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The National Museums and Education.[1]

TO-DAY, as at no past period in the history of the museums of Great Britain, active and enlightened minds are applying themselves to review the accomplishments of these institutions and to devise means for their greater participation in the life of the nation. In endeavouring to interpret the 'new museum outlook' which loomed through this outburst of interest, we alluded in a leading article in NATURE (June 29, 1928) to a museum feeling in the air. Fresh and welcome evidence of this spirit is afforded by Part 1 of the Final Report of the Royal Commission on National Museums and Galleries, to which references have already been made in our columns.

The whole field of museum activity in Great Britain has now been covered. The Carnegie United Kingdom Trustees, through Sir Henry Miers, surveyed the land of the provincial museums, and they found a desert, brightened, it is true, by occasional oases, but nevertheless an arid country which could be made fruitful only by an infinitely patient and plenteous irrigation, some of the streams whereof must be of pure gold. The Royal Commission, facing another quarter, has looked upon the great institutions where are housed the nation's treasures, and although barrenness is here replaced by a certain amount of jungle growth—for the golden streams have been running steadily if not copiously for many years—yet here also is envisaged in the near distance a land of promise towards which the museums must strive.

This section of the Final Report embodies the general conclusions and recommendations of the Commissioners; a second section to be issued at an early date will contain the findings relating to individual institutions. While the latter, therefore, will fix the milestones along the highway of museum progress, to the former we look for the finger-posts pointing the general direction of advance and indicating the objective of the museum body as a whole. Three big problems are involved in any forward movement—the inter-relationship between the national museums and galleries themselves, the relationship of the national institutions to similar provincial bodies, and the share to be taken by the national institutions in education. This last lies at the very heart of the matter, and its proper solution can be the only means of

[1] Royal Commission on National Museums and Galleries. Final Report, Part 1: General Conclusions and Recommendations, dated 20 September 1929. (Cmd. 3401.) Pp. 93. (London: H.M. Stationery Office, 1929.) 2s. net.

enabling the museums to play their due part in the life of the nation.

That lack of vision of the educational possibilities of museums and galleries which appears to be characteristic of British administration is painfully evident in the terms of reference set for the guidance of the Commission. Education is mentioned there only once, and with a negative emphasis which does not make for encouragement —"to consider in what way, if any, expenditure may be limited without crippling the educational and general usefulness of the Institutions"—and not in all the eight instructions is there a word to suggest that in the possibility of creating new contacts with childhood, youth, and manhood, might be a field worthy of the closest inquiry.

The Commission, however, has been bolder than its mandate, and appreciating that "the National Museums and Galleries are *essentially educational institutions*", makes many suggestions the adoption of which would add to the teaching efficiency of the institutions. It cannot be said, however, that the attainment even of these suggestions will bring the educational facilities of British museums within measurable distance of those already in full force in the museums of the United States of America, to which we have made favourable reference again and again in the pages of NATURE. To take one example: the report, in recording certain outstanding deficiencies in the national museum service of Great Britain, suggests the creation of a museum of ethnography, a museum of casts, a folk museum, and an Oriental museum, but there is no hint of a prospective children's museum, such as that which has been so successfully developed at Brooklyn, New York. Yet it is obviously unfair to expect children, though they do their best, to grapple with exhibits arranged and labelled for adults.

Part of the present-day deficiency in the educational organisation of museums and the like is undoubtedly due to that lack of vision which is apparent in the terms of reference. Whilst the stock educational bodies have advanced relatively by leaps and bounds, the museums stand still. The report reveals the insufficiency with unanswerable statistics:

"For the last twenty-five years, the development of the National Institutions measured in terms of State support has advanced hardly at all as compared with the development of elementary education, secondary education, or university education. The exchequer expenditure in respect of these three forms of education in England and Wales has in this period increased approximately as follows: elementary education threefold: secondary education and technical education eightfold: university education nineteenfold. In the case of National Museums and galleries expenditure has increased twofold: in other words, taking account of the change in the value of money, it has almost stood still. . . . It seems to us that so great a disparity is an indication not only of a lack of appreciation of the purpose of these Institutions, but of a definite defect in the relations between them on the one side and governmental authority on the other."

To three main lines of development the Commissioners look for increased efficacy in the spread of knowledge: the enlargement in scope and improvement in quality of circulating collections, the more effective display of exhibits, and improved methods of contact with the public. We cannot follow here the recommendations in detail, but we note that while the further development of the loan system of the Victoria and Albert Circulation Collection to schools of art, secondary schools, and training colleges is contemplated, no suggestion is made of participation in these great privileges by elementary schools, although the success of the system organised by the great American museums rests on this lowly basis. Nor is it quite clear that natural history material is to be included in the enlarged Victoria and Albert central circulating agency, though experience elsewhere has shown that the circulation of life-histories and natural groups of common creatures and plants is perhaps the best appreciated of all the activities of museums in relation to school work, and although the Commission views with favour the ultimate circulation of natural history and other scientific objects.

It need scarcely be said that much could be done in existing space to improve the appeal and the teaching quality of exhibits. We are reminded of the comment of a young German friend, familiar with the Deutsches Museum in Munich and the other great German institutions, who after a visit to London a month ago, remarked that one of the leading museums there was more like an antique shop than a museum.

A great future lies in the tightening up of contact with the people. Better publicity, publications with a popular appeal, the development of the guide-lecturer system, lecture theatres and evening lectures, are some of the most obvious methods. The report passes lightly over the question of the inadequacy of the present staffs of the national institutions to carry out the many reforms that are foreshadowed and are indeed long overdue. It suggests the appointment in the larger institu-

tions of a whole-time officer whose duty it would be to keep contact between the public and officials. We doubt if this step, progressive though it is, would meet the case, and we look further to a closer *rapprochement* between education authorities and museums, and the consequent delegation of teachers wholly set aside for the conduct of school classes in museums, for the foundation of that close contact which alone can bring the nation's treasure-houses of art and science adequately into the educational life of the day.

