we need not use that name at all in moving the group it represents into a group of such a different status as a hybrid swarm.

The "Rules" demand diagnoses in Latin for hybrids as for species. This is all very well for small groups made up of fairly uniform individuals, and many such diagnoses occur in systematic literature. Obviously, however, with the groups we are considering, *e.g.* × *Myrtus bullobcordata* with its hundreds of distinct forms, diagnoses of reasonable length must be vague in the extreme, and we think that this requirement should be abandoned. This, of course, does not gainsay that detailed analysis of the individuals composing the groups is imperative.

Since the whole matter is of not merely local interest, but also applies to all floras and is particularly important from the point of view of definite names for the use of students of evolution, and since some commonsense uniformity of treatment is highly desirable, we bring the subject forward in the hope of arousing discussion, so that perhaps some such procedure as we have indicated may be adopted, and suitable rules drawn up for insertion at a future revision of the "Rules."

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Feilding, N.Z.

Early Egypt and the Caucasus.

WE are grateful to Sir Flinders Petrie for constituting himself his own reporter (NATURE, Oct. 9, p. 514) in the matter of his reply to our papers at Oxford, for we had at the meeting no opportunity to cover the ground on to which he transferred the argument. On that occasion, we kept studiously to the examination of the prehistoric and the geological evidences for the Caucasian-Solutrean argument. The difficulties we indicated: (1) cultural, (2) distributional, (3) geological, were left unanswered. If Sir Flinders Petrie prefers to argue on historical ground we have here, too, certain comments to make.

The essential question is stated to be a conflict between (*a*) a 'received view,' whereby the Fayum lake gradually rose by the rise of the Nile level up to '205 or 220' feet above present lake, and (*b*) a 'new view,' whereby a high lake in the early human period was gradually dried down to the present size. In regard to this summary of the position the following comments may be apposite.

The view which is labelled 'received' was formulated in the late 'eighties; the chief contributors to the subject being Hanbury Brown, Scott Moncrieff, Cope Whitehouse, and Sir Flinders Petrie himself (as a result of his excavations of Biahmu and Arsinoe). This was long before the Fayum depression had been geologically investigated. The evidence for two lakes was undreamt of, and none of the palæontological or stratigraphical work required as a sound basis for what is primarily a geological theory was attempted, nor had these gentlemen the specialised training to do so. It was not until 1905 that H. J. E. Beadnell published the official geological memoir on the Fayum. As is usual in these official surveys, the Pleistocene received relatively little investigation, but the fact was noticed that the upper limit of the lacustrine beds occurred at 223 feet (O.D. 23 m.), and the view was expressed that this gives evidence for "a great fresh-water lake in Pleistocene and prehistoric times."

The chief authors of the 'received view' do not appear to be in agreement between themselves.

Sir Hanbury Brown writes: "There is nothing to support the theory that there has been any great change in the Nile levels since the waters first found their way into the Fayum," and he believed that the old high-level lake was controlled and artificially kept at 222 feet in XII. Dynasty times. Sir Flinders Petrie, on the other hand, believes that instead of the prehistoric lake being at a more or less constant high level, it was gradually rising, reaching a height of about 205 feet (O.D. 17 m.) in XII. Dynasty times, attaining its full maximum of 220 feet (O.D. 22 m.) in Ptolemaic times.

With regard to the 'new view' (*b*), may we point out that we found abundant evidence for the existence of two lakes, the older corresponding to the 220-foot level; the newer never exceeding a maximum of 205 feet, which was attained in prehistoric times. From this point a steady fall appears to have taken place; the Fayum industry is closely linked to its 190-foot stage and lower, thus limiting the waters of the historic period to something below this level. We should like to add, what is not clear from Sir Flinders Petrie's statement of our case, that we consider, so far as the evidence is available, that both lakes were connected with the Nile, but the nature of this connexion cannot be definitely stated until detailed investigation has been undertaken along the Lahun-Hawara channel.

Our answers to Sir Flinders Petrie's six reasons in support of his view are briefly as follows:

(1) There is no evidence as to the depth of the inlet channel. As regards the question of siltage, geologists with knowledge of modern rivers under similar natural conditions regard blockage as highly probable, and Hanbury Brown himself considered that the growth of rushes in the channel "would check the inflow, and, while preventing the rise of the lake, would favour silt deposit."

(2) Completely ignores the probability of climatic change in Quaternary times, to which the other oases bear witness.

(3) The interpretation of the name "Soknopae Nesos" is not sufficient evidence to counteract hard geological facts.

(4) Schweinfurth notes especially the abundance of ruins around the edge of the basin, and it seems probable, from topographical considerations, that the nature of the underlying ground controlled the choice of site, rather than the relation to the lake level. The partially consolidated lake deposits would give but poor foundations for the massive ancient stone buildings. It should also be noted that dynastic flints were found at levels which would have been submerged at that time according to view (*a*).

(5) Of the four stone structures regarded by Sir Flinders Petrie as quays, three lie at Qasr-el-Sagha; these are known to him by photographs only. The fourth is the termination to the long paved road leading south from Dimê Temple; evidence points to this being not earlier than the first century A.D. The three structures at Qasr-el-Sagha show rough slabs of stone capping outstanding ridges of old lacustrine beds. This accounts for their approximately uniform height. The loosely consolidated material upon which they are based would not serve as foundation for a 'quay.' We are supported in our view of them by several archæologists, who came over at our request to see them, and are emphatic that such structures could not serve as quays. Further, one of these would, on Sir Flinders Petrie's rising levels, have been an island.

(6) The value of Herodotus as a witness can be judged from the fact that his estimate of the circumference of the lake was at least 87 miles too big, supposing the water to have stood at the 220-foot level in his time.

G. CATON-THOMPSON.
E. W. GARDNER.

Bedford College, London.

The Occurrence of Helium and Neon in Vacuum Tubes.

A SHORT time ago we published (*Proc. Roy. Soc.*, A, 109, 186, 1925) an account of some attempts to confirm the observations by Collie, Patterson, and Masson (*ibid.* 91, 30, 1915) of the occurrence of helium and neon in vacuum tubes. In view of the fact that we were able to obtain small quantities of these rare gases by passing the discharge through oxygen at low pressures when a magnesium or aluminium anti-cathode coated with nitride was used, no trace being found in the absence of the nitride, we attributed their formation to the disintegration of the nitrogen atom. Success depended on the use of an induction coil provided with a hammer break rather than a mercury break, an observation which agrees with those made by the previous authors.

We have now carried out some further experiments which would seem to confirm our original results. In the first place, both helium and neon have been obtained by passing the discharge between a concave aluminium mirror as cathode and a magnesium anode through a mixture of oxygen and nitrogen under reduced pressure. No trace of the rare gases was formed if the discharge were passed in the opposite direction; and since in this series of experiments the two types of discharge were used alternatively, the same mixture of oxygen and nitrogen was used, and the apparatus was not changed in any way, this would obviate any possible criticism that the rare gases had their origin in an air leak.

In the second place, the rare gases are produced when the condensed discharge is passed between aluminium wire electrodes through mixtures of oxygen and nitrogen, no result being obtained in the absence of the condenser. In these experiments the character of the discharge was found to be of great importance, as the production of the rare gases depended on the length of the auxiliary spark-gap, the capacity of the condenser, and the pressure of the gases. An increase in the gas pressure necessitated an increase in the length of the spark-gap. Considerable trouble was at first met with, owing to the fouling of the mercury in the exhaust pump by ozone and active nitrogen, and this difficulty was surmounted by interposing a vessel containing boiling mercury.

In the third place, the aluminium of the electrodes was replaced by tungsten; and in view of Boomer's observation that active helium is readily absorbed by this metal (*Proc. Roy. Soc.*, A, 109, 198, 1925), we confined ourselves to the examination of the electrode splash. Little or no splashing occurred until the pressure of the nitrogen-oxygen mixture was reduced so far that the discharge tube phosphoresced strongly. After the discharge had been passed for sixty hours the electrode splash was heated, and helium and neon were obtained. In these experiments a 14-inch spark coil was used and supplied either with alternating current (110 volts, 50 cycles) or with direct current, using a mercury break. A condenser and auxiliary spark-gap were used in both cases.

Lastly, we have obtained a successful result by passing a condensed discharge between two tungsten electrodes about 1·5 inches apart in mixtures of oxygen

and nitrogen at atmospheric pressure. Before use the electrodes were strongly heated in a vacuum to remove all occluded gases. After passing the discharge for sixty hours, the electrodes were strongly heated and, after removing a small trace of hydrogen, pure helium was obtained. This result is one of very few in which helium has been obtained without the presence of neon, and may be accepted as a final disproof of any contamination by air. Moreover, no rare gas was obtained with the uncondensed discharge in the same apparatus.

These more recent results would seem to establish the reality of the formation of helium and neon in vacuum tubes, and completely to confirm the original observations by Collie, Patterson, and Masson. As regards the origin of these gases, we believe that they arise from the disintegration of the nitrogen atom. Attention may be directed to the fact that hydrogen is always to be found in the residual gases along with the helium and neon, although the greatest possible care was taken to remove it from the electrodes before each experiment. At the same time it may be pointed out that in spite of all precautions it is impossible to secure the total absence of oxides of carbon. Whilst it seems very improbable that our last recorded observation at atmospheric pressure can be attributed to the disintegration of carbon, it may be mentioned that Bell and Bassett (*Science*, 56, 512, 1922) noted the presence of helium lines in the spectrum of the negative tongue of the Sperry searchlight and suggest that this gas is produced by the disintegration of the carbon atom.

E. C. C. BALY.
R. W. RIDING.

Chemical Laboratories,
University of Liverpool, September 27.

The Canadian School of Prehistory in France.

THE Canadian School of Prehistoric Research in France was started in Ottawa, Canada, in May 1925, when twelve fellows of the Royal Society of Canada were elected on a committee for the object in question. The first year's work in France under the auspices of "Les Beaux-Arts de France" in Paris, Ministry of Public Instruction, Department of Historical Monuments, etc., has just closed its labours, and the School can now be stated to have been fairly well launched and started, having gathered a rather extensive and interesting lot of materials for study and distribution to various academic and scientific centres throughout the Dominion.

The site, or *gisement*, granted by the Beaux-Arts to Canada is situated in the Dordogne district, at Combe-Capelle, near Monferrand, up the beautiful valley of the Couze river, Commune of St. Avit-Sénieur. Amongst the many problems in prehistory to be solved, there occur a number at this locality, as well as in other not distant *gisements*, including La Micoque and other Moustierian sites of the Vézère valley.

Combe-Capelle was expected to yield some information desired, and the result of the work of the Canadian School at this site, in June, July, and August, has revealed a certain amount of excellent material—especially at the base of the section examined—bearing upon some of those problems. No sensational discoveries were made in this virgin piece of excavation, but a large amount of worked-stone implements of a very primitive sort were found in four distinct layers or beds at Combe-Capelle.

Two nearly complete skeletons of a fairly large rodent (Marmota), besides isolated and fragmentary bones and teeth of bison, equus, rhinoceros (?), were added to the collections of flint or stone implements made on the spot. The work was undertaken as a careful and methodical piece of investigation under the auspices of the Beaux-Arts in order to obtain certain definite results. Very curiously and roughly shaped implements were found in all of the four layers traversed, being especially abundant in the oldest two beds. Types not hitherto much heeded, on close examination, proved to be either new or unrecorded implements made by Moustierian man as revealed in the Combe-Capelle station, exhibiting much cleverness and skill, as well as resourcefulness in the result of his industrial achievements in stone.

The type of human beings living in this very early stage of man's civilisation utilised even the simplest, rudest, or most common type of flint-flake, obtained by one or more well-directed blows given by his right hand or left hand, holding a *percuteur* or hammer, and from this flake wrought a number of fascinating shapes of instruments for his everyday use, whether it were for hunting, skinning animals, cleaning hides, building canoes, or for domestic purposes.

This ancient citizen of the Couze valley, like Moustierian man of other parts of France, of the Channel Islands, and of Great Britain, made a number of racloirs (scrapers), tranchets, blades, knives, saws, and other tools of rough, yet of intelligent workmanship. All the implements found reveal, as of to-day, two types of men: one, careful and industrious, taking an intelligent interest in his work; the other, careless perhaps and heedless of the advantage of turning out a well-made tool, satisfied with a comparatively inferior article to meet his tastes in all likelihood. There were good, fine, and well-made implements discovered at Combe-Capelle, of materials carefully chosen, carefully wrought, which any one, even a twentieth-century man, might be proud to be able to produce. Time, evidently, was not of very much consideration, and amongst the best, or carefully made tools, some must have taken quite a long time to make.

Careful study of the various types discovered at Combe-Capelle by members of the Canadian School in France remains to be made, and it is hoped that excellent results will be achieved, besides the procuring of specimens to illustrate the various epochs in the history of human civilisation, for which France is specially noted:

The Chellean Period (Chelles in Seine and Marne); the Acheulean (Somme valley): Moustierian (Vézère valley); Aurignacian (southern France and at Cro-Magnon in Les Eyzies); Magdalenian (La Madeleine, of the Vézère valley); the Azilian (Mas-d'Azil, of southern France); and the Tardenoisian (Tardenois-en-Fer)—all French stations marking the advancement and progress of humanity throughout the ages of man in Quaternary times, in the last chapter of the history of life on this planet. H. M. AMI.

London, September 25.

Liveing's Fire-Damp Indicator.

THE author of a note on p. 497 of NATURE of October 2, while giving credit to E. H. Liveing as the originator of the method of detecting and measuring fire-damp by means of an electrically heated platinum wire, wrote: "The apparatus in skilful hands would certainly measure fire-damp, but its value lay rather in its promise than in its practical utility." I desire to protest against this disparaging statement. I helped Mr. Liveing to make his original magneto-electrical machine, for this was before the days of the Faure battery or the Clowes hydrogen lamp. While

all sorts of physical laboratory methods for comparing the temperatures of the two platinum helices, for example, Wheatstone bridge, etc., were considered. Liveing elected to adopt the more simple photometric device of a sliding white angle block placed between the two sources of light. When the two sides appeared equally bright the position of the block read against a scale indicated the proportion of fire-damp. This was an operation which a fireman could perform quite as quickly and easily as the usual one with a 'cap.'

Not long after the development of this instrument, I went at the instance of Mr. Fletcher, of Bolton, to investigate fire-damp in his own and in some neighbouring fiery pits. Its practical utility was such that, at any place selected, about a quarter of a minute was sufficient to turn the handle, slide the block, and read the proportion from ¼ per cent., the lower limit, up to about 2 per cent. While I was in Bolton there was a minor explosion of fire-damp in a neighbouring pit, and Mr. Fletcher and I went there immediately. On reaching the place where the gas had fired the safety lamp filled with flame. On collecting gas from the roof I found it to be practically pure fire-damp, for, like hydrogen, it quenched the wire exposed to it in consequence of its greater mobility. If instead of writing "practical utility" the author had used the expression "general adoption," he would have been right. At this time the really practical man had much influence. He suspected instruments which he did not understand, and he did not want to have fire-damp found even in minute quantities where none could be detected by the usual means, and where therefore no danger existed.

C. V. BOYS.

IN my note I had no intention of disparaging the very ingenious invention of Mr. E. H. Liveing; on the contrary, I wished, while commenting on a new application of the same principle, to recall the fact that the credit of utilising the increased glow of a heated wire over which a methane-air mixture is drawn, as a measure of the methane present, is due to Mr. Liveing. Like Prof. Boys, I tested the apparatus both near working faces and in the return airways of mines which gave off fire-damp. Although I cannot claim to approach Prof. Boys's unique experience in photometric work, I had had several years' practice in comparing the illuminating power of lights—and especially of lights of different tints—and I found it possible to make concordant readings with the instrument. But my companions—men of great mining experience—did not agree with my readings, or with each other's. The impression formed by me was that the indicator was not adopted because the mine-managers thought (rightly or wrongly) the instrument allowed too much margin to the 'personal equation.'

THE WRITER OF THE NOTE.

The Imaginary Roots of Equations.

IN discussing the stability of an oscillating system, it is often necessary to know whether the period-equation has any root the real part of which is positive. We proceed to show how to find out the number of such roots. Let the equation $f(z) = o$ be of degree n and let $f(iy) = u + iv$ where u and v are real. If v is of higher degree than u put $f_1(y) = -v$, $f_2(y) = u$, otherwise put $f_1(y) = u$, $f_2(y) = v$. Go through the operation of finding the G.C.M. of f_1 and f_2 with the difference that the sign of each remainder is changed before it is recorded or used as a dividend (just as in getting Sturm's Functions), and let the remainders (with changed signs) be $f_3(y), \ldots f_m(y)$. Let the number of changes of sign in the sequence $f_1, \ldots f_m$ be χ when $y = \infty$ and χ' when $y = -\infty$. Then the number of roots of $f(z)$ having their real parts positive, less the number having their real parts negative, is $\chi' - \chi$. If now there are r real roots of the common divisor $f_m(y)$ of f_1 and f_2, then $f(z)$ has $(\chi' - \chi + n - r)/2$ roots with the real part positive, $(\chi - \chi' + n - r)/2$ with the real part negative, and r purely imaginary roots.

For proof we divide f_1 and f_2 by $f_m(y)$ and $f(z)$ by the corresponding factor $f_m(-iz)$, and then find the increase in argument of $f(z)/f_m(-iz)$ on going round the positive half plane by considering its passages through $n\pi$ in the first case or $\pi/2 + n\pi$ in the second. The number for the infinite semicircle is the degree of $f(z)/f_m(-iz)$, and that for the axis of y is found by reasoning very similar to that used for Sturm's Functions to be $\chi' - \chi$.

H. C. POCKLINGTON.

6 Blenheim Crescent,
Leeds.

Spatial and Time Relations in Dreams.