Aviation and the Future.

The World, the Air and the Future. By Comdr. Sir Charles Dennistoun Burney. Pp. xxiv + 356 + 24 plates. (London: Alfred A. Knopf, 1929.) 21*s*.

THE vast significance of air transport to civilisation in general and to the British Empire in particular has as yet been appreciated by comparatively few. That Britain, which of all nations is the one most called upon to lead the way in the use of this wonderful instrument for linking the world together in peace and prosperity, should have fallen so far behind others, in particular the United States and Germany, in civil aviation developments as to be no better than third-rate, is little short of a tragedy.

Those who have realised this regrettable state of affairs have impatiently awaited a book that would enable the thinking man to appreciate the deep significance of air transportation for us in the progress of mankind. It is to Commander Sir Dennis Burney that we are indebted for the first real attempt to write such a book. The subject is big and contains many difficult problems, but, although some of his arguments and assertions may be subject to criticism, the main principles, propounded with marked sincerity and courage, may be expected to survive.

To all men, especially to men of science and men of commerce, it is increased *speed of communication*, whether by personal contact or by written document, that is daily in greater demand. It makes co-operation more effective and increases efficiency by enabling more work to be done in a given period of time, quicker contact to be established with minds in distant lands, and a better use to be made of leisure time. Air transportation, whether we like it or not, has arrived to impart this acceleration to our lives.

At present, aviation is in its infancy and its teething troubles must be recognised as such. It is as ridiculous to point to the present limitations of aircraft and their operations and to the relatively high cost of air travel as an argument that they cannot be of any commercial use, as to say that a child which cannot work efficiently and pay its own way will never do so. There is a tendency to ignore the fact that there already exist air services which, due to special conditions, pay their way handsomely, and each day progress is made towards the establishment of economically run services where conditions are not so favourable.

The construction and mechanism of aircraft require the attainment of the highest perfection, and therefore their successful economic development will depend to an exceptional extent on the application of the results of the research work at present occupying the attention of several branches of science. It thus appears probable that the attainment, not perhaps of vastly higher speeds, but at least of the greater efficiency we require, is likely to be a very rapid process.

Just as the coming of the steamship, the railway, and the motor-car completely changed the life of each nation into which they intruded, so will aircraft entirely change the character and mode of life of the world. Whereas in the past the units influenced have been separate nations, in the future there will be but one unit—the world. Aircraft, in other words, will, by the nature of the operations, render all obstacles to free movement about the world at a speed of 100 m.p.h. or more, so objectionable, that the force of international public opinion will sweep aside all national barriers and other man-made obstructions. Aircraft "are going to create the conditions of their own development. Indirectly, and without altogether realising it, they will dictate policies, transform issues, solve old problems in a new way, and bring important new changes into the psychological structure of human society."

Can we possibly doubt the far-reaching effect this will have on the human race? On the contrary, it is clear that we are indeed witnessing the beginning of a new phase in our evolution. It is perhaps prophetic that at a time when the world is struggling to free itself from the tangles of numerous man-made restrictions which prevent humanity moving on to a higher plane, this mode of locomotion in that free, universal medium, the air, should have appeared to aid it. Flight implies something more than an extra rapid means of transport; it implies a new framework in the mind, a new mental outlook affecting all our thoughts and activities.

No one who reads this book by Sir Dennis Burney can fail to recognise this new outlook. The mental shock experienced by the realisation of the great changes that are impending will be stimulating or unpleasant according to the temperament of the percipient. It may be said that the change from surface transport to air travel is as big a leap, when considered in its psychological effect on the ordinary man, as that which the mathematician faced in the acceptance of Einstein's theory of relativity. In each case a dimension has been forced on the attention of unwilling recipients in a manner extremely disturbing to complacent minds.

The remarkable thing about aviation is that it contains such vast potentialities for the solution of each of four of the most vital problems we have to face to-day, namely :

(1) *Commercial Efficiency.*—The saving of time over long distances enables a business man, his correspondence, his samples, his contracts, and his money to act more quickly and go farther afield. Air transport will therefore be of prime importance to commercial prosperity.

(2) *Empire Development.*—The ability of aircraft to cover ground quickly enables even difficult countries to be easily and quickly surveyed and exploited, enables large areas to be efficiently inspected and controlled at low cost, and keeps the pioneer workers at the outposts of the Empire within easy reach of civilisation.

(3) *Imperial Solidarity and Security.* — The essential for all work of Imperial co-operation, both in peace and war, is rapid and efficient co-ordination and intercommunication. Air transport, by minimising large distances (in terms of travelling time), will draw the Empire together and thereby secure a better understanding and increased co-operation. Moreover, effective Imperial defence at present depends primarily on the security of England, and that is essentially an air matter and requires an air-active nation to support it.

(4) *International Peace.*—The ultimate establishment of a peace psychology throughout the world rests on the attainment of a better understanding between the peoples of the different nations and on the recognition of mutual cultural values. Only by a greatly increased intermixing and intercommunication of the peoples can this be brought about. Air transport, by its international nature, and by its impatience of all obstacles that prevent rapid travel, will assuredly achieve this in the end.

Sir Dennis Burney has a great deal to say about all these subjects in the first four chapters of his book. The problems of Imperial defence are dealt with at great length, and he shows that, although in the main they are naval problems, the defence of Great Britain is an air problem. Not only, therefore, is a complete re-orientation of naval policy required, but also a reserve of civil pilots and of aircraft manufacturing power as an essential support for our small air force. Such an economic reserve can only be built up by the expansion of civil aviation both at home and in the Empire.