THE letter with regard to so-called 'mind-pictures,' printed on page 372 in NATURE of September 11, has greatly interested me because such non-volitional pictures have been very familiar to me from my childhood up. I used frequently to amuse myself by observing them, especially when in bed, just before I went to sleep, but I can bring them on by closing my eyes at almost any time. They are non-volitional in the sense that I do not knowingly control their content. So far as my consciousness is concerned, I am simply in the position of an observer. The pictures are of moving events and include landscapes with persons and animals, buildings, trees, vehicles, etc. I am totally ignorant at any one moment with regard to what may appear on the scene at the next, and the whole thing is as interesting and amusing as if I were observing an actual scene. The fact that I do not amuse myself with these pictures in my adult age as I used to do as a child, I attribute to the fact that they are mentally tiring. Their production must involve some expenditure of energy in the brain in a way of which I am ignorant.

ARTHUR E. BOSTWICK,
Librarian.

St. Louis Public Library,
St. Louis, Mo., September 30.

The Influence of General Electron Displacement on the Reactivity of Conjugated Systems in the Molecules of Carbon Compounds.

IN the September issue of the *Journal of the Chemical Society*, Baker and Ingold state that the nitration of benzoic esters is being investigated at Leeds. A similar study is in progress in these laboratories, and preliminary results show, for example, that the proportion of the *m*-nitrobenzoic acid derivative obtained on nitration rises in the series $Ph.CO_2 \leftarrow\!\!- CR_3$ (R = alkyl), $Ph.CO_2.CH_3$, $Ph.CO_2 \longrightarrow CH_2 \longrightarrow C_6H_4NO_2$. This is in accordance with the writer's theoretical views (*Chemistry and Industry*, 1925, 44, 118, 563; Allan, Oxford, Robinson, and Smith, *J. Chem. Soc.*, 129, 401, 1926; Ing and Robinson, *ibid.*, 1655), and it is anticipated that the nitration of benzoic esters (and of substituted benzamides) will afford a convenient auxiliary method for the estimation of the electron affinities of various groups. The arrows show the assumed direction of displacement of electrons, methyl benzoate being the standard of reference.

R. ROBINSON.

The University, Manchester,
October 10.

The *Discovery* Expedition.

By Dr. STANLEY KEMP, Director of Research.

August 18, 1926.

THE R.R.S. *Discovery* left Falmouth on October 5, 1925, and, after touching at Las Palmas and Ascension Island, arrived at Cape Town on December 20. On this passage apparatus and nets were tested, and certain defects which were found were made good. Later passages, until our return to Cape Town in June of the present year, are shown in the accompanying track-chart (Fig. 1).

We left Cape Town on January 17, delivered mails and stores at Tristan d'Acunha on January 30, and sailed for South Georgia on February 1. During the first few days very heavy weather was experienced and we were driven far out of our course by gales of almost hurricane force from the west and south-east. On the passage five deep-water stations were taken. We sighted our first iceberg on February 16, and arrived at Grytviken, in Cumberland Bay, on February 20. For about two months from this date we were engaged in observations on the whaling grounds, sailing for the Falkland Islands on April 17 and arriving in Port Stanley on April 25. A short cruise was made to Falkland Sound (northern end), where whales had been reported, and on May 20 we left on the return passage, laying a course to the north-east in order to pass the reported position of two shoals. On the passage nine full stations were taken and large plankton nets were towed at intervening points. Strong westerly winds and high seas prevented us from making as many observations as we had hoped. We reached Cape Town on June 29.

An account of the *Discovery* expedition and its objects has already been published in this journal (vol. 115, 1925, p. 950), and our principal aim during the recent cruise was to carry out a biological and hydrographic survey of the South Georgian whaling grounds. In this we were largely frustrated by the bad weather which prevailed. Data of considerable interest were, however, obtained and experience acquired which will be of great value in our next attempt.

During the 1925–1926 season the whaling grounds at South Georgia were situated on the shelf on the north-east side of the island in soundings of 200 to 250 metres.

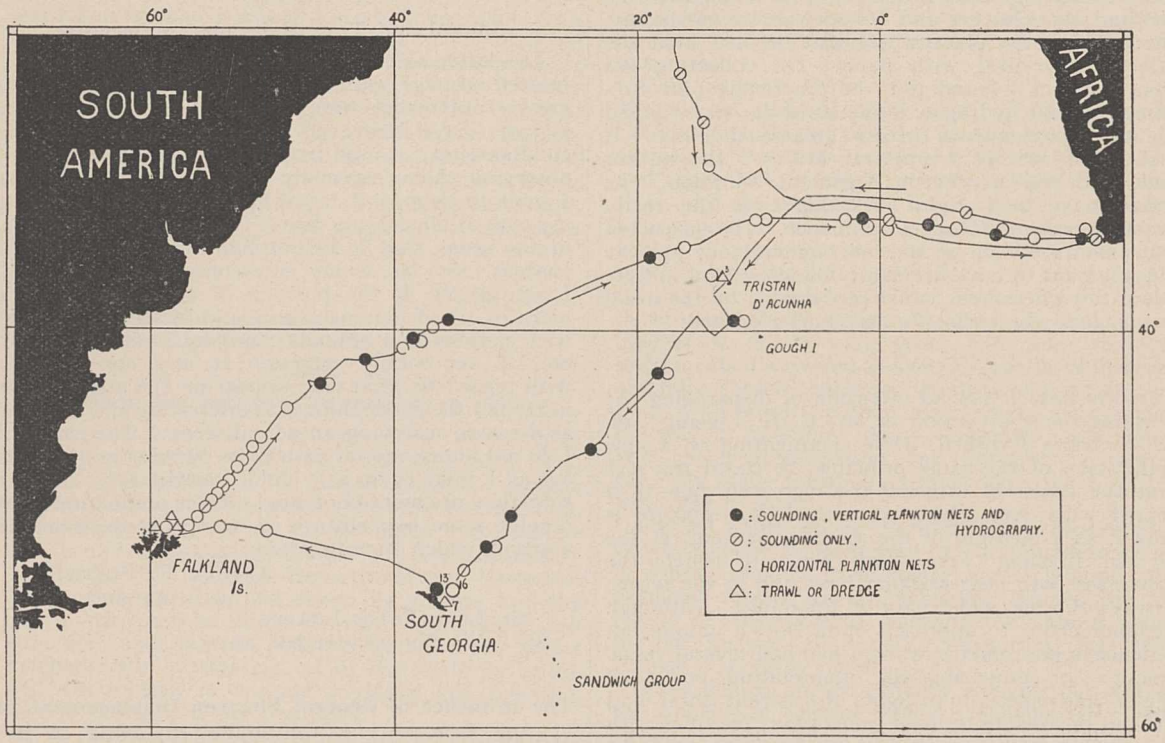

FIG. 1.—Track-chart of the R.R.S. *Discovery*, November 1925–June 1926.

In this area, at the time of our visit, Euphausian Crustacea were plentiful and *Euphausia superba*, which in our experience forms the only food of fin and blue whales, was often extremely abundant. *E. superba* is a comparatively large species, too active to be caught in vertical nets; to obtain adequate samples it is necessary to use nets towed horizontally. We have not yet sufficient material for a study of the life-history of this species. On the whaling grounds we obtained a few very early post-larval forms, while the great majority were in stages just short of sexual maturity. An Amphipod of the genus Euthemisto occurs in prodigious numbers in the same area and appears to feed almost exclusively on young Euphausians.

As regards hydrographic conditions on the whaling grounds, the most striking feature was the existence of a cold middle layer, with temperatures of about 0° C. at a depth of some 150 metres. This layer was

found to within about ten miles of the shore and, as shown by observations taken on our passage from Tristan d'Acunha, extends seaward to 50° 26′ S. The salinity increased regularly from about 33·7 per thousand at the surface to 34·3 per thousand at the bottom. As might be expected, at the end of the season Diatoms were almost absent on the whaling grounds, but a dense patch of *Thalassothrix longissima* was found in 51° 55′ S. and another of *Rhizosolenia polydactyla* between South Georgia and the Falkland Islands. Phosphates showed very high values in the whaling area, the readings, expressed in mgm. per m.^{3}, varying from 102 to 108 at the surface to 183 at the bottom. Hydrogen-ion concentration varied from 8·26 at the surface to 7·96 in the lower layers.

During a short cruise to the northern end of Falkland Sound, quantities of *Grimothea gregaria* were taken. This decapod Crustacean, which is the pelagic post-larval stage of the rock-lobster, *Munida gregaria*, no doubt forms the food of the rorqual whales which periodically visit the islands.

Large midwater nets have been hauled on numerous occasions, more particularly on the passage from the Falklands to the Cape, yielding collections which should add greatly to our knowledge of the plankton of this region. Among the more interesting forms are great numbers of Diphyids, including a species with scarlet zooids, several pelagic Nemertines—one 13 cm. in length—Decapods with luminous organs belonging to the genera Sergestes, Systellaspis, Hoplophorus, and Stylopandalus, the Pteropod Schizobrachium, Thaumatolampas, and other peculiar Cephalopods, and, among the fish, Chiasmodon, Cynomacrurus, and *Stylophthalmus paradoxus*.

The Continuous Plankton Recorder has been employed on numerous occasions and has given successful records on runs which exceed 1300 miles in total length. Mr. A. C. Hardy, to whom the invention of this instrument is due, contributes an account of the apparatus and of the results so far obtained (see App. II.).

The 40-feet otter trawl was used on a few occasions in shallow water at South Georgia and off the Falkland Islands. The bottom fauna is very rich and varied, and, particularly in the former locality, quantities of Nototheniiform fish were taken. Among large collections of invertebrates special mention may perhaps be made of the ten-legged Pycnogonid *Decolopoda antarctica*, of which six individuals were obtained. Dredgings off Tristan d'Acunha resulted in large hauls of Alcyonaria and Antipatharia, and it was found that some colonies of the latter were being invaded by a small brilliantly luminous Actinian, apparently allied to the genus Girardia.

Between the equator and Ascension Island, over a distance of some 600 miles, vast quantities of Pyrosoma were seen every night at the surface, giving a most wonderful display of luminescence, and, at a later date, not far from Cape Town, a colony of another species of this Tunicate was caught which must have been fully 8 ft. in length when intact. Patches of discoloration in the water were on one occasion found to be due to the alga Trichodesmium, on others to swarms of Salpa, in which numbers of semi-parasitic Copepods of the genus Sapphirina were obtained.

During the course of the work, 48 deep-sea soundings have been taken and an examination made in the vicinity of a reported shoal lying to the north-east of the Falkland Islands. Latterly, tests have been made with a modified form of the Nansen tube, designed to bring up cores of ooze enclosed in glass tubes. With this apparatus a core of red clay 47 cm. in length, and one of Globigerina ooze 30 cm. in length, have been secured. It is anticipated that still better results will be obtained in the future. At two points between Tristan d'Acunha and South Georgia, in 46° 35′ S. and 50° 26′ S., the bottom was found to consist of a pure radiolarian ooze, a deposit apparently hitherto reported only from the Pacific. The deep-water echo-sounding apparatus unfortunately developed defects which rendered it unserviceable, but repairs have been put in hand and it is hoped that good results will be obtained with it during the latter half of the voyage.

While at South Georgia, the coasts of which are very poorly charted, as much survey work as possible was undertaken by Lieut.-Comm. J. M. Chaplin. He made a special visit in a sailing vessel to Undine Harbour in order to fix positions at the north-west end of the island.

To shoot and haul large nets and to carry out all the operations necessary for modern oceanographic research in a barque-rigged vessel such as the *Discovery* has naturally proved to be a formidable undertaking. The results we have obtained are due in no small measure to the interest and enthusiasm shown by Commander J. R. Stenhouse, who has invariably done his utmost to render the work successful.

A second ship belonging to the expedition, the R.S.S. *William Scoresby*, has recently arrived in Cape Town. She is of the whale-catcher type, and has been designed especially for whale-marking and trawling. According to the provisional programme which has been drawn up, both vessels will be employed on the south-west coast of Africa until the middle of October, the *Discovery* in plankton investigations on the whaling grounds off Saldanha Bay and the *William Scoresby* in whale-marking. Towards the end of October the passage to South Georgia will be made, the *Discovery* taking a southerly route and skirting the pack-ice. At the end of the year the two vessels will co-operate in a survey of the South Georgia whaling grounds, the *Discovery* afterwards proceeding to the South Shetlands, while the *William Scoresby* undertakes trawling in the vicinity of the Falkland Islands. The Marine Station at Grytviken, South Georgia, will be open throughout the season. I append an account of the work at Grytviken.

APPENDIX I.

WORK OF THE MARINE STATION AT GRYTVIKEN.

By N. A. MACKINTOSH.

The Marine Station was established chiefly for investigations on whales brought to the whaling station, and work has now been in progress since February 1925.

The main problems with which the whale work is concerned fall under the following headings: (1) the specific and subspecific identity of southern whales in comparison with their northern representatives; (2) the investigation of various problems connected with the reproduction, growth, and general breeding habits

of whales; and (3) the interrelations of breeding, migration, nourishment, age, adolescence, etc. Data have been obtained from 738 whales examined at South Georgia.

The routine work included under the first heading consists in the collection, by a series of measurements, of statistical records of the bodily proportions of a large number of whales and notes on a variety of external characters taken with the view of determining what characters are constant and to what extent variation may occur. In this way a large body of material has been collected for subsequent analysis. Attention has been paid to such parasites as occur, since the study of the species of external and internal parasites might be found to have a bearing on the distribution of species or communities of whales.

In regard to breeding and the subjects with which it is related, it should be pointed out that whaling at South Georgia is carried on almost exclusively during the southern summer. The indications point to the winter as the period of maximum pairing and calving, and the material so far obtained cannot therefore be regarded as complete until observations have been made which extend over the whole year. In order that these observations can be made, work is now being started in South Africa at Saldanha Bay, where whaling is carried on during the southern winter. In the meantime, some provisional conclusions can be drawn from the results obtained at South Georgia.

The type of information required relates to such problems as the time occupied by the different stages in the reproductive cycle, and the seasons at which they take place, the time required to reach sexual and full maturity, etc., and to the general reproductive potentiality of the stock of whalebone whales in southern waters. A certain amount of evidence has been obtained on a number of these points, and some indication can be given of the lines on which the investigations are developing. A study of the monthly increment in the average length of fœtal fin whales at South Georgia corroborates the theory that both pairing and parturition occur most frequently during the winter months, while the diversity of lengths of the fœtuses taken at any one time shows that the pairing and consequently the calving seasons are relatively extensive. There is evidence that parturition occurs when the fœtus has reached a length of about 6·0 metres, and the monthly average fœtal lengths suggest that this length would in general be reached about the middle of the southern winter. It does not in any case seem possible that the period of gestation can be much more or much less than a year. With regard to the frequency of the recurrence of pregnancy, the most that can be said at present is that whales probably do not become pregnant every year.

The study of the ovaries has revealed no sign of œstrus occurring between October and May, which is in keeping with the supposition that impregnation mostly takes place during the southern winter. The testes also appear to be in a quiescent condition. The inspection of the ovaries of whales taken in South African waters should be of special value in defining the pairing season more exactly.

An important point to be considered is the proportion of sexually immature whales which are killed. In the case of fin whales, about 26 per cent. are estimated to be immature, while in the case of blue whales, the ratio is so high as 58 per cent., a fact to which attention must be paid in considering the effect of the whaling industry on the general stock of whales.

A point of special interest arises from a study of the numbers of blue whales taken at different sizes. There are indications that the majority of these whales approximate to one of three different lengths, two of which represent a stage of growth at which the animal is still sexually immature. This suggests that young blue whales are inclined to visit South Georgian waters at two successive stages in their development towards maturity, living elsewhere between the stages until they grow to the next size. If they make regular annual migrations, the suggestion at once arises that the difference between the first and second sizes represents a year's growth. Then, assuming that the young are born in the warmer waters during winter and travel towards South Georgia during their first spring, it would follow that sexual maturity is reached just three years after birth. This, however, is a point which will need confirmation from a larger body of material, and it is noteworthy that no indications of the same nature have been detected in the fin whale statistics.

In regard to the estimation of the age of whales, there is some indication that the number of corpora lutea, including the traces of very old ones left in the ovaries, may be to some extent correlated with the age of the whale. The evidence is arrived at from a comparison of the length of the whale with the number of corpora lutea, and partly from the fact that blue whales, which appear to be taken in general at an earlier age than fin whales, usually have fewer old corpora lutea in the ovaries.

Several other points of interest have arisen, amongst which are the observation of a curious structure, found only in some immature female fin whales, which consists of a fleshy band bridging the entrance to the vagina, and the finding of a 24-mm. fin whale fœtus. Twin fœtuses have been found on two occasions.

Other work done at the Marine Station includes the chemical analysis of water-samples collected by the *Discovery* and investigations on elephant seals and on the bird life of the island. With the help of a motor-boat, with which the station is now provided, observations have been begun on the rich fauna of Cumberland Bay.

APPENDIX II.

A NEW METHOD OF PLANKTON RESEARCH.

By A. C. HARDY.

Hitherto our knowledge of the density and distribution of the plankton has been gained from samples taken at a number of stations within the area concerned. When, as on long cruises, the stations have to be twenty, fifty, or even a hundred or more miles apart, it may be doubted whether such samples are giving a true idea of the planktonic content of the water traversed: at one point one may strike a swarm of Copepods, or between two others miss an important zone of Diatoms. For a long time I have felt the need of an instrument which, by giving a continuous record

mile by mile to scale, would enable one to study and compare the uniformity or irregularity of planktonic life in different areas, to measure the size, varying internal density, and frequency of patches, and to indicate more exactly than can be done with comparable tow-nettings whether any correlation exists between different species.