Sir Dennis makes no demands for increased armaments ; on the contrary, the chapter on international peace is a strong plea for an organised move towards peace and for the exploitation of this inherent ability of air transportation to bring nations together. In the end, aviation must be made international, and will thus help to ensure the peace of the world.

The second half of the book is devoted to a discussion of the technical capacities of different kinds of aircraft and their probable future development. In Sir Dennis's view, the airship will be the vessel for trans-oceanic flights, while the flying boat already shows great promise for long-distance coastal routes and is capable of development to a far greater size than the aeroplane.

The chapter on airships, which received undue prominence in the daily Press, will naturally be of interest to all readers. It was never claimed that *R100* and *R101* would be anything but experimental, and already it appears that the expenditure on this experiment, in view of its Imperial importance, has been justified by the knowledge gained. Sir Dennis Burney admits that he has changed his mind regarding certain aspects of the airship problem, that he underrated the difficulty of handling and mooring such large ships, and that for commercial operation a higher cruising speed, namely, 90 m.p.h., is essential. He offers, however, ingenious solutions for the problems : first, a mechanically operated mooring and docking raft ; and secondly, the use of fuel-gas engines more efficiently disposed on the ship. He also advances a completely new solution in his proposed elliptical airship, which he claims would be capable of landing on any sheltered waters and of mooring like a marine vessel.

The book concludes with a chapter of constructive proposals for the international organisation of flying and for Empire air development. A revision is suggested of the Imperial defence policy which will save such a sum that £10,000,000 could easily be set aside annually and devoted to the adequate expansion of civil aviation.

The reader may ask, What is the standing of Great Britain and the Empire in the air developments of to-day? The answer is that while our men of science and our craftsmen have left us technically unsurpassed, we occupy an altogether inferior position in the air commerce of the world. We have lost aircraft markets we might have obtained, and the development of our Imperial and international air routes, though sound, has been so hopelessly slow that in the amount of scheduled commercial flying we stand to-day no better than a bad fourth on the list; the United States, Germany, France, and possibly Russia, are more active than we. These nations pay large subsidies, either directly or by mail contracts, in order to develop and secure in advance a stake in the great future that is coming to aviation. Great Britain, the transport nation of the world, spends a negligible amount on this new form of transport, and is thus failing to secure her share of what is destined to be more vital to her than to any nation in the world.

There is great work to be done in rousing the nation to a realisation of the great world-wide opportunity it is neglecting, and of the fact that the future security, prosperity, and prestige of the Empire is being jeopardised by our apathy. It is a hopeful fact that there is a body at work to bring this knowledge to the people, namely, the Air League of the British Empire (Astor House, Aldwych, London, W.C.2).

Sir Dennis Burney is to be congratulated on completing so successfully a pioneer book, a book of vision, on matters of such vital significance to us all. It cannot fail to interest everyone who wishes to see the British Empire retain a leading part in the progress of human evolution. G. MERTON.

Persuasion and Belief.

Phantom Walls. By Sir Oliver Lodge. Pp. 251. (London: Hodder and Stoughton, Ltd., 1929.) 5*s*. net.

THIS volume is a sketch of Sir Oliver Lodge's well-known theories concerning the universe, man, survival, and immortality. There would not appear to be anything new in his treatment of these matters in the present work; rather is it intended for a different type of audience. For on examination, it seems that the book is primarily put forward as a persuasive essay to be read by those who, for whatever cause, are forsaking organised religions and embarking independently in their quest for truth. As a handbook of spiritualism for the bereaved person or for the perplexed cleric the book is admirable; as an exposition of the same theme for the unemotional and critical man of science, it is not altogether convincing.

Sir Oliver sets out by remarking upon the gradual secession of educated people from the churches, but "the instinct for worship" which he believes man to possess prevents him from becoming altogether divorced from spiritual realities. Hence, if through spiritualistic manifestations it can be shown that man survives bodily death, then the instinct for worship can be given full play, fortified by the assurance that the saints and great men of the past still live and still struggle for the elevation of the race, although, like ourselves, subject to a Higher Power which "guides humanity in some far seen and hopeful direction".

Now Sir Oliver has received, it seems, indubitable proof of the persistent continuity of individual personal existence. Therefore it behoves him to explain to those who have not been granted this knowledge how the fact of survival can be reconciled with physics and psychology, with biology and evolution. The first thing to understand is that the brain is merely the organ of the mind. Thought is no more in the brain than music is in the violin. The mind cannot be damaged by a brick-bat: only the instrument through which it manifests can thus be destroyed.

This hypothesis opens up the attractive idea that minds can manifest themselves when they possess the appropriate instruments. On earth they make use of material brains, and then only for a short time; but, according to Sir Oliver, the earth life is an exceptional thing. We are spirits temporarily incarcerated in matter and we are more at home in the spirit world than we are here (p. 100). Moreover, even imprisoned as we are in matter, the reality of the spirit world is often borne in upon us. Such phenomena as veridical dreams, 'direct' voices, premonitions, and trance lucidity are indications of its existence, and the so-called cross correspondences are full of almost incontrovertible evidence. Personality survives bodily death: the mind functions by means of another instrument after the brain has long crumbled to dust. This theory of *personal* survival relieves us of having to accept the idea that all living things survive and permits us at the same time to grant survival to domesticated pets and other creatures which exhibit signs of conscious striving for unrealised ends (p. 75). Indeed, the chance of survival appears to depend upon the growth of the neopallium through which those elements may function which are worthy of a continued existence.

It is true that Sir Oliver sees a few of the difficulties in the way of accepting his theories of man's destiny. But the new outlook in physics is in no wise antagonistic. Science, it seems, is becoming idealistic and bio-physics is beginning to investigate the interaction of life and matter. Indeed, simple ideas are tending to clarify what were at one time momentous problems. Such questions as those concerning prayer and miracles can best be understood by an argument from the lower animals. To the cat which wants the door opened, the man who obliges is a higher being; and we are able to perform similar services to bees and birds when trapped in closed rooms. Difficulties vanish when one thinks of them as the lower and ourselves as the higher beings.