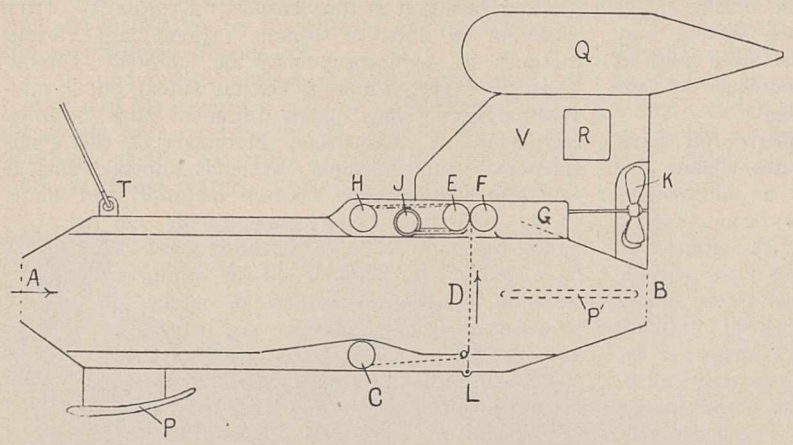

FIG. 2.—Diagrammatic section of the continuous plankton recorder.

Whilst on the *Discovery* expedition I have been experimenting with such an instrument, which I am calling the Continuous Plankton Recorder. Numerous little defects and difficulties have had to be overcome; but now that, taken together, more than 1300 miles of plankton have been recorded, it may be of interest to publish a brief description of the instrument and a note of some of the results obtained by its use. It is a development of the simple Plankton Indicator which I used in the North Sea (*Min. of Agric. and Fisheries Fishery Investigations* II, vol. 8, No. 7, 1926), but in place of the silk netting discs, which had to be reloaded for each sample, I have substituted a long continuously moving roll operated by a propeller turned by the water through which it is towed. Like the Indicator, it is used at full speed without stopping the ship.

Fig. 2 is a diagram of the instrument. It has a hollow cylindrical body tapered at each end, is weighted in front and furnished with planes P and P′, a vertical fin V with adjustable rudder R, and buoyancy chamber Q, so that when it is towed at the point T it 'flies' like a paravane in a horizontal position in the water at the required depth. I am greatly indebted to H.M.S. *Vernon*, Portsmouth, which carried out stability tests up to a speed of 16 knots and fitted the present planes and fin in place of those of my own design which proved unsatisfactory.

As the apparatus is towed, water enters through the circular opening A, passes through the cylinder and out at B. A length of silk netting, 9 inches wide and with 60 meshes to the inch, is arranged to wind off the braked roller C across the stream of water at D, where, supported behind by a gridwork of fine rollers, it catches the organisms in the water, then between the driving rollers E and F, which are of soft rubber but with hard ends gripping the edges of the silk, and so on to the storage roller H. The openings A and B, of 4 inches diameter, are smaller than that of D and approximately equal to the filtration area of the netting; a steady flow of water is thus assured, which by its pressure causes the organisms to adhere to the silk. The rollers E and F are driven through the gear-box G by the propeller K, and the storage roller H from E by a chain and friction drive, which prevents acceleration in winding due to its increasing diameter. At J, in a box, is a roll immersed in 5 per cent. formalin; this winds in with the catching roll between E and F, so preserving and separating the layers of organisms on the storage roller H. The instrument is hinged at L and made to open so that the rollers C, J, and H can be quickly taken out and replaced by others. It will be noted that the opening A is not masked by any towing bridle and cuts the water cleanly. The drawings of the instrument were prepared by Mr. M. T. Denne of

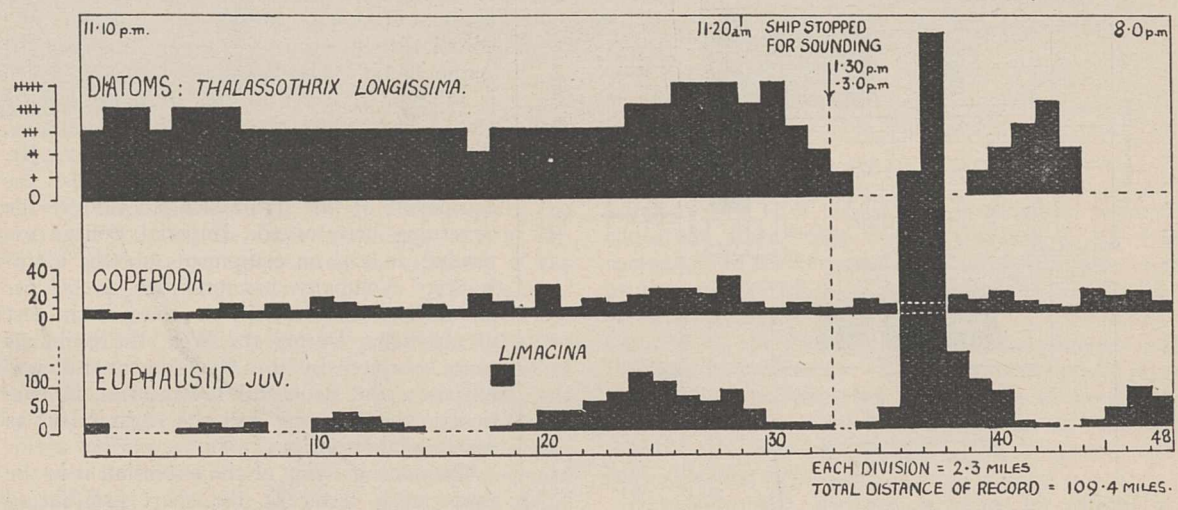

FIG. 3.—Graphic representation of continuous plankton record approaching South Georgia, February 18-19, 1926.

310 Regent Street, W., to whom I am indebted for a number of valuable suggestions.

Each silk-catching roll is ruled with transverse numbered lines at 6-inch intervals. Rolls up to 75 sections in length may be used. The blades of the propeller are adjustable so that each section may represent an equal distance of one or more miles as required; the distance actually travelled by the instrument is measured by the ship's log.

At the end of the record the completed roll is unwound across a glass stage with mirror below and examined section by section with a microscope; occasionally an organism may have been removed from the netting for identification. As detailed an analysis is made as may be desired or time permits, from an exact quantitative estimation of all the species to a rough estimation of the general density in different places. The specimens are sometimes damaged in the process of winding, but in nearly all cases they can be identified; in areas where the plankton is well known determination is conspicuously easy. The instrument is not intended for collecting purposes, and, having different functions, is a supplement to, rather than a substitute for, the plankton net.

Fig. 3 shows one of the records obtained; it indicates the distribution of the Diatom *Thalassothrix longissima*, the Pteropod Limacina, the Copepoda, and young Euphausians on a run of 109·4 miles, each section representing approximately 2·3 miles. In the twenty-two records so far made there is evidence of a marked variation in the density and regularity of the plankton in different oceanic regions, and various methods of comparison may be adopted. Discontinuity is expected more in coastal waters, but in mid-ocean sharply defined patches of small Salps, *S. democratica* and *S. longicauda*, Pteropods of the genus Limacina, young Ianthina, Ostracods, Copepods such as *Candacia ethiopica* and *Calanus robustior*, and young Euphausians have been demonstrated. On the other hand, Diphyids and Chætognaths, where they occur, have tended to be constant in numbers. On one occasion, by their occurrence in patches on the roll together, a relation was suspected between small Salps and the Copepod *Sapphirina angusta*; this was afterwards confirmed by living material, the latter being found to enter the former and feed upon the food collected on the endostyle.

Operations with the instrument were temporarily suspended owing to a mechanical defect; this has, however, been remedied, and I hope in the coming season that many more results may be obtained.

City and Guilds (Engineering) College.

THE Duke of York, on October 21, opened the extension of the City and Guilds (Engineering) College at South Kensington, which has been provided by the munificence of the Goldsmiths' Company at a capital cost for building of 87,000*l*. Soon after the Royal Charter was granted in 1907 to the Imperial College of Science and Technology, of which the City and Guilds College forms the engineering department, it was decided that a large extension was necessary to provide adequate equipment for engineering education and research. A site was granted for the purpose by the Commissioners of the 1851 Exhibition to the north of the old college in Exhibition Road, and Prof. Dalby, the Dean of the College, drew up a scheme for three new laboratories: (1) hydraulics, (2) structural engineering, motive power engineering and strength of materials, and (3) railway engineering. Building was commenced in 1911 and completed in 1914, the architect being Sir Aston Webb. The laboratories, one of which is top-lighted, cover an area of 32,900 square feet. Apart from the cost of the building, defrayed by the Goldsmiths' Company, Mr. Hawksley contributed 4000*l*. towards the equipment of the hydraulics laboratory, the governing body of the Imperial College expended 20,000*l*. on equipment, and the Clothworkers' Company has provided 4000*l*. per annum for a number of years towards the cost of research. During the War, the buildings were occupied by the Government for war purposes, the structural laboratories, in particular, being used by the Admiralty as research laboratories.

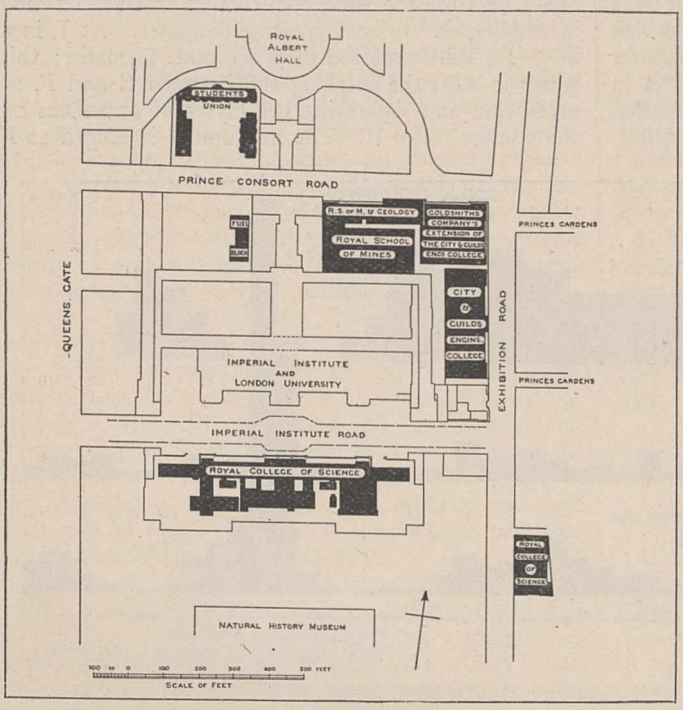

FIG. 1.—General plan of the associated buildings which have been erected on the site of the 1851 Exhibition. The areas coloured black indicate the buildings of the Imperial College of Science and Technology.

The main building of the extension is in the shape of a letter L, the short arm facing Exhibition Road and the long arm Prince Consort Road, the space in the angle being filled by the top-lighted laboratory. The façades are pleasing and well-designed, and the building forms a worthy addition to the great group of educational and public buildings for which South Kensington is famous. Equipment has been provided

for the laboratories on a generous scale with the double object of training engineering students and providing for research. With the old building the new extension forms a complete unit providing undergraduate training in all branches of engineering for 500 students, post-graduate instruction for between 50 and 100 students, and opportunities for research.

In the unavoidable absence of Lord Buckmaster, the chairman of the governing body of the Imperial College, the guests were received by Mr. Herbert Wright, the chairman of the Executive Committee. Sir Dugald Clerk, as Prime Warden of the Goldsmiths' Company, delivered the building to Mr. Wright, representing the governing body of the Imperial College, and to Mr. Walter T. Prideaux, representing the delegacy of the City and Guilds (Engineering) College. The Duke of York, in declaring the building open, made a graceful reference to the interest which his grandfather, the late King Edward VII., had always shown in technical education. The late King, then Prince of Wales, laid the foundation column of the original City and Guilds College building in 1881 and became president of the City and Guilds Institute. Three years later he opened the buildings, declaring that the college represented one of the most cherished objects his lamented father (the Prince Consort) had in view. Finally, in 1909, towards the end of his reign, King Edward laid the foundation stone of the new Royal School of Mines, adjoining the engineering extension and also forming part of the Imperial College. Throughout his life his interest in technical education, inspired by the example of his father, was sustained and enthusiastic, and he took an active part in establishing many of the institutions at South Kensington which were rendered possible by the success of the 1851 Exhibition.

The completion of this great undertaking, which places London in the leading position it should occupy in engineering education and research, provides an appropriate occasion for expressing appreciation of the work of the City Guilds in the promotion of technical education. Their munificence was enlisted in the earliest days of the movement and has not been restricted to London. Mr. C. T. Millis, the historian of technical education, states that the total grants of the City companies to the City and Guilds Institute amounted to the end of 1924 to 1,122,994*l.*, the Goldsmiths' Company heading the list with total grants of 204,523*l.*, followed by the Clothworkers', the Fishmongers' and the Mercers' Companies. Adding contributions to other institutions, including the Universities of Leeds and Sheffield, and the East London College, he estimates that the total amount expended by the companies must have exceeded 2,000,000*l.*

Naturally, the original schemes for promoting technical education were somewhat nebulous and have suffered modification in course of time. For example, the college at South Kensington, now dedicated to the training of engineers, was originally intended for the training of teachers in diverse crafts and industries. With the lapse of time also, the Government

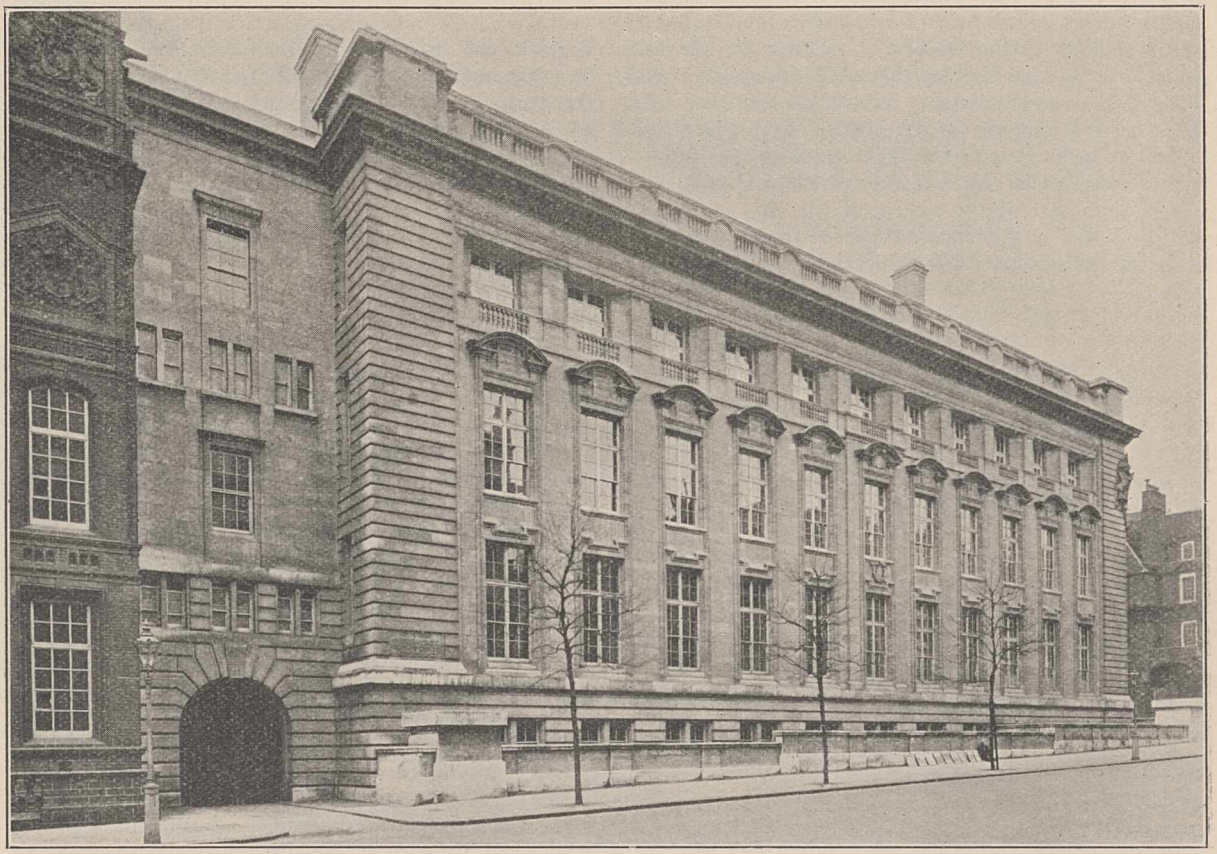

FIG. 2.—The front, facing Exhibition Road, of the Goldsmiths' Company's Engineering Extension of the City and Guilds (Engineering) College.

and other public authorities have accepted an increasing responsibility for the maintenance of technical institutions; and the companies, relatively impoverished by the War and confronted by many other urgent calls for financial assistance, have shown a tendency to restrict their educational expenditure. One of the unfortunate results of this economy has been the recent closing of the Finsbury Technical College.

There is a desire also on the part of some of the companies to restrict their interest in technical education to the crafts represented by the respective companies; thus, the Clothworkers' Company has subsidised the textile department of the University of Leeds by a capital sum of 220,000*l.* and an annual grant of 4000*l.*; the Drapers' Company has devoted 20,000*l.* to scholarships for the textile industries; and the Leathersellers' Company have expended more than 20,000*l.* for a building for the Leather Tanning College.

In the early days of the technical education movement, a strong feeling was expressed by Huxley and others that part of the wealth of the city companies could be used to great advantage for the assistance of technical education. The educational deficiencies of the British workman were the first object of solicitude, and the provision of purely craft training still retains an important place in schemes of technical education. Developments in engineering, in the use of electricity, and in many other industries based on science, brought a demand for more specialised training, a demand which, in respect of civil, mechanical and electrical engineering, has been admirably met by the City and Guilds (Engineering) College.