The spiritistic hypothesis solves many of the difficulties of man's life and ultimate destiny. Undoubtedly, as Sir Oliver points out, it is somewhat hard to formulate in a precise and scientific manner. It is, he says, "an appeal to the activity of unknown agents, acting by unknown methods, under conditions of which we have no experience, and by means of which we are unaware" (p. 209). Indeed, it does not sound very hopeful—or helpful.

A Bibliography of Applied Science.

Mededeelingen van het Nederlandsch Instituut voor Documentatie en Registratuur. No. 6, 1928, 10/12. Pp. 2073-2249. (Amsterdam: Nederlandsch Instituut voor Efficiency, 1929.) Bimonthly, £2 10*s*. a year.

THIS unassuming but extremely valuable publication is the descendant of the "Index of the Technical Press" which was commenced in 1903 by the International Institute of Bibliography at Brussels to supply the need for a comprehensive bibliography of applied science. The "International Catalogue of Scientific Literature" had recently been started on the domain of pure science, and the "Index of the Technical Press" was intended to cover the ground on the applied side. Afterwards the title was changed to "Revue de l'Ingénieur et Index technique". The present publication was commenced in 1922 by the Dutch Institute of Documentation under the auspices of the Institute.

The series from 1903 to the present date is the only comprehensive bibliography devoted to the various aspects of the application of science to industry, and is undoubtedly of the greatest value as an index to the literature of applied science. The current volumes contain some sixteen thousand entries a year and relate to such subjects as hygiene, testing materials, steam engineering, electrotechnics, electric generation and transmisson, telegraphy, radio communication, mechanical engineering, civil engineering, railways, hydraulic engineering, transport, aviation, agriculture, industrial organisation, chemical technology, fuels, gas and oil technology, mining, heating and lighting, ceramic industries, dye manufacture, paints and varnishes, metallurgy, paper making, textile industries, rubber industries, building construction, photography, etc.

The entries are printed in type script in two columns on one side of pages of quarto size and classified by the Universal Decimal Classification of the International Institute of Bibliography, which is now rapidly coming into use as standard international classification. In addition to the classification numbers, which are printed at the beginning of each entry, the names of the main classes are printed at the heads of the pages, so that, by looking through the headings, a clue to the entries on a particular topic may be obtained without consulting the tables of the classification. As a further convenience, a dotted line is printed at the end of the entries in each class. This makes it unnecessary to read the classification number at the head of each reference, when once the appropriate division has been found. It is intended that the bibliography should be cut up, mounted on cards, and filed in arithmetical order of the classification numbers, so as to form a cumulative bibliography, in which all the references relating to a single subject fall together automatically as received. As, however, the pages are issued in loose leaf form, it is possible to file them, as received, in a single series under the classification number of the first entry on each page. This will serve to bring the entries on each subject fairly closely together.

The bibliography is really indispensable to scientific investigators, research associations, and all who need a ready means of gaining access to the literature of a technical subject. It is particularly useful to those who adopt the Decimal Classification for their own subject-matter indexes, as the mounted references fall naturally into place with all references classified on the same system, and in this way a very comprehensive bibliography of a special subject can be built up.

It is unfortunate that the printing is poor. This is due to lack of support in the past. But, as the bibliography attains a larger circulation, it will be possible to improve the style. S. C. BRADFORD.

Our Bookshelf.

(1) *Die Arithmetik in strenger Begründung.* Von Prof. Otto Hölder. Zweite Auflage. Pp. v + 73. (Berlin: Julius Springer, 1929.) 3·60 gold marks.

(2) *Theory and Application of Infinite Series.* By Prof. Dr. Konrad Knopp. Translated from the second German edition by Miss R. C. Young. Pp. xii + 571. (London and Glasgow: Blackie and Son, Ltd., 1928.) 30*s.* net.

(1) THIS little book gives a method of basing the theory of arithmetic on the properties of finite aggregates and on Dedekind's section. Prof. Hölder holds the view that an arithmetic founded solely on postulates and axioms must be insufficient, since even in this case series of operations must be counted.

(2) Prof. Knopp's book is beautifully printed and arranged. Of the three parts into which it is divided, the first begins with the theory of real numbers, the starting-point being an assumption of a knowledge of Hölder's arithmetic of rational numbers. From this point, Dedekind's theory of irrational numbers and the notion of convergent sequences are introduced. The second part discusses the foundations of the theory of infinite series, and the third part proceeds to modern developments. Here the author gives many valuable chapters, including an illuminating discussion of Fourier series. Chapter xiii. contains a very useful digest of methods for associating the notion of 'sum' with divergent series. Chapter xiv. on Euler's summation formula and asymptotic expansions has been specially written for the English edition. The author's aim has been especially to help the private student, and to this end many explanations of difficult points and apt illustrations have been included. The translation has been well done and there is an easy flow of the language.

In both the above books Dedekind's theory of irrational numbers has been adopted, presumably because of the uniqueness of their representation. But Cantor's theory lends itself more naturally to a simple detailed treatment, and, being fundamentally equivalent to Dedekind's theory, might with advantage have been used. L. M. M.-T.

Geologie von Perú. Von G. Steinmann. Mit Beiträgen von R. Stappenbeck: *Nutzstoffe*; F. Sieberg: *Erdbeben*; C. Lissón: *Geologische Karte.* Pp. xii + 448 + 9 tafeln. (Heidelberg: Carl Winters Universitätsbuchhandlung, 1929.) 28 marks.

THIS work by the veteran Prof. G. Steinmann gives an excellent summary of what is at present known of the geology of Peru. Unlike Bolivia, Chile, Colombia, and Venezuela, which were visited in the first half of the nineteenth century by D'Orbigny, Darwin, and Humboldt respectively, scarcely any investigations into the geology of Peru were made before the work of Raimondi, whose first publication appeared in 1862. The bibliography now given by Steinmann extends to 22 pages, but owing to the extent of the country and its climatic and physical characters, vast tracts are still unknown or almost unknown geologically. Much of the knowledge we have is due directly or indirectly to the work of geologists who have been primarily concerned with the investigation of the mineral resources (gold, silver, zinc, copper, quicksilver, iron, nickel, cobalt, wolfram, antimony, petroleum, coal, etc.).

The account of the stratigraphy, tectonics, and geological history occupies nearly three-quarters of the book, and is followed by a section on the mineral resources by R. Stappenbeck, and an account of the earthquakes of Peru by A. Sieberg. The geological record begins with the Archæan crystalline rocks, followed by the pre-Cambrian phyllites, the Middle and Upper Ordovician, the Lower Devonian, the Upper Carboniferous and Permian, the Trias, Jurassic, Cretaceous, Eocene, Miocene, Quaternary. The chief breaks in the succession are (1) between the Archæan and the phyllites, (2) during the whole of the Cambrian and probably Lower Ordovician, (3) during the Middle and Upper Devonian and Lower Carboniferous, and (4) between the Chalk and the Middle Eocene. The work is illustrated with numerous sections, and with reproductions of published figures of characteristic fossils. The map of the Cordillera, showing the distribution of the formations so far as known, has been prepared by Steinmann and Lissón.

A Treatise on Pharmaceutical Chemistry: embracing certain Special Topics of Analytical, Organic and Physical Chemistry as they are related to Pharmacy. By Dr. John C. Krantz, Jr. Pp. 282. (London: Henry Kimpton, 1928.) 15*s.* net.

IN this volume the author has selected certain subjects for special consideration. The work is divided into three parts: in the first, the quantitative estimation of certain inorganic elements, of pharmaceutical importance, either as remedies or impurities, is discussed; the actual methods are not always given in detail, but reference is made to the U.S. Pharmacopœia. The method and its theoretical implications are then submitted to discussion. The section is intended to serve as an illustration of the importance of quantitative methods for pharmacists. The second part is devoted to a consideration of the structure and methods of preparation of a number of complex organic compounds used in medicine, such as the hypnotics, local anæsthetics, antipyretics and bactericides, including the organic arsenicals. This section is useful for quick reference to the formulæ of a number of substances which are in everyday use. In the third part, there is a theoretical consideration, accompanied by illustrative experiments, of certain aspects of physical chemistry.

On the whole, this can be considered an advanced text-book, probably of greater value to the pharmaceutical research worker than to the student. For readers in Great Britain it suffers from the disadvantage that the possession of the U.S. Pharmacopœia is an essential prelude to its use. On the

other hand, the second and third sections should be of value to chemists and pharmacologists as well as to pharmacists.

Paleontology. By Prof. Edward Wilber Berry. Pp. xii + 392. (New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd., 1929.) 17*s.* 6*d.* net.

THE author, in his preface, describes the scope and intention of this book, which is to lay emphasis on one hand on the evolutionary story that the study of palæontology tells us, and on the other to illustrate the adaptation of animals to their environment. The author further states that his purpose is "to interest rather than to repel the beginner—a pedagogical principle all too frequently ignored". In these aims he appears largely to succeed, and the book compares well with others of its class. Naturally, in a book which deals with the whole of palæontology from Protozoa to man in 364 pages, there must be either compression or omission, and the second alternative has wisely been chosen, with the result that the reader, who is supposed to be a beginner, is at all events saved from mental indigestion.

Of the figures and diagrams, a good proportion, especially in the chapters on invertebrates, are the author's own, are refreshingly new, and remind the reader that extinct animals were once alive. In the various tables of affinity and descent a cautious position is held. Here and there a captious critic will find that the author has not always been able to keep up with the flood of recent discovery, but from some slips and errors no writer of a text-book can hope to be free, and there is none that prevents the book from being recommended to a student as a jumping-off ground to larger and more detailed works.

Trailing the Giant Panda. By Theodore Roosevelt and Kermit Roosevelt. Pp. xi + 278 + 33 plates. (New York and London: Charles Scribner's Sons, 1929.) 16*s.* net.

THE giant panda (*Æluropus melanoleucus*) is rather like a bear, with black spectacles, saddle, forearm, and quarters of dark brown, and the rest of the body white. He lives in steep bamboo jungle, on which he feeds, sleeps in a hollow tree, and ranks as a sahib because he does not cry when shot. No civilised man had ever seen him alive until the present authors tracked down an old male, with fatal results for the panda. Scarcely better known is the takin (*Budocras taxicolor*), half goat, half antelope. Very rare is the golden monkey. These and other rare species were the quest in a successful expedition, by the Bhamo route from Burma into the Chinese provinces of Yünnan and Szechuan, penetrating a wild region to northward of the Yangtze-kiang and leaving by way of Indo-China, a journey of about two thousand miles.

Among the numerous and excellent photographs is one of Mt. Koonka, mapped here by some optimist as thirty thousand feet high, pending more careful survey. The country as a whole, however, is unsurveyed, large parts of it unexplored by Europeans, although inhabited to the last possible limits of saturation, partly by Chinese, but mainly by semi-independent tribes, not always cordial to visitors. The present work deals mainly with the adventure, but contains a great deal of interesting material, while the scientific staff, collecting for the Field Museum at Chicago, will doubtless publish their results through the usual channels.

The Biochemistry of the Amino Acids. By Prof. H. H. Mitchell and T. S. Hamilton. (American Chemical Society Monograph Series, No. 48.) Pp. 619. (New York: The Chemical Catalog Co., Inc., 1929.) 9.50 dollars.