The College has been loyally served by many distinguished professors and instructors and has rigorously maintained a high efficiency in all its work. No college can be trusted more implicitly to ensure proper standards of education and training in the award of degrees and diplomas. The College has sent out a large number of well-trained engineers to all parts of the world, and the Duke of York was well advised that he may expect to meet many City and Guilds men during his forthcoming Imperial tour. It will afford great satisfaction to all friends of engineering education that the College, thanks mainly to the generosity of the Goldsmiths' Company, has acquired this important addition to its equipment.

Obituary.

MR. G. W. LAMPLUGH, F.R.S.

BY the death of George William Lamplugh on October 9, British geology has lost one of its ablest exponents. Born at Driffield on April 8, 1859, he was educated at private schools, but spent the latter part of his boyhood at Bridlington, where the absorbing interest of the Yorkshire coast stimulated his natural bent for geology. Here arose a question, the answer to which was to determine the course of his future life. He had actually embarked upon a commercial career with geological work as a recreation. On one hand lay lucrative posts with the possibility of affluence; on the other, scientific research with a small competence. He considered the matter with characteristic deliberation; the possibility of affluence appealed to him not at all; he decided in favour of a life of research as soon as he was satisfied that the competence, if small, would suffice for his modest needs. In 1892 he joined the staff of the Geological Survey.

Lamplugh's first paper was published in the *Geological Magazine* in 1878 when he was nineteen years of age. In this and several papers which followed in the next few years, he described the sequence of beds which constitute the glacial drift of the Yorkshire coast, and the occurrence of marine shells, more or less fragmentary, in them. He noted also the drawn-out remains of a pond deposit crowded with the fresh-water shell *Limnæa peregra*, which occurred as lenticles in the boulder clay. At that time marine shells in the glacial drift were held by many to betoken submergence. Lamplugh then, as always, formed his own conclusions. Of the Bridlington Crag he writes that it is "probable that its great thickness and amassed appearance may have been due to the accumulating power of a huge mass of ice, which, grounding (and not, as with the smaller bergs, merely grating) on a soft bottom, would slowly continue its forward course for some distance . . . and might push before it a constantly increasing mass of sand and shells"; and again: "the movement of ice at one time on a soft sea-bottom and, at another, over the silty bed of a pond, has produced precisely similar effects." More than thirty years later I was with him and shared his excitement on seeing the process of transportation he had pictured, actually in operation in Spitsbergen.

The more important part of Lamplugh's work in those early years lay, however, in his study of the Speeton series and of his comparison of it with the Tealby series of Lincolnshire. He approached the subject from a thoroughly scientific point of view, bringing to bear an intimate knowledge of the fossils, acquired apparently and not taught, as well as detailed field-work. One of the results was to show "that in Lincolnshire, as in Yorkshire, the various species of belemnites present in the rocks afford the most natural and convenient means for classifying the strata; but that the well-defined zones which they form do not always coincide with the lithological divisions." This work attracted the attention of Prof. Alexis Pavlow, of the University of Moscow, and led to a joint paper on the correlation of the Upper Jurassic and Lower Cretaceous horizons of Speeton with their equivalents in Russia and other parts of Europe.

In 1892, as a member of the staff of the Geological Survey, Lamplugh commenced official duties which were to occupy nearly all the remainder of his life. He was entrusted soon after his appointment with the geological surveying of the Isle of Man. Except for a few weeks, during which I accompanied him for the purpose of initiating him in survey methods, he accomplished this great work single-handed. The range of problems which confronted him was prodigious, including as it did the sequence and structures of the older palæozoic rocks, the mapping of the newer palæozoic rocks and of the Trias, the great suite of igneous rocks, both contemporaneous and intrusive, an extraordinary development of glacial deposits, and lastly, mining developments that had once been of much importance. Some of

these lay outside the scope of his previous experience, but on all he brought to bear a judgment founded on the deliberate and exhaustive consideration of a problem from every point of view that was characteristic of him. Incidentally, I am reminded that we disagreed on the interpretation of the small tract we mapped together. I thought that certain structures in the volcanic rocks of Scarlet Point might be attributed to the turmoil of the eruption. He took the view that they were due to subsequent overthrusting. Which was right I do not know. The Isle of Man occupied him for five years. His memoir upon it, with its wealth of records and of original observations, takes rank as a classic in modern geology.

In 1901 Lamplugh was placed, as a district geologist, in charge of the Irish branch of the Geological Survey. He remained in Dublin until that branch was transferred to an Irish Department in 1905, and during his stay took part in the mapping of the country round Dublin, Belfast, Cork, and Limerick, turning his experience of glacial phenomena to great advantage. On his return to England he served as district geologist for the Midland district and afterwards for North Wales. Administrative duties took up much of his time, but he contributed to and edited several memoirs. Later on he was engaged in surveying part of the Wealden area and became concerned with the borings which were then being made to prove the extent of the Kent coal-field. The records of the boreholes were obtainable only under much difficulty, and many of them until they were interpreted by him were unintelligible. They revealed developments of the Secondary strata that differed from any known exposures, and when accompanied by the palæontological observations made by his colleague Dr. Kitchin, threw a new light on the Secondary geology of southern England. In 1903, with the late J. F. Walker, he wrote "On a Fossiliferous Band at the top of the Lower Greensand near Leighton Buzzard." The conclusions formed were not accepted by palæontologists, on the ground that the fossils were characteristic of a higher stratigraphical horizon and could not be in place. The beds, it was argued, must have been inverted, presumably by glacial agency. Lamplugh's last paper, in the *Quarterly Journal of the Geological Society*, in 1922, was devoted to a detailed account of all the sections in which the band had been recognised. He showed that the sequence originally described by himself and Walker has invariably held good in every successive exposure and over a large area. He did not regard the palæontological evidence as conclusive, and considered the suggestion of inversion to be untenable.

It was Lamplugh's desire to continue his work on the Lower Cretaceous rocks after his retirement from the Geological Survey in 1920, but it was not long before failing health rendered it impossible. In 1914 Lamplugh had been appointed assistant director for England and Wales. He held the post until his retirement. Never could there have been a more loyal colleague than he was to me.

Lamplugh loved travelling, but always with the view of increasing his geological experience. In 1884 he visited the Eastern and Central States of North America, Vancouver, and Alaska, and went southwards to the Mexican border and as far as New Orleans. In 1893 he saw the Grand Cañon of the Colorado, and in 1897 attended a British Association excursion to Vancouver. In 1905 he made a systematic examination of the gorge of the Zambezi, below the falls. "It is difficult to believe," he writes, "that the fissure into which the river is so suddenly precipitated has been formed gradually by the action of the river itself, and not by some great convulsion during which the very crust of the earth was rent." He was able, nevertheless, to find conclusive proof that the gorge was due to the erosive action of water as the river gnawed its way back into the heart of the continent, a view that had been put forward by Molyneux. In 1910 he attended the International Geological Congress at Stockholm and took part in an excursion to Spitsbergen. There, under the leadership of Baron De Geer, we were shown not only a magnificent development of Tertiary, Secondary, and Upper Palæozoic rocks, but also shelly drift in the process of manufacture. His last trip was to Australia, for the meeting of the British Association in 1914.

Lamplugh received several honours, but, if I may say so without breach of confidence, declined some through a somewhat over-sensitive modesty. In 1891 he was awarded by the Geological Society a half of the Lyell fund in recognition of his work on the Yorkshire coast, and in 1901 he received the Bigsby medal as an acknowledgment of the value of his researches on the Speeton series. In 1925 he was awarded the Wollaston medal, the highest honour in the bestowal of the society. He became a fellow of the Geological Society in 1890, served several times on the council, partly as vice-president, and was president in 1918–20. He was elected to the Royal Society in 1905, and served on the council in 1914–16. He was for a time secretary of Section C of the British Association, and was president of the section in 1906. He was past-president of the Yorkshire Naturalists' Union, of the Hull Geological Society, and of the Hertfordshire Natural History Society, and an honorary member of several other societies.

Lamplugh's work was characterised by thoroughness of observation and by his habit of devoting prolonged consideration to a subject before forming conclusions. Though an original thinker, he never advanced a view that he was not able to support by sound evidence. He was a wide reader, mainly of a class of literature that makes no appeal to the multitude, and had acquired a critical judgment of style. In his own writing he took infinite pains to express his exact meaning, and expected this of others. As a colleague he was loyal; as a friend, lovable. A. STRAHAN.

DR. PAUL KAMMERER.

THE family Kammerer is of Saxon descent. The ancestors migrated first to Transylvania, and from there to Lower Austria and Vienna. Here Paul Kammerer's father erected a manufactory for scientific instruments. Paul Kammerer was born on August 18, 1880, studied at the University of Vienna in 1899–1904, took the degree of doctor in philosophy on June 23, 1904, and got the *venia legendi* for experimental morphology at the philosophical faculty of this same University. Having been a member of the staff

of the Biologische Versuchsanstalt since its beginning (1902), he was given the post of state-adjoint when this institution was taken over by the Viennese Academy of Sciences, and remained in this post from 1914 until 1923. He then applied for his pension, and undertook lecturing tours to many European states, and twice to North America. Last year he was called to Moscow, where he was appointed to a chair in the State University and was entrusted with the erection of a laboratory for the biological department of the Moscow Academy. However, in a moment of mental depression, he deemed himself not able to undertake this task and shot himself on the Hochschneeberg, near Vienna, on September 23.

Kammerer's work will without doubt secure him a lasting place in the memory of biologists, even if some points in his papers require further elucidation and are still open to criticism. His scientific investigations were mostly published in the *Archiv. für Entwicklungsmechanik*. They apply to experimental modification of animal form, colour, and function, to their behaviour in subsequent generations, to regeneration and age, symbiosis, and the crossing of species. Kammerer's first studies were in pœcilogony or the modifiability of gestation in the same species For his discoveries of this phenomenon in *Salamandra atra* and *S. maculosa* he was awarded the Sömmering medal for the year 1909 by the Senckenbergische Naturforschende Gesellschaft in Frankfort-on-Maine. The president of this society, Prof. A. Knoblauch, had himself undertaken the task of repeating some of these experiments (*Zool. Garten*, 45, n. 11, 12, 1904). Kammerer later extended his studies on pœcilogony to Hyla, Alytes (1906), Proteus (1912), and Lacerta (1910, 1925). Summarising the results, we may say that external factors, especially temperature and moisture, may modify the reproductive process in amphibians and reptiles in such a manner as to shift it in the direction taken by other species living in localities with a corresponding climate.

For many years Kammerer was occupied with the adaptation of amphibians, reptiles, and other animals to the colour of the background. He showed that *Salamandra maculosa* is capable of changing its colour after metamorphosis according to the colour of light reaching its eyes (1913), and that this slow morphological colour-change evolves from the quick physiological colour-change in the larvæ (1922). These results, often doubted, have been confirmed from different quarters (see Przibram a. Dembowski, 1922; *A. f. Entwm.* 50, 108; Biedermann in *Ergebnisse der Biologie*, 1, 1925; MacBride, *Proc. Zool. Soc. London*, 3, 983, 1925). Succeeding several times in raising Proteus, Kammerer had the opportunity, in his experiments on pœcilogony and colour-change, to test the dependence of the eye on light, a question to which he was able to give a positive answer (1912). He also proved the restoration of the power of vision (*Pflüger's Archiv.*, 1913). The possibility that these specimens with enlarged eyes may have been mutations was later discarded even by the originator of this explanation, Jacques Loeb, in his last book, "The Organism as a Whole" (1916), as highly improbable.

Kammerer exhibited his most remarkable specimens to the Linnean Society of London, and in Cambridge, during the year 1923. The honour he was shown during his visit to England was one of his most pleasant recollections. Even if Kammerer's proof of the inheritance of acquired characteristics may be held to require confirmation, it is not too much to say that no one else has made greater advance towards the solution of this fundamental question, and that his numerous papers include several very important contributions to biological science. Results confirmatory of his views have been obtained by Dürkhen (1924) and Heslop Harrison (1925), who worked entirely independently of Kammerer, and on totally different animals. Kammerer's last paper on the origin of the island-races of Lacerta in the Adriatic (1926) is one of the finest contributions to the theory of evolution which has appeared since Darwin.

PROF. ALEXANDER GUTBIER, Rector of the University of Jena, died suddenly on October 4 at the age of fifty years. We learn from the *Chemiker Zeitung* that Prof. Gutbier was a native of Leipzig. He became professor of chemistry at the Technische Hochschule at Stuttgart in 1912, and ten years later he succeeded Prof. Knorr at Jena, where he built up an efficient modern chemical institute, in which numerous valuable researches in analytical and colloid chemistry were carried out. His own publications dealt chiefly with investigations of tellurium, selenium, and the noble metals, with atomic weight determinations, and with colloidal metals and protective colloids. He also published several works on practical chemistry.

WE regret to announce the following deaths:

His Honour Sir John Bucknill, Puisne Judge of the Patna High Court, formerly editor of the *Journal of the South African Ornithologists' Union* and author of works on the birds of Surrey and of Cyprus, on October 5, aged fifty-three years.

Prof. J. D. F. Gilchrist, professor of zoology in the University of Cape Town, and president in 1922 of the South African Association for the Advancement of Science, aged sixty years.

Mr. George Lewis, who devoted the greater part of his life to the study of the Coleoptera, and particularly the Histeridæ, visiting China, Japan, Ceylon, and Algiers, on September 5, aged eighty-seven years.

M. Edouard Naville, fellow of King's College, London, and a foreign associate of the Institute of France, distinguished for his archæological work in Egypt, on October 17, aged eighty-two years.

Mr. Washington A. Roebling, engineer and builder of the Brooklyn Bridge, on July 21, aged eighty-nine years.

Mr. Oberlin Smith, an authority on the pressing and stamping of metals, and a past president of the American Institute of Mechanical Engineers, on July 18, aged eighty-six years.

Mr. Charles Turner, for many years principal of the Manchester School of Pharmacy, who made many contributions to our knowledge of the freshwater algæ, on September 10, aged sixty-two years.

News and Views.

THE address given by the Secretary of State for the Dominions and Colonies at the fourth session of the Imperial Conference is a further revelation of the growing popularity of scientific research as a theme for statesmen's utterances and an indication of their lost faith in ephemeral economic theories. The greater part of Mr. Amery's discourse was devoted to a survey of the problems of Empire development which await investigation and the steps which must be taken towards their solution. He announced that a very small committee has been appointed to consider what existing research organisations can do for the improvement of the production, transportation, and storage of Empire food-stuffs and raw materials required for manufacturers, what further support is necessary to make their work more effective, and what additional institutions are required. He reminded the Empire premiers that the standard of work of the agricultural departments of the Colonies and of the agricultural staffs of various private companies is no credit to the Empire, and that there is need for greater support for such institutions as the Imperial College of Tropical Agriculture at Trinidad and the Amani Institute in Tanganyika, to act as training centres for agricultural staffs and as an inspiration to all agricultural departments in the tropics. Out of the fund at the disposal of the Empire Marketing Board, further support has been given to assist the work of the Low Temperature Research Station at Cambridge, probably a grant will be made to the Fruit Research Station at East Malling, and the Imperial Bureau of Entomology has been allocated a contribution to enable it to set up a special laboratory for the breeding of beneficial parasites and their distribution as required to all parts of the Empire. Mr. Amery expressed his belief that incalculable results will follow the expenditure of money derived from a fund which can be freely allocated to the vital needs of research on Empire problems.

MR. AMERY might have reminded the Empire delegates that the British Empire is on its defence in the matter of scientific research. Great Britain has assumed the responsibility for the development of the illimitable potential resources of a large part of the world's surface. It possesses some of the finest scientific investigators in the world, but hitherto our statesmen have not performed the essential function of catalysts in bringing the knowledge of the latter to bear upon the problems of the former. Several other colonial powers, notably France, Belgium, and Holland, have given more scope and encouragement to the work of their scientific researchers than Great Britain, and a former colonial power, Germany, in the comparatively few years in which it was interested in colonial development, built up a corps of research workers in every field of scientific endeavour and a chain of scientific institutions which still commands the respect of the world. Mr. Amery's speech, it is hoped, will imbue the Empire premiers and other representatives with the same enthusiasm and appreciation for the need to apply science to the problems facing them as he and his able Under-Secretary, Mr. Ormsby-Gore, already possess. Elsewhere in this issue of NATURE appears the first of two articles referring to Mr. Ormsby-Gore's recently published report on West Africa, a report which can be commended to the Empire delegates for their most careful study. Therein is set forth in some detail the avoidable waste which occurs in this part of the British Empire in connexion with the production, storage, and transport of the products of the tropics, the avoidable waste of human endeavour and human life, the toll taken by insect pests on human beings, domestic stock and plants, the non-utilisation of natural resources, and the tremendous expansion of trade which would result if these problems were investigated by competent scientific workers.

BOTH Mr. Amery and Mr. Ormsby-Gore emphasise the need for co-ordination and dissemination of the knowledge accumulated by scientific investigators, to the end that science shall be applied generally throughout the Empire to the common problems of development. But neither of them realises, apparently, that the present machinery of administration is inadequate to this all-important task. Last year the Prime Minister raised great hopes by the announcement of the creation of a body charged with the responsibility of initiating research into imperial problems. These hopes have not been realised. The new body, the Civil Research Committee, was modelled on the Imperial Defence Committee; its deliberations are characterised by the utmost secrecy: even its findings and its reports on subjects of general interest are not made available to the public, and it has been overloaded with irrelevant problems. No scientific man was appointed to the Committee; its work has been farmed out to *ad hoc* sub-committees possessing no powers and commanding no funds. It bears no resemblance to the body suggested by Mr. Baldwin, and later by Lord Balfour during the House of Lords debate on the Report of the East Africa Commission—the Report which gave such prominence to the need for scientific research in Empire development. Perhaps Mr. Garvin's demand in the *Observer* of October 24 for "a Great General Staff for . . . the systematic accumulation and arrangement of knowledge—a greater Domesday Book showing clearly what works, enterprises, and scientific institutions are required to make the most of the resources of the Empire in every part," may have the desired effect. Mr. Garvin might have added that it is imperative that this general staff should be composed mainly of those who have been trained in the methods of science, appreciate the aims of science, and understand its language.