IN this monograph the authors have given a detailed account of the chemistry and physiology of the amino-acids, their preparation, determination and properties, and the part they play in metabolism and nutrition. They have examined the available evidence very critically, more especially in the physiological chapters, so that the work forms a very useful review of our present knowledge. The fact that the monograph is of the size of many text-books of physiology indicates the extent of the literature dealt with. The chemical chapters account for about one-third of the volume: the remaining two-thirds give an up-to-date account of the digestion of the proteins and the absorption of their constituent amino-acids, the catabolism of these compounds and their relationships with carbohydrate and fat metabolism, the breakdown of the individual amino-acids being considered in detail. Finally, there are chapters on their specific dynamic action, on the catabolism of tissue protein, and on the nutritive values of proteins and the protein values of foods in nutrition. The book will be of great use as a work of reference by research workers, and also to all advanced students of biochemistry and physiology.

A Challenge to Neurasthenia. By Doris Mary Armitage. Pp. 52. (London: Williams and Norgate, Ltd., 1929.) 5*s.* net.

THIS book is principally an appreciation of the late Dr. L. S. Barnes. It describes his attitude to neurasthenia and his method of treating the neurasthenic, which appears to have been by the application of his own strong personality in encouragement, coupled with an appeal to the patient's intelligence. Apart from the statement that Dr. Barnes considered all neurasthenic troubles to originate in fear, there is no indication of what he considered to be the etiology of functional nervous disorders. This defect, and a lack of detail regarding the line of treatment, will hamper other physicians attempting to follow the same method of psycho-therapy. The book does, however, encourage doctors to pay serious attention to the neurasthenic, and provided the tendency to regard the subconscious mind as a sort of separate personality is not taken too literally, it will also encourage patients to believe that neuroses are susceptible to treatment. It is a matter for regret that Dr. Barnes did not live to publish his own views on psycho-pathology and psycho-therapy.

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 Earthquake South of Newfoundland and Submarine Canyons.

THE powerful earthquake south of Newfoundland which, on Nov. 18 and 19, broke eleven submarine cables in at least twenty-three places and devastated the southern coast of Newfoundland, promises important evidence as to the nature of the submarine canyons off the Atlantic coast of Canada and the United States. The earthquake was obviously of the highest order of intensity at its centre, for it overthrew chimneys, and was therefore of the order of over No. 7 on the Rossi-Forel scale in the towns of Nova Scotia, more than 400 miles from its origin, and it occasioned a tsunami or earthquake wave, which drowned 26 people on the Burin Peninsula in Newfoundland, did extensive damage to property, and in places swept inland to the height of 100 feet.

The accompanying sketch map (Fig. 1), based on one kindly supplied by Mr. L. Robinson of the Western Union Telegraph Co., and on a list of seven breaks on the cables of the Commercial Cable Co., by Mr. R. J. Hughes, shows that the breaks are mainly in two roughly parallel lines in continuation of the trough-like valley, in places 285 fathoms deep, through Cabot Strait. The lines are not fully straight: but as the positions of the fractures are based on tests from the shore-ends, they may not be exact, as they may be displaced by strains or injuries to the cable outside the main fractures.

Eleven of the twelve damaged cables have two fractures apiece, at the distance of usually from 80 miles to 150 miles apart. The positions are roughly in two lines, which continue the straight steep side of the trough of Cabot Strait. That trough is up to 285 fathoms deep and trends from north-west to south-east. The earthquake appears to have been due to a renewed subsidence on the submarine southern continuation of Cabot Strait, though the trend bends to south-south-east. The depths along the middle of this sunken bend were 1750, 2332, 2680, 3450, and 2934 fathoms, and the depth is usually hundreds of fathoms greater than in the area on either side. The earthquake is probably due to a fresh subsidence of the floor of this submarine rift valley.

The new evidence throws light on the nature of the famous submarine canyon of the Hudson River off New York, which makes a notch in the 100 fathom line by a depression 2400 feet deep. The buried channel inland is known to be in places bounded by faults.

The St. Lawrence Valley has been interpreted as a strip sunk between parallel faults by Mgr. Laflamme (*Trans. R. Soc. Canada*, ser. 3, vol. 1, 1908). Its tributary, the Saguenay fiord, the site of the powerful earthquake of February 1925, the latest of the violent shocks of the Charleston—New England—St. Lawrence series, is probably due to subsidence as its bed is in places 140 fathoms below sea-level. It trends approximately east and west in line with the pivotal line across Newfoundland.

Such submarine canyons have been attributed to four processes: to excavation by rivers when the land stood thousands of feet higher than at present; to the power of glaciers to excavate troughs deep below sea-level; to the accumulation of sheets of sediment on either side of a channel kept clear by currents, as suggested by Darwin for the canyons of the Blue Mountains in New South Wales, and by J. Y. Buchanan for the submarine canyon off the Congo. The fourth explanation is that they, like fiords, are due to the subsidence of strips of land along faults; that conclusion, advanced in "The Nature and Origin of Fiords" (1913) appears strongly supported by the evidence of this new earthquake, which in this case has not enjoyed

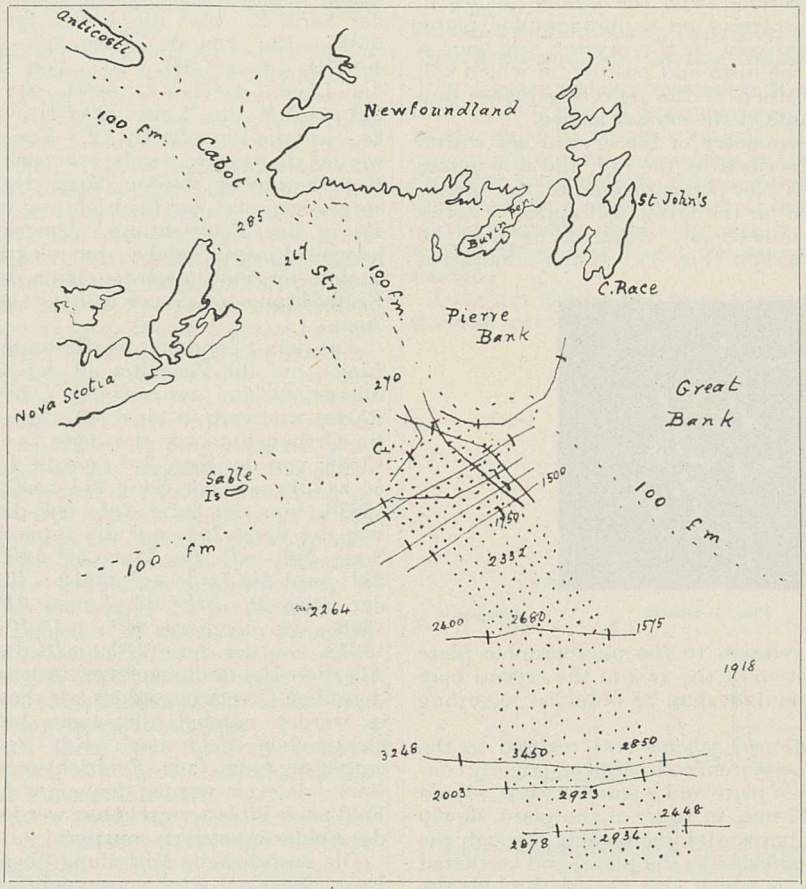

FIG. 1.—Sketch map of the Cabot Strait earthquake, Nov. 18–19, 1929.

The thin lines represent the twelve broken cables: the cross bars the approximate positions of twenty-three fractures.
The dotted area represents the probable foundered band in continuation of the Cabot Strait.
⊥ Approximate position of the *Caledonia* when violently shaken by the earthquake.
The devastation on the coast of Newfoundland was mainly near the Burin Peninsula.
Depths in fathoms.

the comparative harmlessness of submarine disturbances as it lies across the main series of trans-Atlantic cables.

The re-sounding of the ocean around the epicentral area of the Cabot Channel earthquake may be expected to reveal instructive changes in depth.

J. W. GREGORY.

4 Park Quadrant, Glasgow, C.3.

Method of Determining the Position of the Symmetry Axis of a Crystal by means of X-Rays.

A NARROW beam of X-rays, passing through the same point of a thin plate of a crystal, and moving in such a way that it successively occupies all the possible positions within a definite solid angle, will have Bragg's reflections from the atomic planes in the crystal. Their traces on a photographic plate, which is fixed relatively to the crystal, will give a sequence of lines the form and position of which will depend on the position of the reflecting planes and also on the constants of the crystal lattice.

If the axis of symmetry of the crystal lies within the space angle described by the ray, and if it makes a small angle with the perpendicular to the photographic plate, then on the latter will appear a series of hyperbolæ, symmetrically situated, as may be seen on the photograph (Fig. 1). If the orientation

FIG. 1.—Quartz.

of the crystal in relation to the photographic plate is known, the position of the axis in the crystal may be found, and some data may be obtained regarding its structure.

The above-mentioned scheme was realised in the following manner: a system consisting of a rigidly connected photographic plate and a small crystal, placed at a distance of 17 mm. in front of the plate, slowly rotated round the horizontal line passing through the crystal and perpendicular to the plate, and oscillated round a vertical axis which also passed through the crystal intersecting the first one. A horizontal beam of rays emitted by the target of a Röntgen tube passes through a pin-hole placed close before the crystal, through the point of intersection of both axes of rotation, and then is stopped by a small fixed screen situated in front of the photographic plate. This screen prevents the blackening of the plate by the undeflected beam and thus only reflected rays strike the plate and give the above-mentioned picture. The diagrams thus obtained are equivalent to the '*P*-patterns' with an electron beam described by Kikuchi (*Japanese Journal of Physics*, vol. 5, No. 2).

It is obvious that the same picture will be obtained by means of a wide cone of rays emitted from a large radiating surface and passing through the above-mentioned pin-hole. In this case it is not necessary to rotate the plate and the crystal, but the blackening of the plate, caused by undeflected rays, spoils the photographs.

W. LINNIK.

Optical Institute, Leningrad, Oct. 9.

Weitere Beobachtungen über die Dissymmetrie der Emission von Serienlinien.

AN einer früheren Stelle dieser Zeitschrift (NATURE, Juli 27, 1929, p. 125) habe ich eine kurze vorläufige Mitteilung über die neue Erscheinung der Dissymmetrie der Lichtemission im elektrischen Feld veröffentlicht. Im Folgenden seien kurz die Ergebnisse weiterer Beobachtungen über diese Erscheinung mitgeteilt.

Wie ich in meiner Schrift über die Axialität der Lichtemission und Atomstruktur (Polytechnische Buchhandlung A. Seydel, Berlin, 1927) dargelegt habe, stellen die im elektrischen Feld erscheinenden Komponenten der Linien des Wasserstoffatoms Linienserien von bestimmter Charakteristik dar. Von diesen Wasserstoffserien habe ich auf ihr Verhalten in der neuen Erscheinung folgende Linien untersucht: von der Serie $2s - mp^2$ die Linien $3p^2\mathrm{H}_\alpha \pm 1$, $4p^2\mathrm{H}_\beta \pm 6$, $5p^2\mathrm{H}_\gamma \pm 13$; von der Serie $2p^2 - md^3,f^3$ die Linien $4d^3,f^3\mathrm{H}_\beta \pm 4$, $5d^3,f^3\mathrm{H}_\gamma \pm 10$; von der Serie $2s - mp^4$ die Linien $4p^4\mathrm{H}_\beta \mp 2$, $5p^4\mathrm{H}_\gamma \pm 3$; von der Serie $2p^2 - md^5,f^5$ die Linie $6d^5,f^5\mathrm{H}_\delta \pm 6$, von der Serie $2s - mp^6$ die Linie $6p^6\mathrm{H}_\delta \mp 2$. Von allen diesen Linien werden diejenigen, welche vom elektrischen Feld nach Rot verschoben werden, längs der Achse des Feldes entgegengesetzt zur Feldrichtung intensiver emittiert als in der Feldrichtung. Umgekehrt werden diejenigen Linien, welche vom elektrischen Feld nach Violett verschoben werden, längs der Feldachse in der Feldrichtung intensiver emittiert als entgegengesetzt dazu.