IN his inaugural address to the Institution of Electrical Engineers, delivered on October 21, Dr. W. H. Eccles presented a review of the present-day position of electrical industry in Great Britain, both in relation to its development and to the state of the industry in other countries. The conclusions he drew are in some respects unfavourable to British practice and he suggested certain necessary lines of

advance. Dealing first with electric supply, Dr. Eccles finds for the five countries, the United States, Canada, Germany, France, and Great Britain, taking only the larger undertakings which had collectively an output of 2000 million units or more in 1925, that the output in units per kilowatt of plant installed varied from 4500 for Canada to 2110 for Great Britain and 1820 for France. The low efficiency of the British undertakings is attributed to the smallness of the machines and stations and the rigid separation of the undertakings. The chief cause of the slow development in Great Britain appears to be the neglect of the principle of intercommunication. With a few large generating stations between which there is thorough intercommunication, each in turn can take the peak of the other's load. The size of each station need not then be so great and the efficiency of the whole undertaking is enhanced. In Germany there are four great zones the power of which varies from 400,000 kilowatts to 1,500,000 kilowatts, and these zones are now being connected into one national system. Similarly in France, the United States and Italy, but in Britain the largest plant capacity is that of the London Power Company, which is about 250,000 kilowatts. The use of electricity on railways was discussed, and it was pointed out that the electrification of main lines may not lower the cost of working; its chief advantage will lie in providing national intercommunication networks and in extending electrical facilities into areas which could not otherwise be made suitable for modern factories.

IT is satisfactory to note the growth in the use of electricity in the chemical and metallurgical industries pointed out by Dr. Eccles. There is a marked rise in the production of aluminium. In the case of sodium, we imported from Norway 41,860*l.* worth and exported 14,000*l.* worth in 1924; in 1925 the figures are 17,000*l.* for import and 28,000*l.* for export. Increases are also taking place in the production of ammonium sulphate and magnesium. Electricity in agriculture is backward in Britain. In Germany, 90 per cent. of the farms have an electric supply; in America there are 700,000 farms using electricity, but in Britain only 400 farms, *i.e.* 0·8 per cent., are supplied with electricity. One of the brightest points in the address refers to the export of submarine cable for telegraphy and telephony. The new type of cable loaded with permalloy (American) or mumetal (English) has rendered possible the transmission across the Atlantic of 2500 letters a minute. Of the 12,000 miles of this cable which has been ordered, all but one length is from British manufacturers. The positions of the telephone, telegraph and radio manufacture and services also come under review, and two appendices give details of the imports and exports of electrical apparatus and machinery for 1912, 1913, 1923, 1924 and 1925. The third appendix gives the export figures for the United States, Great Britain, and Germany for 1913, 1924 and 1925.

PERHAPS the most significant fact brought forward by Dr. Eccles in his address was that referring to research and invention. Dr. Eccles has obtained statistics of the patents granted in America, Germany, and Great Britain, the three principal electrical countries. The native inventors were in the case of America 89·2 per cent. of the whole number; in Germany 77 per cent.; and in Britain, 57 per cent. Of the electrical patents in America, 13·5 per cent. are of foreign origin, and in Germany the figure is 26 per cent.; in Britain 59 per cent. are foreign. This means that "in this intellectual side of industry we have a big adverse trade balance, for which, doubtless, we pay a correspondingly large annual tribute in money." Dr. Eccles insists again upon the folly of starving technical education and research, which must both be considerably extended, unless we are to "pay other nations to do the necessary brain work for us."

ON Monday last, October 25, a commercial high-speed radio telegraph service, utilising the principles of short-wave beam transmission and reception, was opened between Great Britain and Canada. This event followed the satisfactory completion of a preliminary seven days' test conducted by the General Post Office, during which the average speed of signalling was 600 letters per minute simultaneously in each direction. In England the transmitting station is situated near Bodmin and the receiving station near Bridgwater, while the corresponding stations in Canada are in the neighbourhood of Montreal. The stations at each end of this communication channel are similar in design, and they utilise a straight row of vertical aerials located in front of a similar row of wires forming the reflector; the resulting radiation is thus concentrated in the form of a beam directed towards the receiver. The wave-length employed is in the neighbourhood of 100 metres, and while the transmitting power is only 20 kilowatts, the effect of the reflectors at each end is to give a very much greater received signal strength than is obtainable with the usual type of aerial arrangement. Among the advantages possessed by this beam system for long-distance radio communication are the comparatively low capital cost of erection, economy of maintenance, freedom from atmospheric interference, and the possibility of very high signalling speeds. The combination of these advantages should result in the handling of a large volume of traffic at a cheap rate. The service now opened is the first of four similar beam circuits which will link Great Britain directly with Canada, South Africa, India and Australia. The completion of these 'point-to-point' services will, together with the high-power 'world-wide' station already in operation at Rugby, place Great Britain in the forefront of commercial radio practice.

THE news that Messrs. Brunner, Mond and Co., Ltd., Nobel Industries, Ltd., the British Dyestuffs Corporation, Ltd., and the United Alkali Co., Ltd. are about to fuse their interests and form a huge chemical combination on the lines of the German Dye Trust, was not entirely unexpected, owing to recent activity in the shares of some of these companies. Rumour had mated Brunner, Mond and Co. with the

Dyestuffs Corporation, but the adhesion of the other two companies to the alliance was not anticipated. Only in July last, Lord Ashfield told his shareholders that it was more than probable that the Corporation would co-operate, and possibly consolidate, with other large chemical undertakings. On October 22 the directors of the four companies announced in the Press the proposed formation of a new company to acquire their shares and to develop their businesses and resources on broad Imperial lines. Nobel Industries already controls thirty companies largely, but not exclusively, engaged in the manufacture of explosives; and Brunner, Mond and Co. has a controlling interest in such important undertakings as Synthetic Ammonia and Nitrates, Ltd., and the Castner-Kellner Alkali Co., Ltd. The aggregate authorised capital of the associating companies is 47,500,000*l*., and their issued share capital is 38,225,714*l*. On October 22 the market value of the ordinary and deferred shares (24,918,753*l*.) was more than 40,000,000*l*.

SIR ALFRED MOND will be chairman of the new holding company, and Sir Harry McGowan, chairman of Nobel Industries, will be its president and vice-chairman. In a statement issued to the Press, Sir Alfred Mond emphasised the national and Imperial aspect of the combination. The existence of similar organisations on the Continent and in the United States has compelled the British manufacturers to combine their forces and present a united front to the rest of the world. The identity of the individual companies is not to be destroyed, but the board of the new company will act as a supervisory and connecting link between them, in finance and in policy. Modern mergers are not made to create monopolies or to inflate prices, but to achieve economy in effort and costs, and to provide insurance against market fluctuations. A combination such as that now contemplated will be able to finance, develop and explore many new potentialities in chemical industry, and so keep Great Britain in the front rank both as regards national safety and the supply of chemical products to a vast number of industries that depend upon chemistry. Few will disagree with Sir Alfred's remarks, although he did not mention certain disadvantages that sometimes result from the concentration of money and power in the hands of small groups.

ON October 22 a destructive earthquake occurred in the district of Alexandropol (or Leninakan) in Armenia. Three hundred persons were killed and twelve villages were badly damaged, but as communications in many places are interrupted, the full extent of the disaster is as yet unknown. Alexandropol is one of the most active earthquake-centres in the territory between the Black Sea and the Caspian, though it is surpassed in the frequency and severity of its earthquakes by two other centres, near Tiflis and Chemakha. On the same day three earthquakes were felt in California, only one of which was strong enough to cause slight damage. The interest of the shocks is due to their possible connexion with the San Andreas rift and the earthquake of 1906. Their centre was evidently some distance, perhaps a hundred miles, to the south of San Francisco.

SHORTLY after the announcement of the recent discovery of a skull of Pithecanthropus type at Trinil in Java (see NATURE, October 2, p. 491) private information from Washington made it appear likely that its importance had been overrated, and that the skull would not provide the data relating to the facial portion which anthropologists especially desired. Later news had not confirmed the first announcement that the skull was complete. It now appears that the find is not a skull but a cast in spongy stone of volcanic origin. Its appearance indicates that volcanic ash settled round the skull and, in time, the bone disappeared. The cast shows the frontal bone, the right and two-thirds of the left parietal bones, the upper part of the right and a little of the left temporal bones, and the supra-orbital ridge. It must be noted that the cast was not obtained *in situ* but from natives by whom it had been unearthed, so that the geological conditions of its discovery must remain in doubt. It is not easy to understand how a cast made in such circumstances, which normally would give the internal and not the external form, could show the characteristic supra-orbital ridge; but for the re-solution of this and other questions, the arrival of photographs must be awaited.

THE problem of peopling Australia is discussed by Mr. J. de V. Loder in an article in the October issue of the *Empire Review*. He quotes the late Lord Leverhulme's advocacy of black labour in tropical Australia as an opinion based solely on economic grounds, without consideration of the deeper sociological issues involved. It is not merely the desirability of excluding cheap labour that would undercut the whites, but the danger of introducing social, political, and religious ideals unacceptable to white civilisation, that are the real arguments in favour of the 'white Australia' policy. The suitability of the tropics for permanent white settlement by an increasing population has not been proved, and cannot be proved except by experiment. Modern science has done much to solve the problem, but there still remains a doubt as to the possibility of racial acclimatisation on a large scale. Mr. Loder thinks that the policy of keeping Australia for the white races is a justifiable gamble, and sees possibilities for white settlement in the hot dry regions of the north which are suited for sheep-ranching. In the hot wet regions he is less hopeful, and unfortunately for Australia these are the really productive and valuable parts of tropical Australia. In any event, there is little hope of attracting emigrants to such lands until the more temperate parts of Australia are filled.

ON October 9, H.R.H. the Duke of York opened the new X-ray Department in the Royal Infirmary of Edinburgh, which has just been completed at a cost of 52,000*l*. The new Department, which is about 160 feet long by 60 feet wide, contains a sunk basement and two floors. The basement contains a large motor generator supplying alternating current to the whole

of the Department, together with X-ray transformers, main control boards, and a workshop. Thus there is no moving machinery with its attendant rumble on the ground floor where all the X-ray rooms are situated (radiographic, screening and treatment). The deep therapy (250,000 volts) and superficial therapy sets are valve rectified. There are also a lecture and demonstrating hall, dark rooms, waiting and examination rooms, together with private rooms for the staff. On the upper floor, accommodation is provided for electrical and massage treatment, remedial exercises, radium treatment, and artificial sunlight treatment. Some features of the new building are designed with the view of furnishing the fullest protection for the operators against constant exposure to the X-rays. The walls are constructed of concrete slabs containing barium sulphate. These afford protection equivalent to 5 mm. of lead, as measured by the National Physical Laboratory, which has also inspected the completed Department. From the point of view of the X-ray Protection Committee's recommendations, the new Department is almost ideal, and it should prove a worthy model for future X-ray departments. The University has instituted a diploma, D.R.Edin., for which a candidate will take a suitable course in physics at the University and carry out practical work in the infirmary, the course extending over about a year.

AT the thirtieth annual meeting and annual foray of the British Mycological Society, held at Hereford on Sept. 27-Oct. 2, Dr. G. H. Pethybridge, president, gave an address on "Mycology and Plant Pathology." The British Mycological Society to some extent may be looked upon as an expansion and continuation of the activities of the Woolhope Naturalists' Field Club, which originated fungus forays more than half a century ago. The fungus flora of Britain is now fairly well worked out, and more attention might be paid to the ecology and bionomics of fungi. Tracing the development of plant pathology in Britain, we find that at one time mycology was regarded as of little or no importance in relation to the causation of plant diseases; fungi occurring in connexion with disease were regarded as the *result* of such disease, not the cause of it. Disease in plants is the consequence of disharmony between the plant and its environment. A parasite, if present, is part of the environment considered in its widest sense, and it must not be forgotten that both host and parasite are to some extent variable or unstable and that the fluctuating factors of the environment may influence the parasite as well as the host. However, the parasite—most frequently a fungus—is often the most important factor in disease production. Plant pathology in Great Britain is of comparatively recent growth. The possibility of the introduction of the Colorado beetle occasioned the passing of the first Act of Parliament dealing with the protection of crops; it was extended and amplified as the Destructive Insects and Pests Act in 1907 on account of the spread of the American gooseberry mildew. A small *ad hoc* inspectorate was then inaugurated by the Board of Agriculture. The greatest stimulus to the development of plant pathology has followed from the provision by the State of greatly increased funds through the Development and Roads Improvement Funds Acts 1909 and 1910, and afterwards through the Corn Production Acts (Repeal) Act of 1921.

AN appointment to a Beit Memorial Fellowship, of the annual value of 1000*l.* and tenable for five years, is to be made for whole-time research in tropical medicine; allowances will be given for travelling and laboratory expenses. Applicants must be of European descent and of degree standing in a university of the British Empire approved by the Trustees of the fund, and must state their proposed subject of research. Forms of application, obtainable from the honorary secretary of the fund, Sir James K. Fowler, at 35 Clarges Street, London, W.1, are to be returned on or by February 1 next. This fellowship is a noteworthy addition to the opportunities for research now available, and there is no doubt that it will lead to important contributions to our knowledge of health and disease in the tropics.

THE seventeenth annual Exhibition of Electrical, Optical and other Physical Apparatus arranged by the Physical and the Optical Societies will be held at the Imperial College of Science and Technology on January 4-6. It has been decided again to include, in addition to the well-established Trade Section, a Research and Experimental Section similar to that successfully initiated in last January. The groups in this section comprise: (*a*) Exhibits illustrating the results of recent physical research and improvements in laboratory practice; (*b*) effective lecture experiments; (*c*) repetitions of famous historical experiments. Offers of exhibits should be addressed to the Secretary of the Physical Society at the Imperial College of Science and Technology, South Kensington, S.W.7, not later than November 16.

THE People's League of Health, 12 Stratford Place, Oxford Street, London, W.1, has arranged two interesting series of lectures to be delivered during November and December at the rooms of the Medical Society of London, 11 Chandos Street, Cavendish Square, W.1. One series, on November 1, 8, 15, 22, 29, December 6, 13, and 20, deals with the mind in normal and abnormal subjects, and the lecturers are Dr. E. Mapother, Dr. E. D. Macnamara, Dr. N. Hobhouse, Dr. H. Crichton-Miller, Sir Maurice Craig, Sir Robert Armstrong-Jones, Dr. W. A. Potts, and Dr. A. F. Tredgold. The other series, on November 3, 10, 17, 24, December 1, 8, and 15, is on various aspects of diet and foods, and the lecturers are Dr. H. Campbell, Prof. Leonard Hill, Prof. Winifred Cullis, Prof. W. E. Dixon, Dr. J. Lewis Rosedale, Prof. Hugh MacLean, and Dr. R. Ll. J. Llewellyn. The lecture hour is 6 P.M.

A LICENCE under Section 20 of the Companies (Consolidation) Act, 1908, has now been issued by the Board of Trade to the Research Association of British Paint, Colour, and Varnish Manufacturers, which has been approved by the Department as complying with the conditions laid down in the Government scheme

for the encouragement of industrial research. The Secretary of this Association is Mr. J. B. Graham, 8 St Martin's Place, London, W.C.2.

IN the short notice of "Phototopography" by Mr. A. L. Higgins which appeared in NATURE of June 26, p. 889, it was stated that ground photographs had been used for surveys in Canada but not in other parts of the British Empire. The Surveyor-General of India points out that experiments with the photo-theodolite were carried out in India more than twenty-five years ago, and the method was utilised on the Mount Everest expedition. The ground photographs which are being taken this year in Kashmir will be utilised in conjunction with plane-table surveys. They will only cover a small area of the country. It was not the reviewer's intention to suggest that ground photo-surveying had not been tested in India or elsewhere, but that it had not been adopted for ordinary topographic surveys outside Canada.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A lecturer in physics at the Royal Dental Hospital of London, School of Dental Surgery—The Dean of the School, Leicester Square, W.C.2 (November 1). A head of the department of Leather Trades of the Port Elizabeth Technical College, South Africa—G. H. Penney and Co., 23 Lime Street, E.C.3 (November 8). A head of the mechanical engineering department of the L.C.C. School of Engineering and Navigation, Poplar—The Education Officer, T.1.a., County Hall, Westminster Bridge, S.E.1 (November 8). A chemist for tobacco work under the Egyptian Government—The Chief Inspecting Engineer, Egyptian Government, 41 Tothill Street, S.W.1 (November 12). An assistant lecturer (man) on education at King's College—The Secretary, King's College, Strand, W.C.2 (November 26). A professor of archæology in the University of Edinburgh—The Secretary, University, Edinburgh (December 31). An assistant chief entomologist, an entomologist and a mycologist under the Egyptian Ministry of Agriculture—The Under-Secretary of State for Agriculture, Ministry of Agriculture, Cairo (January 1). An expert in pisciculture under the Egyptian Government—The Royal Egyptian Legation, 7 Charles Street, Berkeley Square, W.1. A lecturer in physics and electrical engineering at the Handsworth Technical School—The Principal, Handsworth Technical School. Goldshill Road, Handsworth, Birmingham. A head of the mining department of the Barnsley Technical and Mining School—The Principal, Harvey Institute, Barnsley. A technical officer in the air-worthiness department, Royal Aircraft Establishment, South Farnborough—The Chief Superintendent, R.A.E., South Farnborough, Hants, quoting A. 130).

Our Astronomical Column.

RELATIVITY AND THE DAYTON MILLER EXPERIMENTS.—The issue of the *Nineteenth Century* for October contains an article on this subject by Prof. H. Wildon Carr. The article is largely of a philosophical character and emphasises the great change that relativity has brought about in our outlook on the phenomena of the universe. Interesting parallels are drawn with the Copernican revolution, and with the birth of philosophy in ancient Greece. There is also an explanation of the theory in non-technical language. Incidentally, Prof. Carr gives 5000 miles per minute as the earth's orbital speed: it should be 1110.

Referring to the system of dynamics accepted by Newton, Prof. Carr says: "It is now rejected as untrue in theory and useless in practice." This statement, however, needs qualification. The tables of the sun, moon, and planets that are still in use are based on pure Newtonian principles, save for an empirical increase in the motion of certain perihelia (adopted long before Einstein explained its cause) and an empirical term in the moon's motion (quite unconnected with Einstein). The most ardent relativist would not desire to supersede these tables, since the changes in them that would result from Einstein's law are absolutely inappreciable with our present means of observation.

The close of the paper deals with Dr. Dayton Miller's repetition of the Michelson-Morley experiment, but it describes him as still adhering to the theory of an ether-drag, which diminishes with increasing altitude. Dr. Miller made it fairly clear in his lecture at the Royal Institution some months ago that he no longer holds this view. He now considers that observations at all altitudes (including the original Michelson-Morley experiment) indicate an apparent change in the velocity of light depending on the sidereal time of observation. The change is only a small fraction of the orbital speed of the earth: it was suggested that the Lorentz-Fitzgerald contraction damps down the observable effect, but does not conceal it entirely. This tends to weaken the argument drawn by Prof. Carr for the non-existence of the ether, from the difficulties which he rightly puts forward as regards an ether-drag.

SOLAR ACTIVITY DURING 1925.—An account of solar observations made at the Astrophysical Observatory of Catania is published by G. A. Favaro in "L' attività del sole nell' anno 1925," in continuation of the series commenced in 1919. Observations for sunspots were made on 332 days in the year 1925, for faculæ 290 days, for prominences 194 days, and for the measurement of the height of the chromosphere on 140 days. Tables are given of the mean frequency of sunspots, faculæ, and prominences. Drawings also illustrate the chief disturbances of the year, the dates selected for sunspots being February 14, May 5, November 26, and December 27; those for prominences being February 24, June 17 and 18. The highest prominence recorded during 1925 occurred on February 24 with a maximum height of 211″, or about 153,000 km. The mean height of the chromosphere measured in the *C* line of hydrogen was 10″·9 or about 8000 km., the monthly means of the measures ranging from 10″·5 to 11″·7.

It is of interest to show in tabular form the rise of solar activity since the last spot minimum in 1923 as indicated by various observations.

Observation.	Place.	Year. 1923.	1924.	1925.
Daily sunspot frequency (groups and single spots) . . .	Catania	0·7	1·8	3·6
Wolfer's "Spot Numbers" .	Zurich	5·8	16·7	41·6
Daily spot areas [1] . . .	Greenwich	55	276	829
Days without spots . . .	Greenwich	171	97	19

[1] Corrected for foreshortening, in millionths of the sun's visible surface.

Research Items.

INDIAN ORIGINS.—An ingenious if highly speculative note by Mr. H. Bruce Hannah in the *Journal and Proceedings of the Asiatic Society of Bengal*, N.S., Vol. 21, No. 1, deals with the question of the approximate period of the Mahābhārata war and the ethnological affinities of the participants in it. According to the legend the war was fought between the Kūrūs and their cousins the Pāndavas. The concrete historical protagonists appear to have been the Kūrūs (Dasyūs and their followers) and the Pāncha-Janāh. The Pāncha-Janāh consisted of the Pūrūs or Pauravas, Yādūs or Yādavas, Tūrvaśas, Ānūs, and Drūhyūs—all mentioned in the Rig Veda. They were probably four communities of western Asia, namely, the Philistines, the Amorites of Yādai in Nāharin, broken Hittites, and a Phallus-worshipping people called "The People of the Pillar," of Heliopolis, in Deltaic Khem, who had been driven out by Rameses III. about 1156 B.C. These were the people responsible for the introduction into India of the divine names afterwards transmuted into Indra, Mitra, etc. They settled in the Punjab, where they found aborigines and a dominant race of dark white, or perhaps semi-mongoloid, stock. These latter were the representatives of a widely diffused ancient central Asiatic people known to the rosy-blond Aryanians as Dahyūs or Tokhs, and descendants of the Kūśa or "wolf-folk." They were not, however, uncivilised, and they dwelt in cities. Possibly the culture discovered at Mohenjo-Daro and Harappa and the civilisation of Susa discovered by de Morgan are vestiges of this civilisation. As a result of the struggle between the Dasyūs and the Pāncha-Janāh about 1000 B.C. in the Mahābhārata war, the Dasyūs or Kūrūs established themselves and acquired some of the culture of the Aryan Kshatriyās, evolving what has come to be known as Brāhmanism and caste. Further, it is suggested that about 4000 B.C. Dahyūs from central Asia penetrated to south India and, combining with the aborigines, founded the Dravidian race.

NEW AND LITTLE-KNOWN INSECTICIDES.—In the August issue of the *Annals of Applied Biology* (vol. 13, No. 3) Messrs. F. Tattersfield, C. T. Gimingham, and H. M. Morris have a fourth contribution dealing with studies on insecticides. In the present instance they are more especially concerned with the insecticidal properties of plant materials, in the form of alcoholic extracts. Perhaps the most interesting plants with insecticidal properties are certain kinds used by natives of tropical countries as fish poisons. The roots and stems of White Haiari and the stems of Black Haiari (both species of Lonchocarpus from British Guiana), the roots of *Tephrosia toxicaria* and the leaves of *T. vogelii*, when tested as stomach poisons, all exert both a repellent and toxic action to caterpillars. The most toxic substance obtained from the Haiaris is shown to be identical with tubatoxin, the crystalline poison found in *Derris elliptica*. In the same journal Messrs. C. T. Gimingham, A. M. Massee, and F. Tattersfield discuss the toxicity of 3 : 5-dinitro-*o*-cresol and its sodium salt to the eggs of certain species of insects. The figures obtained show that these compounds have a very high toxicity to insect eggs. The 3 : 5-dinitro-*o*-cresol at concentrations ranging from 0·5 per cent. to 0·15 per cent. killed 80-82 per cent. of the eggs of the hop-damson aphis and did not injure the trees upon which the trials were carried out. These two compounds exercised a marked cleansing effect upon the bark, and it is evident, if further trials substantiate the results obtained, that such compounds afford considerable promise as winter sprays upon various fruit-trees.

LITERATURE OF SALMON FISHERIES.—In a paper recently prepared by Mr. W. J. M. Menzies (*Fisheries, Scotland, Salmon Fish.*, 1925, II. (Edinburgh and London: H.M. Stationery Office, 3*s.* 6*d.* net)) is given a general index to the reports and papers issued by the Fishery Board for Scotland on the subject of salmon fisheries for the years 1882–1924 inclusive. This has been arranged to contain an authors' index, a subject index, and a district index in which can be found all the published information about any particular district, river, or loch. Arranged as it is in these three divisions, the work should prove of great value.

FOREST IN RELATION TO HUMUS.—Dr. W. H. Pearsall has recently reviewed (*Journ. of Ecology*, vol. 14, No. 2, August 1926) a number of publications upon the Finnish forests; a comprehensive publication of similar nature upon the Swedish conifer forests and their relation to the different types of humus, by Henrik Hesselman (*Meddelanden från Statens Skogsförsöksanstalt*, Häfte 22, No. 5), has also appeared. Different types of humus covering are distinguished, and attention is directed to the importance of the agencies preventing undue accumulation of leaf debris in the permanent forest. The mobility of the nitrogen in the products of decay, during the changes undergone by vegetable remains in the humus layer, is suggested as a very important factor in forest ecology, as also the content of the humus in acid and basic buffering substances. The Swedish study covers some 330 pages, with a 40-page abstract in German.

VALUES OF SCOTS AND CORSICAN PINES.—A recent number of the Oxford Forestry Memoirs (No. 6, by W. E. Hiley), entitled "The Financial Return from the Cultivation of Scots and Corsican Pine," should prove of value to those interested in afforestation work in Great Britain. By means of financial calculations the author endeavours to show, using for convenience the general term *range of probability*, the financial advantages to be attained by planting either Scots pine or Corsican pine on suitable soils of different quality. Mr. Hiley bases his conclusions on the possibility that higher prices may rule in the future than those at present obtainable for these timbers. It may be premised that Corsican pine costs more to raise in the initial stages than the Scots, and its timber is at present priced lower. "The result of this investigation," says the author, "shows that on first quality plantations, if the costs of the two species are the same, except that Corsican pine costs 1*l.* per acre more to plant than Scots pine, then the financial yield from the two species will be equal if the prices obtained for Corsican pine timber are 59 per cent. of those obtained for Scots pine timber of the same size. On Quality II. sites, too, the price of Corsican pine timber would have to be about 60 per cent. of that of Scots pine to yield the same financial return. If the prices for Corsican are more than 60 per cent. of those for Scots the advantage is with the former, and if they are three-quarters, the advantages in favour of Corsican pine are very great." As a result of his study of this important matter the author considers that only under the most favourable set of conditions—cheap land, planting and cost of maintenance combined with high quality growth and a rise of prices of 1½ per cent.

per annum—could Scots pine yield five per cent. compound interest on money invested in it, and under similar conditions four per cent. on second quality soil. The possibility, of doubtful practical feasibility on large areas, of so ameliorating pine soils that they would grow more profitable conifers, for example, larch, or Douglas fir, is also considered.

UNITED STATES RIVER SURVEYS.—In recent years the United States Geological Survey has published a number of monographs on various river systems from the point of view of water supply. The same department has now issued, as Water-Supply Paper 558, a preliminary index to all existing river surveys in the United States accompanied by a map showing the drainage areas. Twelve major drainage areas are recognised as the basis of the classification adopted both by the Geological Survey and the Weather Bureau. The index is by States and rivers, with references to the drainage areas indicated on the map. Maps produced by all Government departments and various States and private bodies are included. The list, which is to be revised from time to time, forms a useful guide to the cartographic resources of the United States.

TERTIARY MARLS IN NORTH CAROLINA.—Mr. L. B. Kellum undertook the task of clearing up certain doubtful relations in the Tertiary section of North Carolina represented by the Castle Hayne and Trent Marls, through a systematic study of their faunas. The result, as set forth in the *U.S. Geological Survey Professional Paper* 143, has been to show that the Castle Mayne Marl has its strongest affinity with the Jackson horizon of the Eocene, and that the Trent Marl is of approximately the same age as the Miocene 'Silex Beds' of the Tampa of Florida. The palæontological portion occupies the greater part of the paper. The Castle Hayne fauna comprises 305 species, of which 214 are Bryozoa, and these last have been described elsewhere by F. Canu and R. S. Bassler (*U.S. Nat. Mus. Bull.* 106). The Trent Marls yielded only 26 species of Mollusca. Tables of the local distribution of all these are given with systematic descriptions, especial attention being devoted to the new species and varieties. Eleven exceedingly good plates and a useful index complete this important paper.

MAGNETIC MOMENTS OF ALKALI METAL ATOMS.—In the *Physical Review* for September, J. B. Taylor describes a modification of the apparatus of Gerlach and Stern with which he has carried out determinations of the magnetic moments of sodium and potassium atoms. The metals were evaporated into the apparatus at 345° C. and 245° C. respectively, and the images formed by the deposition of the atomic rays on cool glass strips were rendered visible by immersing the strips in hydrochloric acid gas, whereupon films of opaque chloride were formed. Both metals were found to possess an atomic moment of one Bohr magneton, within the limits of experimental error, which were about ten per cent.

ELECTROMETERS.—The new list of electrometers and photo-electric cells issued by the Cambridge Instrument Co., Ltd., contains complete descriptions of the instruments and outlines of the theory of their action. The table of sensitivity data of electrometers given in the list will prove of special value to research workers. Taking the instruments under normal working conditions, the sensitivities of those using microscopes magnifying 8 to 12 times with eyepiece scales of 0·1 mm. are for the tilted gold leaf 100, the string 30, and the Lindemann 40 divisions per volt; for the Dolezalek quadrant 1000 mm. and the Compton quadrant 12,000 mm. per volt on a scale a metre away. These values may be varied considerably by changing the volts on plates or needle or the diameter of the suspending fibre, with corresponding changes in the time required to obtain a reading of the instrument. The photo-electric cells are of the pattern used at the Clarendon Laboratory, Oxford.

SURVEYING INSTRUMENTS.—A new catalogue (No. 541), issued by Messrs. C. F. Casella and Co., Ltd., contains a description and price list of the very large number of instruments which this well-known firm is prepared to supply. There is scarcely an instrument required by the surveyor, engineer, navigator, or draughtsman which cannot be found in the catalogue. The firm invites special attention to its new Double Reading Micrometer Theodolite. This instrument is so arranged that all four micrometers and the bubble can be read without moving from the front of the instrument. Much time is saved by this device. Another new instrument to be noted is the Casella Precise Tilting Level. The spirit-level is entirely enclosed in the instrument, and is fitted with a prism, which brings the two ends of the bubble into view in the field of the telescope. By means of a slow-motion tilting screw under the telescope, the two ends of the bubble can be brought into vertical alignment, and the telescope is then level. The adjustment of the bubble is made by moving the prism longitudinally, by means of a slow-motion screw. This enables a very fine adjustment to be obtained. Messrs. Casella are willing to let out certain survey instruments on hire.

NITROGEN IN IRON-CHROMIUM ALLOYS.—In a paper on "The Effect of Nitrogen on Chromium, and some Iron-Chromium Alloys," read at the Stockholm meeting of the Iron and Steel Institute by Mr. Frank Adcock, it is shown that when chromium is melted in an atmosphere containing nitrogen, the gas is rapidly absorbed and alloys containing up to 3·9 per cent. of nitrogen are readily obtained. Hence the melting-point of the pure metal cannot be ascertained when the melt is exposed to such an atmosphere. Pure iron, on the other hand, absorbs the gas slowly, and even when nitrogen is passed for thirty minutes over the surface of molten iron, 0·02 per cent. only is retained. Iron-chromium alloys both in the liquid and solid states take up nitrogen at high temperatures; the quantity of nitrogen in the alloy increasing with the chromium content. In alloys containing about 12 per cent. of chromium, nitrogen gives rise to a martensitic type of structure closely resembling that usually associated with iron-carbon alloys. The hardness of these alloys can be considerably modified by heat treatment, and ranges from about 115 Brinell in the annealed state to 315 Brinell when quenched. Most of the alloys containing nitrogen in the range 20 to 60 per cent. chromium present a two-phase structure under the microscope. Although one of these constituents invariably develops a structure of the sorbitic or pearlitic type on suitable heat treatment, these changes are not accompanied by any great variation in hardness. This pearlitic or lamellar type of structure is absent from the corresponding pure iron-chromium alloys, and is thus not due to carbon. It would thus appear that the presence of nitrogen in iron-chromium alloys can give rise to structures closely resembling those generally attributed to carbon in ordinary steel. Micrographs of stainless iron often reveal a martensitic type of structure which has been difficult to explain. This work on the effect of nitrogen may reveal the cause of this structure.

The Skin Constrictor (Psychogalvanic) Reflex.[1]

By Prof. R. J. S. McDOWALL and Dr. H. M. WELLS.

THE term 'psychogalvanic reflex' has been given to the fall in the electrical resistance of the skin which occurs during mental effort or emotion. It is probable that the fall in resistance in not the sole change which occurs, but from the work of Thouliss it is evident that it is by far the greatest change concerned. Various explanations have been sought for by individuals whose interests lay in special directions and who were not fully acquainted with the literature of the subject or with the physiology of the factors concerned.

It will be shown below that the fall in resistance can readily be explained as being the result of constriction of the blood vessels of the skin. In the past, this conception has been ignored because of the fact first noted by Veraguth, that the reflex was not abolished by the cutting off of the blood to the part concerned. Since, however, it has become realised, largely as the result of the investigations of Krogh, that the peripheral vessels are independent of the blood pressure, such negative evidence carries no weight.

The Influence of the Circulation on the Resistance of the Skin.

In the past too little attention has been paid to this aspect of the problem. In 1924, however, Aveling, McDowall and Wells carried out a series of experiments on chloralosed or decerebrate animals in which it was found that all procedures calculated to bring about vaso-constriction in the skin, *e.g.* hæmorrhage, adrenaline and cold, caused a fall in the electrical resistance; while conditions producing vaso-dilatation, *e.g.* obstruction of the venous return, caused a rise. They found that the fall could be brought about by sensory stimulation in a decerebrate animal, thus showing the elementary nature of the reflex, and suggested that the term 'skin constrictor' reflex should be substituted. It should be stated that conclusive evidence was obtained that the change in electrical resistance was not brought about by activity of the sweat glands. This sweat hypothesis was shown to be based on ignorance of the pharmacological action of pilocarpine and atropine. It was actually shown that pilocarpine, in the sweating stage when the blood-vessels are dilated, caused a rise in resistance, although it may be preceded by a fall in the pallor stage. In this point the results of Waller were confirmed. In final condemnation of the sweat theory, it may be stated that Golla records an example of neurotic hyperidrosis in which the sweat literally dripped from the patient who gave a normal reflex. It is inconceivable that such activity would not interfere with the reflex were it due to increased glandular activity.

The work has now been further extended by Wells, who has shown in a very simple series of experiments, the details of which will be given in a forthcoming paper, that any alteration of the circulation through the skin of the hand causes a considerable change in electrical resistance, greatly in excess of that occurring in the reflex. For example, if the carbon dioxide which normally keeps up the tone of the vasomotor centre be reduced by over-ventilation, a procedure producing an obvious pallor of the skin, the fall in resistance may amount to 20-30 per cent. of the original resistance. On the other hand, if the peripheral vessels be dilated by preventing the normal venous return by compression of the arm with a sphygmomanometer cuff at a pressure of 50 to 60 mm., there is a marked rise in resistance.

It is, however, important to note that all such experiments can only be carried out if conditions, as indicated below, are such that vaso-constriction can show itself; while it is not until the subject is thoroughly accustomed to the procedure of the experiment that the effect of psychical states can be got rid of.

The Influence of the Circulation on the Reflex.

It has long been known that in cold weather it may be very difficult to obtain the skin constrictor reflex; indeed, it is a routine procedure amongst psychologists to wash the hands in warm water in such circumstances. It is evident that if the cold causes the skin vessels to be constricted, no further constriction may be expected. Mere compression of the skin vessels by the electrodes may prevent the reflex from showing itself. There is little doubt that this accounts for the fact that it is most readily obtained from the palms of the hands and the soles of the feet, since the superficial blood-vessels in these regions are protected by a greatly thickened stratum corneum. This may readily be observed by pressing the finger on the palm and back of the hand and comparing the pressure necessary to cause an evanescent pallor. There seems little doubt that the failure to obtain a rise in resistance in blushing is due to the fact that the vessels in the face are exposed, since Wells has shown that hyperæmia of the hand, produced by plunging the hand alternately into hot and cold water, gives a marked result.

In the usual method of obtaining the reflex there is added to the pressure of the electrodes the cold due to evaporation of the saline by which they are kept moist, while the skin becomes sodden. All these factors may interfere with the appearance of the reflex.

Similarly, the reflex is abolished by drugs which cause marked dilatation and paralysis of the skin vessels, such as large doses of alcohol and atropine.

It is important also to remark that many observers who have been unable to explain the fact have noted that there is great difficulty in obtaining the reflex in patients suffering from arterial disease such as arterio-sclerosis.

Evidence of Vaso-constriction during the Reflex.

It is stated by Krogh that if the ear of an unanæsthetised rabbit is observed, the occurrence of the slightest unusual sound causes the blood-vessels in that region to become constricted; while Carrier, working in the same laboratory, has recorded closure of the skin capillaries of man during a thunderstorm which caused much apprehension in the subject. Hemingway in this laboratory, using Lombard's method, has found that there is commonly a closure of the capillaries of the skin during conditions which produce the reflex. The constriction is, however, limited to certain capillaries, while others remain permanently open. To be certain of these changes it is necessary to observe a given area of skin for several days in order to be thoroughly familiar with the normal state of the region; and due precautions must be taken to prevent the capillaries being affected from other causes during the observations.

[1] Summary of a paper by the authors before Section I (Physiology) of the British Association, delivered at Oxford on August 5. (From the Department of Physiology, King's College, University of London.)

It would be expected from the foregoing that if the reflex is caused by vaso-constriction, there ought to be a diminution in the volume of the limb as shown by the plethysmograph. This has been thoroughly investigated by Golla, and in a Croonian lecture he states that he not only found that there was a constriction of the limb, but also that the time relations and the degree of constriction corresponded to the change in electrical resistance. We have fully confirmed these results, which may readily be demonstrated by the ' rubber glove ' method.

On searching the literature the extremely interesting fact has come to light that this was the first experiment of its kind ever done by Mosso, the inventor of the plethysmograph. Mosso records that so important did he consider the experiment that he visited Ludwig in Leipzig to demonstrate it. So impressed was the ' father of physiology ' by the reduction in the volume of the limb of the subject, Prof. Paglianni, that he wrote in German on the tracing " Enter the lion."

Mosso goes on to relate how the volume of the limb changed in a subject passing from ' seen ' to ' unseen ' Greek translation, and remarks that in such emotional constriction we have the explanation of the common saying " Cold hands and a warm heart."

Since the blood flow through the skin influences an individual's temperature sensations, a number of common sayings such as " the blood running cold," " the pallor of fright," " eat till you grow cold," may be considered to have been placed on a definite physiological basis.

Taken together with the experiments on animals, it appears clear that the reflex is a very elementary one which may be brought about without co-operation of the higher centres, as the result of sensory stimulation. It should therefore be known as the *skin constrictor reflex* and may be considered as part of the mechanism by which the animal normally adapts itself to the anticipation of muscular exercise and defence. In man it occurs not only on sensory stimulation, *e.g.* of a pin-prick, but also in anticipation of the stimulus. Here we may look upon a threatening movement as a conditioned stimulus which has developed as an effect of experience. The fact that many of the emotional stimuli affecting civilised man may bring about a reflex so closely associated with sensory stimulation physiologically and apparently teleologically, suggests that in responding to such stimuli the individual is, in a sense, defending or preparing to defend himself. The problem appears to offer an excellent line of psychological investigation.

Fuel Research

AT the postponed annual general meeting of the Institution of Gas Engineers, commencing September 21, a number of papers were submitted, some of a professional kind, dealing with such subjects as the layout and extension of works, and the supply of high-pressure gas, while others dealt with the principles and problems of carbonisation.

Among the latter was the sixteenth Report of the Joint Research Committee of the University of Leeds and the Institution of Gas Engineers, which contained the first results forthcoming from a systematic study of the different factors which influence the results obtained in the carbonisation of coal. The first factor examined was the influence of the size of the coal particles, which was shown to exercise an appreciable influence not only on the strength and nature of the coke produced, but also on the gas yield, this latter fact being traced to a cracking of the tar, which was more pronounced with the charges made up from the smaller sizes of coal. The retort used for the process was of ' Cronite ' metal supported by a complete fireclay sheath, which enabled a gas-tight apparatus to be secured working at a temperature of 1000° C. without deterioration. A carbon balance could be struck, and also a thermal balance, which confirmed the deduction previously made that the products of carbonisation contained within 2 per cent. or 3 per cent. as much potential heat of combustion as the original coal.

A paper dealing with somewhat similar subjects was submitted by Mr. T. F. E. Rhead, who described results obtained on the experimental plant of the Birmingham Corporation Gas Department. Mr. Rhead concluded by a plea for closer scientific supervision of the retorting process as essential if it is to be carried out efficiently and economically.

C. B. Marson and J. W. Cobb reported striking results which they had obtained in studying the influence of the ash constituents in the gasification of specially prepared cokes in steam and in carbon dioxide. Working on a coal containing only 1 per cent. of ash, it was found that additions of 5 per cent. of different oxides made, in some cases, great difference in the results obtained. With the same rate of steam supply, the percentages decomposed were 61 for ' pure ' coke, and 82, 91, and 98 for the calcium oxide, iron oxide, and sodium carbonate cokes respectively, while the corresponding percentages of carbon dioxide in the water gas generated were 9·2, 5·4, 21·6, and 0·4 respectively. Again, the percentages of carbon monoxide found after passing carbon dioxide at the same rate through the different cokes were 6·6, 29·9, 45·6, and 89·0 for the ' pure ' coke, iron oxide coke, calcium oxide coke, and sodium carbonate coke respectively, while the enhanced reactivity was also displayed by the figure for quantity in grams gasified per hour, which was more than twenty times as great for the sodium carbonate coke as for the ' pure ' coke. The increased reactivity of these special cokes so tested was, in the main, due to the specific catalytic effect of the added compound, and not to the alteration in physical structure on carbonisation resulting from the addition, which was sometimes itself quite remarkable. The importance of the results in connexion with such subjects as the preparation of a free-burning carbonised smokeless fuel is obvious.

The fifteenth Report of the Joint Research Committee of the University of Leeds and the Institution of Gas Engineers was of a preliminary nature, and was concerned entirely with a careful and detailed examination of the conditions which have to be satisfied if trustworthy determinations are to be made, by the iodine pentoxide method, of any carbon monoxide produced in the use of typical gas appliances.

Another report submitted at the meeting was that of the Refractory Materials Committee, in the form of a series of papers. Among these may be mentioned papers by A. J. Dale, entitled " The Testing of Refractory Material for Resistance to Slag Corrosion and Erosion," and " The Control of Silica Brick-Making, based on Load-Test Indications," one by E. J. Vickers, entitled " The Influence of Oxidising and Reducing Atmospheres on Refractory Materials," and another by A. T. Green, continuing his work on " Temperature Diffusivities and Thermal Conductivities in relation to Silica and Fireclay Refractories."

University and Educational Intelligence.

BIRMINGHAM.—The Rev. Hilderic Friend, who recently presented his collections of earthworms to the British Museum, has now given to the biological department of the University a further collection of material, on which he has been working for thirty-six years. This material includes tubes of oligochætes (chiefly enchytræids) and water worms—some of them type specimens and quite unique. The gift also includes a valuable collection of books and MSS. and material relating to the distribution of annelids in Great Britain and Ireland.

The Alcester Rural District Council has presented to the Museum of Anatomy, as a permanent loan, a number of human skulls discovered in the course of some excavations at Alcester.

Messrs. Latch and Batchelor (Wire Rope Manufacturers, of Hay Mills, Birmingham) have offered to the Department of Oil Engineering a scholarship of 60*l.* per annum for three years, to be awarded to a candidate from one of the public schools and tenable in the Department of Oil Engineering as the Latch and Batchelor Scholarship.

Prof. W. Boulton has been elected Dean of the Faculty of Science to succeed Prof. T. Turner. Dr. F. W. Norris has been appointed lecturer in the Department of Brewing.

Prof. Keesom of Leyden lectured to a large and very appreciative audience in the Physics Department, on October 18, on the liquefaction and solidification of helium.

Messrs. Cadbury Bros. have made to the city a munificent gift of more than 150 acres of land, of which 100 acres is to be devoted to the site and grounds of a hospital. The land adjoins the site of the University at Edgbaston, so that the gift will have a far-reaching effect on the medical school of the University and will do much to solve the difficulties arising from the present geographical separation of the University buildings and the General and Queen's Hospitals.

CAMBRIDGE.—Mr. R. W. Ditchburn, Trinity, has been awarded an Isaac Newton studentship. This studentship was founded for the encouragement of study and research in astronomy and physical optics.

LEEDS.—The distinction of emeritus professor has been conferred on Prof. A. G. Perkin, who has recently retired from the chair of colour chemistry.

LONDON.—Subject to the consent of the Chancellor of the Exchequer to proposals put forward by the University, the Senate has authorised definite negotiations with the Duke of Bedford for the purchase of part of the Bloomsbury site.

Dr. Percy Stocks has been appointed as from August 1 to the University readership in medical statistics tenable at University College. Dr. Stocks was educated at Manchester Grammar School (1901–1907) and King's College, Cambridge (1907–11). In 1911 he obtained a medical scholarship at the University of Manchester. Recently he has been medical officer to the Galton Laboratory (1921–26) and also lecturer in vital statistics and epidemiology at University College since 1924. His published work includes several papers on the inheritance of bodily deformity published in *Biometrika* and the *Annals of Eugenics*, and a work entitled "Blood Pressure in Early Life" (Cambridge University Press, 1924).

Dr. C. H. Lobban has been appointed as from August 1 to the University readership in civil engineering tenable at King's College. He studied at Glasgow Technical College and the University of Glasgow. After works experience he became demonstrator in engineering at Glasgow, and later lecturer in engineering at Manchester; he was professor of civil engineering at the University of Madras from 1908 until 1910. Since 1920 he has been lecturer in civil engineering at King's College, London, and has also been consulting engineer in connexion with several important buildings in London and Nottingham. He is the author of a series of seven articles on "Railway Engineering" (1920).

Dr. H. T. Flint has been appointed as from January 1 to the University readership in physics tenable at King's College. He is a graduate in mathematics and physics of the University of Birmingham. Since 1920 he has been a recognised teacher of physics at King's College, London. His published work includes papers on the theory of relativity, and on four-dimensional vector analysis in the *Phil. Mag.*, "A Generalized Vector Analysis with Applications to Electrodynamical Theory" (*Proc. Roy. Soc.*, A, 1925), and "Text-Book of Advanced Practical Physics for Students" (Methuen).

A free public lecture on "Recent Developments in Cosmical Physics" will be delivered by Dr. J. H. Jeans at University College on Tuesday, November 9, at 5 o'clock. No tickets will be required.

NOTICE is given by the Royal College of Surgeons of England that the Thomas Vicary lecture will be given at the College at 5 o'clock on Thursday, November 4, by Prof. G. Elliot Smith, who will take as his subject "The Significance of Anatomy." The Bradshaw lecture will be given on Thursday, November 11, at 5 o'clock, by Mr. E. W. Hey Groves. The subject will be "Reconstructive Surgery of the Hip Joint."

THE Northampton Polytechnic Institute, situated at the Islington end of Clerkenwell, offers in its "Announcements, Educational and Social, for the Session 1926–27" a wide variety of courses. In engineering, full-time courses extending over four years are provided on the 'sandwich' system, students in their first year attending the Institute during each of the three terms, whilst for the second and third years they attend during the first two terms only and spend the remaining five months of each year in the works of industrial firms or, when necessary, abroad. Specialisation begins with the third year, when students choose between civil, mechanical, aeronautical, electrical, and radio engineering. The Department of Applied Optics caters for (1) optical engineers, optical instrument makers, and optical glass workers, this work being co-ordinated with advanced classes conducted at the Imperial College of Science; (2) ophthalmic and dispensary opticians. A Horological Department under the direction of an advisory committee representing the British Horological Institute, the Worshipful Company of Clockmakers, and the governing body of the Institute provide a full-time one-year course designed to attract members of the trade from all parts of the country. Other subjects in which instruction is provided, mainly in the evening, are telegraphy and telephony, industrial chemistry, electro-chemistry, furriering, and domestic subjects and women's trades. Grants-in-aid are received from the Skinners' and Saddlers' Companies. Students are actively encouraged to participate in the social and recreative activities of the Institute, the plant for which includes a 100-ft. swimming-bath and 14 acres of playing-fields.

Contemporary Birthdays.

Oct. 31, 1872.	Sir E. J. Russell, F.R.S.
Nov. 1, 1857.	Prof. John Joly, F.R.S.
Nov. 1, 1876.	Capt. Henry P. Douglas, R.N.
Nov. 4, 1855.	Prof. Frederick Orpen Bower, F.R.S.
Nov. 5, 1876.	Prof. Harold B. Fantham.
Nov. 5, 1848.	Dr. James W. L. Glaisher, F.R.S.

Sir JOHN RUSSELL was born at Frampton, Gloucestershire, and educated at Aberystwyth and the Victoria University, Manchester. Head of the chemical department, Wye Agricultural College, from 1901 until 1907, he afterwards joined the staff of the Rothamsted Experimental Station (Lawes Agricultural Trust), succeeding Sir Daniel Hall in 1912 as director. Sir John is the author of important works on general agricultural science, and on soil biology.

Prof. JOHN JOLY'S scientific career has throughout been connected with the University of Dublin. Early he was a demonstrator there of civil engineering and afterwards of experimental physics, while for the past twenty-nine years he has occupied the chair of geology and mineralogy. Since 1901 Prof. Joly has been one of the editors of the *Philosophical Magazine*. President of Section C (Geology) at the British Association's Dublin meeting in 1908, he gave an address on "Uranium and Geology." The Royal Society awarded him a Royal medal in 1910 for his researches in physics and geology. Later the Geological Society allotted him its Murchison medal in recognition of his inquiries respecting the thermal properties of minerals, the relations of radioactivity to geology, and age correlations of the earth. Prof. Joly has made important contributions to the subject of colour photography; also to the theory of biological processes, such as the ascent of sap in vegetation. He is Hon. LL.D. Michigan University.

Capt. DOUGLAS, hydrographer of the Navy since 1924, was engaged in Admiralty survey work from 1897 until 1910; afterwards he was Superintendent of Charts. He is the inventor of various appliances used in navigation.

Prof. BOWER, emeritus professor of botany in the University of Glasgow, was born at Ripon. Educated at Repton, he graduated at Trinity College, Cambridge. Following teaching work in botany at the Royal College of Science, South Kensington, lasting until 1885 (the courses were held in Huxley's laboratory), Prof. Bower removed to Glasgow. In 1909 he was awarded the Linnean Society's gold medal, and in the following year the Royal Society allotted him a Royal medal, both in recognition of distinctive and unremitting services to botanical science.

Prof. FANTHAM was educated at King Edward's School, Birmingham, the Mason College there, University College, London, and Christ's College, Cambridge. Sometime lecturer in parasitology at the School of Tropical Medicine, Liverpool, he became demonstrator in biology at St. Mary's Hospital Medical School, London, and afterwards went as assistant to Prof. Nuttall at Cambridge. In 1917 he was appointed to the chair of zoology in the University of the Witwatersrand, South Africa.

Dr. GLAISHER was born at Lewisham. Educated at St. Paul's School, he passed into Trinity College, Cambridge (of which he is a fellow), graduating second wrangler. Author of many original papers in pure mathematics, and editor of two mathematical journals, the Royal Society awarded him its Sylvester medal in 1913. Dr. Glaisher has been twice president of the Royal Astronomical Society.

Official Publications Received.

BRITISH AND COLONIAL.

Western Australia. Annual Progress Report of the Geological Survey for the Year 1925. Pp. 37+7 plates. (Perth: Fred. Wm. Simpson.)

Publications of the Dominion Astrophysical Observatory, Victoria. Vol. 3, No. 9: The Velocity Curves of 12 Lacertae and the Radial Velocities of 48 Stars. By William H. Christie. Pp. 209-223. Vol. 3, No. 10: Four Double-Lined F-Type Spectroscopic Binaries. By W. E. Harper. Pp. 225-245+1 plate. Vol. 3, No. 11: Three Spectroscopic Binary Orbits. By J. S. Plaskett. Pp. 247-264. Vol. 3, No. 12: The Orbits of Two Double-Lined Spectroscopic Binaries. By W. E. Harper. Pp. 265-273. (Victoria, B.C.)

Report of the Council of the Natural History Society of Northumberland, Durham and Newcastle-upon-Tyne, intended to be presented at the Annual Meeting of the Society, 21st October 1926. Pp. 42. (Newcastle-upon-Tyne.)

India: Live-Stock Statistics, 1924-25. Report on the Second Census of Live-Stock, Ploughs and Carts in India, held between December 1924 and April 1925. Pp. 8. (Calcutta: Government of India Press.) 2 annas; 3*d*.

Report and Balance Sheet of the National Botanic Gardens of South Africa, Kirstenbosch, Newlands, Cape (and the Karoo Garden, Whitehill, near Matjesfontein), for the Year ending 31st December 1925. Pp. 24. (Kirstenbosch, C.P.)

Animal Breeding Research Department, the University, Edinburgh. Report of the Director for the Year April 1st 1925 to March 31st 1926 (being the 6th Annual Report). Pp. 28. (Edinburgh.)

The National Institute for Research in Dairying: Its Work and Needs. By the Staff of the Institute. Pp. 52. (Shinfield, Reading.)

The Scientific Proceedings of the Royal Dublin Society. Vol. 18 (N.S.), No. 25: Photo-electric Measurements of Illumination in relation to Plant Distribution, Part 1. By Dr. W. R. G. Atkins and Dr. H. H. Poole. Pp. 277-298. (Dublin: Royal Dublin Society; London: Williams and Norgate, Ltd.) 2*s*.

FOREIGN.

Sitzungsberichte der Physikalisch-medizinischen Sozietät zu Erlangen. Herausgegeben im Auftrag der Sozietät von Oskar Schulz. 56 und 57 Band, 1924, 1925. Pp. xx+494. (Erlangen.)

Journal of the College of Agriculture, Hokkaido Imperial University, Sapporo, Japan. Vol. 17, Part 2: Contributions to the Knowledge of Abscission and Exfoliation of Floral Organs. By Prof. Isawo Namikawa. Pp. 63-131. Vol. 18, Part 2: Erster Beitrag zur Ichneumoniden Japans. Von Toichi Uchida. Pp. 43-173+Tafeln 6-10. (Sapporo.)

Department of Commerce: U.S. Coast and Geodetic Survey. Serial No. 350: Report on the Readjustment of the First-Order Triangulation Net of the Western Part of the United States. By Oscar S. Adams. Pp. 9. (Washington, D.C.: Government Printing Office.) 5 cents.

The Institution of Electrical Engineers. List of Corporate Members, and of Non-Corporate Members (Graduates, Students and Associates) of the Institution, including a List of Names arranged Geographically. (Corrected to 1st September 1925.) Pp. 367. (London.)

List of Members of the Institution of Civil Engineers. Addresses corrected to 1 July 1926. Pp. 315. (London.)

The Institution of Mechanical Engineers. List of Members, 1st May 1926. Pp. 433. (London.)

Publication No. 586: Recent Improvements in the Design and Construction of Surveying Instruments. Pp. 11. (London: Cooke, Troughton and Simms, Ltd.)

Wild-Barfield High-Temperature Electric Furnaces for the Heat Treatment of High Speed Steel and General Purposes requiring Temperatures up to 1400° C. (Section K.) Pp. 8. (London: Automatic and Electric Furnaces, Ltd.)

Photo-micrographic Apparatus and Accessories. (Reference: Mikro 401.) Pp. 107. (London: Carl Zeiss (London) Ltd.)

Publication No. 1: Astronomical and Optical Instruments. A History of the Foundation of the Company and of its Achievements in the British Optical Industry. Pp. 48. (Newcastle-on-Tyne: Sir Howard Grubb, Parsons and Co.)

Diary of Societies.

SATURDAY, OCTOBER 30.

INSTITUTE OF METALS (North-East Coast Local Section, jointly with Institute of British Foundrymen) (at Neville Hall, Newcastle-upon-Tyne), at 6.15.

ROYAL SOCIETY OF MEDICINE (Study of Disease in Children Section) (at Children's Hospital, Birmingham).

MONDAY, NOVEMBER 1.

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.—General Meeting.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—C. E. Shattock: Demonstration of Scrotal Tumours.

SOCIETY OF ENGINEERS (at Geological Society), at 5.30.—Miss A. Ashberry: Some Products of a Small Machine Shop.

CHILD-STUDY SOCIETY (at Central Hall, Westminster), at 6.—Sir M. E. Sadler: Sandford and Merton.

INSTITUTION OF AUTOMOBILE ENGINEERS (Bristol Centre) (at Merchant Venturers' Technical College, Bristol), at 6.45.—G. F. Mucklow: The Effect of Reduced Intake-Air Pressure and of Hydrogen on the Performance of the Slow-speed Solid Injection Engine.

ARISTOTELIAN SOCIETY (at University of London Club), at 8.—Prof. C. Lloyd Morgan: Objects under Reference (Presidential Address).

SOCIETY OF CHEMICAL INDUSTRY (London Section) (at Chemical Society), at 8.—Dr. H. Drake-Law: Artificial Colours used in Foodstuffs.

ROYAL INSTITUTE OF BRITISH ARCHITECTS, at 8.30. — Presidential Address.

TUESDAY, NOVEMBER 2.

ROYAL SOCIETY OF ARTS (Dominions and Colonies Section), at 4.30.—Sir Stanley Bois: The Importance of Rubber in Economic and Social Progress.

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—Dr. G. W. C. Kaye: The Acoustics of Public Buildings (Tyndall Lectures) (1).

MINERALOGICAL SOCIETY (Anniversary Meeting), at 5.30.—Dr. L. J. Spencer, with a Chemical Analysis by E. D. Mountain: Schultenite, a New Mineral, from South-West Africa.—Dr. L. J. Spencer, with a Chemical Analysis by E. D. Mountain: Aramayoite, a New Mineral, from Bolivia.—Miss Kathleen Yardley: (*a*) X-ray Examination of Aramayoite; (*b*) The Structure of Baddeleyite and of Prepared Zirconia.—W. Binks: The Crystalline Structure of Zircon.

ZOOLOGICAL SOCIETY OF LONDON, at 5.30.—Col. S. Monckton Copeman: Exhibition of Photographs of the Nest and Eggs of a Californian Humming-Bird.—Dr. G. M. Vevers: Report on a Hippopotamus recently born in the Society's Gardens.—H. B. Cott: Observations on the Life-Habits of some Batrachians and Reptiles from the Lower Amazon; and a Note on some Mammals from Marajó Island.—W. E. Le Gros Clark: On the Anatomy of the Pen-tailed Tree-Shrew (*Ptilocercus lowii*).—O. W. Richards and G. C. Robson: The Land and Freshwater Mollusca of the Scilly Isles and West Cornwall.—M. A. Smith: The Function of the 'Funnel' Mouth of the Tadpoles of Megalophrys, with a Note on *M. aceras* Boulenger.

INSTITUTION OF ELECTRICAL ENGINEERS (North-Western Centre) (at 17 Albert Square, Manchester), at 7.—W. J. Medlyn: Chairman's Address.

ROYAL PHOTOGRAPHIC SOCIETY (Pictorial Group), at 7.

INSTITUTE OF METALS (North-East Coast Local Section) (at Armstrong College, Newcastle-upon-Tyne), at 7.30.—Dr. L. Aitchison: Light Alloys.

RÖNTGEN SOCIETY (at British Institute of Radiology), at 8.15.—Dr. N. S. Finzi: Research in Radiology.

WEDNESDAY, NOVEMBER 3.

ELECTRICAL ASSOCIATION FOR WOMEN (at 15 Savoy Street), at 3.—W. C. Jeary: The A B C of Electric Lighting (Lecture).

PHILOSOPHICAL SOCIETY OF ENGLAND (at 138 Piccadilly), at 4.30.—W. Pavitt: Birth Stones and their Talismanic Virtues.

GEOLOGICAL SOCIETY OF LONDON, at 5.30.—S. S. Buckman: Jurassic Chronology. III. Some Faunal Horizons in Cornbrash.

INSTITUTION OF ELECTRICAL ENGINEERS (Wireless Section), at 6.—Prof. C. L. Fortescue: Inaugural Address.

INSTITUTION OF HEATING AND VENTILATING ENGINEERS (at Caxton Hall), at 7.—W. E. Fretwell: Small Hot-Water Supply Systems.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (Graduate Section) (at Bolbec Hall, Newcastle-upon-Tyne), at 7.15.—N. G. R. Thomson: The Trend of Technical Progress in Relation to the Design and Construction of Ships.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (Middlesbrough Graduate Section) (at Cleveland Scientific and Technical Institution, Middlesbrough), at 7.30.—C. T. S. Arnott: Electricity as applied to Iron and Steel Works and Mines.

SOCIETY OF PUBLIC ANALYSTS AND OTHER ANALYTICAL CHEMISTS (at Chemical Society), at 8.—Dr. W. R. Schoeller and C. Jahn: Investigations into the Analytical Chemistry of Tantalum, Niobium, and their Mineral Associates. VI. The Precipitation of the Earth Acids by Sodium Compounds.—A. E. Parkes: A Simple Method of Testing for the Presence of Sulphites in Foods.—J. W. H. Johnson: A Critical Review of the Methods of Analysing Waters, Sewages, and Effluents, with Suggestions for their Improvement.

INSTITUTION OF CHEMICAL ENGINEERS (at Royal Society of Painters in Water Colour), at 8.30.—Annual Reception.

ROYAL MICROSCOPICAL SOCIETY (Biological Section).

THURSDAY, NOVEMBER 4.

ROYAL COLLEGE OF PHYSICIANS OF LONDON, at 5.—Dr. F. G. Crookshank: The Theory of Diagnosis (Bradshaw Lecture).

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Prof. G. Elliot Smith: The Significance of Anatomy (Thomas Vicary Lecture).

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—Sir T. W. Edgeworth David: Antarctic Exploration Past and Future (1).

CHILD-STUDY SOCIETY (at Royal Sanitary Institute), at 6.—Mrs. H. L. Holland: Religion and the Child.

INSTITUTION OF CIVIL ENGINEERS (Birmingham District Association) (at Chamber of Commerce, Birmingham), at 6.—H. H. Humphries: Chairman's Address.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—J. R. Beard and T. G. N. Haldane: The Design of City Distribution Systems, and the Problem of Standardisation.

INSTITUTION OF AUTOMOBILE ENGINEERS (jointly with Royal Aeronautical Society) (at Royal Society of Arts), at 7.—G. F. Mucklow: The Effect of Reduced Intake-Air Pressure and of Hydrogen on the Performance of the Slow-speed Solid Injection Engine.

SOCIETY OF CHEMICAL INDUSTRY (Bristol Section) (at Bristol University), at 7.30.—Dr. Bush: (Paper by).

CHEMICAL SOCIETY, at 8.—Dr. C. K. Ingold and P. G. Marshall: The Structure of the Benzene Nucleus. Part V. Some Meso-derivatives of Anthracene.—W. Wardlaw and R. L. Wormell: The Isomerism of Molybdenyl Monochloride.—R. F. Hunter: The Unsaturation of Heterocyclic Ring Systems. Part I. The Benzthiazole and 1:2 Dihydrobenzthiazole System.—R. F. Hunter and H. Morland: The Unsaturation of Heterocyclic Ring Systems. Part II. The 2-imino 4-keto Tetrahydrothiazole System.—G. M. Dyson, H. J. George and R. F. Hunter: The Inhibitory Effect of Substituents in Chemical Reactions. Part I. The Reactivity of the Nitrogen Atom in Substituted Arylamines.

INSTITUTE OF METALS (London Local Section) (at Royal School of Mines), at 8.—Dr. A. G. C. Gwyer: The Structure and Properties of the Aluminium-Silicon Alloys.

INSTITUTION OF MECHANICAL ENGINEERS (at Manchester).—H. L. Guy: The Value of Increased Steam Pressure for Power Generation.

FRIDAY, NOVEMBER 5.

ROYAL ASTRONOMICAL SOCIETY (Geophysical Discussion), at 5.—Capt. H. Shaw and E. Lancaster-Jones: The Eötvös Gravity Balance (Chairman—Sir Henry Lyons).

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—Prof. E. G. Coker: Elasticity and Plasticity (Thomas Hawksley Lecture).

SOCIETY OF CHEMICAL INDUSTRY (Manchester Section) (jointly with Manchester Sections of Institute of Chemistry and Society of Dyers and Colourists and Manchester Literary and Philosophical Society) (at Manchester), at 7.—Dr. L. Lilienfeldt: The Chemistry of Cellulose.

ROYAL PHOTOGRAPHIC SOCIETY (Pictorial Group), at 7.—J. G. Harper: (Address).

PHOTOMICROGRAPHIC SOCIETY (at 4 Fetter Lane), at 7.—Capt. J. W. Bampfylde: The Investigation of Failures in Steel Material.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (Graduate Section) (jointly with Institution of Electrical Engineers) (at Newcastle-upon-Tyne), at 7.15—A. Robinson: Recent Methods of Measurement.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—R. Lowe: Steel Castings and their Relation to Mechanical Engineering.

SATURDAY, NOVEMBER 6.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—Rev. E. M. Walker: The Study of History (1).

PUBLIC LECTURES.

SATURDAY, OCTOBER 30.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—Miss M. A. Murray: Seed-time and Harvest in Ancient Egypt.

SUNDAY, OCTOBER 31.

GUILDHOUSE (Eccleston Square), at 3.30.—Prof. H. H. Turner: The Fight against Fear.

MONDAY, NOVEMBER 1.

GRESHAM COLLEGE, at 6.—W. H. Wagstaff: Geometry. (Succeeding Lectures on November 2, 3, and 4.)

ROYAL SOCIETY OF ARTS, at 8.—Sir Robert Greig: Deficiency Diseases of Animals in Relation to Public Health (Chadwick Lecture).

WEDNESDAY, NOVEMBER 3.

ROYAL INSTITUTE OF PUBLIC HEALTH, at 4.—Dr. H. M. Vernon: Ventilation in Relation to Health.

THURSDAY, NOVEMBER 4.

KING'S COLLEGE, at 5.30.—J. E. Barnard: The Application of Microscopical Methods to Medical Research.

UNIVERSITY COLLEGE, at 5.30.—P. Hopkins: The Motivating of Conduct.

FRIDAY, NOVEMBER 5.

KING'S COLLEGE, at 5.30.—Prof. W. T. Gordon: Swiney Lectures on Geology. (Succeeding Lectures on November 8, 12, 15, 19, 22, 26, 29; December 3, 6, 10, and 13.)

SATURDAY, NOVEMBER 6.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—C. Daryll Forde: Weather Forecasts and the Weather.

SUNDAY, NOVEMBER 7.

GUILDHOUSE (Eccleston Square), at 3.30.—Dr. W. H. Eccles: The Influence of Wireless on Modern Life.

CONGRESSES.

OCTOBER 30.

REGIONAL SURVEY CONFERENCE (at Royal Society of Arts), at 10 A.M.

OCTOBER 30 TO NOVEMBER 11.

PAN-PACIFIC SCIENCE CONGRESS (at Tokyo).

NOVEMBER 4 TO 7.

JOURNÉES MÉDICALES DE MONTPELLIER (at Montpellier).

NOVEMBER 15 TO 18.

INTERNATIONAL CONFERENCE ON BITUMINOUS COAL: New Developments in Utilisation (at Pittsburgh).—Dr. F. Bergius: The Transformation of Coal into Oil by Means of Hydrogenation.—Prof. F. Fischer: Liquid Fuel from Water Gas.—Dr. C. H. Lander: The Present Status of Low Temperature Distillation of Coal in England.—Dr. R. Lessing: Coal and its Mineral Matter.—G. M. Gill: English Developments in Carbonisation of Coal in Gas Works.—H. Neilsen: The L. and N. Process.—General G. Patart: The Production of Methyl Alcohol from Coal.—M. R. Campbell: Our Coal Supply, its Quantity, Quality, and Distribution.—A. C. Fieldner: The Practical Value of Fundamental Research on Coal.—J. M. Weiss: Coal Tar Disposal.—C. J. Ramsburg: A Continuous Water Gas Generator.—Prof. S. W. Parr: Fundamental Studies on Coal as Related to Carbonisation Problems.—C. V. McIntyre: Development in Low Temperature Distillation of Coal at Fairmont, W. Va.—W. E. Trent: Some New Uses for Pulverised Coal.—Dr. W. H. Fulweiler: Utilisation of Bituminous Coal in the Manufacture of Water Gas.—Dr. H. C. Porter: Economic Aspects of the Pre-treatment of Coal for Smokeless Fuel.—H. Kreisinger: Powdered Fuel for Power Purposes.—R. M. Crawford: The Recovery of Phenols from Fuel Tars.—H. A. Brassert: Utilisation of Heat in Modern Steel Plants.—Dr. L. C. Jones: Coal in Relation to the Production of Fixed Nitrogen.—O. P. Hood: Smokeless Fuel.—Dr. W. P. Runge: The McEwen-Runge Process for the Low Temperature Distillation of Coal.—S. R. Church: The Utilisation of Coal Tar Products.—E. Piron: The Piron Coal Distillation Process.—O. Monnett: The Smoke Problem of Cities.—I. F. Laucks: The Greene-Laucks Process.