Aus dem Spektrum des Heliums habe ich folgende Linien auf ihr Verhalten in der neuen Erscheinung untersucht und zwar in der Achse des elektrischen Feldes wie auch in einer 45° dazu geneigten Achse: für Orthohelium von der Serie $2s - mp^2$ die Linie $3p^2$ λ3889, von der Serie $2p^2 - ms$ die Linien $4s$ λ4713 und $5s$ λ4121, von der Serie $2p^2 - md^3,f^3$ die Linie $3d^3,f^3$ λ5876, von der Serie $2p^2 - md^3$ die Linie $4d^3$ λ4472, von der Serie $2p^2 - mf^3$ die Linie $4f^3$ λ4469, von der Serie $2p^2 - mf^5$ die Linie $5f^5$ λ4025, von der Serie $2p^2 - mp^2$ die Linie $4p^2$ λ4519; für Parahelium von der Serie $2S - mP^2$ die Linien $3P^2$ λ5016 und $4F^2$ λ3965, von der Serie $2P^2 - mD^3,F^3$ die Linie $3D^3,F^3$ λ6678, von der Serie $2P^2 - mD^3$ die Linie $4D^3$ λ4922. Alle diese Heliumlinien folgen in der neuen Erscheinung derselben Gesetzmässigkeit wie die Wasserstofflinien; es werden nämlich diejenigen Linien, welche vom elektrischen Feld nach Rot verschoben werden, entgegengesetzt zur Feldrichtung intensiver emittiert; dagegen werden diejenigen Linien, welche vom Feld nach Violett verschoben werden, in der Richtung des Feldes intensiver emittiert.

Die ausführliche Mitteilung über die vorstehenden Beobachtungen wird voraussichtlich in den *Annalen der Physik* erscheinen. Im Anschluss an sie werde ich die wichtigen theoretischen Folgerungen darlegen, die sich aus ihnen ziehen lassen.

J. STARK.

Grosshesselohe-München, Nov. 18.

Chemical Biogenesis and the Development of Secretion Cells.

AMONG the Research Items in NATURE of Sept. 14, 1929, p. 426, is a note upon an interesting paper recently published by Prof. John Read on "Some Biogenetic Relationships in the Menthone Series".

At the end of the paper referred to in the note (*Chemistry and Industry*, vol. 48, No. 32, p. 786; 1929) Prof. Read says: "The excessively delicate control of molecular transformation which is here implied appears to be a prerogative of the living organism. The organic chemist is powerless to effect such subtle differentiations by artificial means. At the present stage of our knowledge the finer mani-

festations of organic synthesis appear to be inseparably associated with the life-processes."

These statements, which are perfectly true, lead us immediately to postulate that the study of such problems as the origin of terpenes should only be done in close connexion with cytology and cell development. I have made two attempts to study the problem from this side and my results may interest some readers of NATURE.

Studies on the development of secretion cells (Diss., Geneva, 1927) led me to the conclusion that the ideas of Tschirch on this subject are erroneous. Tschirch held that the oil (terpenes) originated from the cell wall by a kind of gelatinisation of the latter; but my experiments on *Asarum europœum*, *Laurus nobilis*, and *Cinnamomum camphora* indicate that the oil (terpenes) is generated directly in the protoplasm. Thus an important chemical conclusion follows from a purely cytological investigation.

Moreover, in a subsequent study of *Persea indica* I have been able to determine the real mechanism of the oil-production (*Planta, Archiv f. wiss. Botanik*, 6 Bd., Heft 2, p. 216; 1928). The oil cells in their youngest stage, when still entirely filled with protoplasm, produce a small drop of a phosphatide-like substance, which is fixed to the cell wall. This 'initial drop', as I call it, serves later on as a membrane to the oil drop. The terpenes originate entirely from the protoplasm without demanding any such intermediate condition as the gelatinisation supposed by Tschirch. At the end of the process the cell is entirely filled with the oil drop, the protoplasm having completely disappeared. The oil drops can easily be detected inside the protoplasm on the spot where they have been formed. The droplets of oil produced thus by destruction of protoplasm are injected into the initial drop. This penetration is only rendered possible by the solubility of the terpenes in the phosphatides. The initial drop then extends, and filling up with terpenes it advances towards other drops in the cell, which are finally all incorporated in the large one. It is also probable that fresh quantities of phosphatides are added to the membrane of the drop as it increases in circumference within the protoplasm. I consider these phosphatides as the active ferments in the destruction of protoplasm (by necrosis or autolysis) and in the synthesis of terpenes. Their presence in the cell walls makes the adhesion of the initial drop easier and even calls for such a formation.

In connexion with these investigations I have formulated the following hypothesis dealing with the synthesis of terpenes in secretion cells.

The protoplasm as a whole is transformed into terpenes (together with phosphatides and perhaps some minor constituents). Thus a destruction of protoplasm has to precede the synthesis of terpenes, and this disintegration certainly leads through the stage of amino-acids. The deamination of amino-acids by the deaminases is a well-known process, which generally leads to the production of an alcohol. If the deamination be incomplete it will result in an aldehyde. *l*-Leucine, one of the most abundant amino-acids, would in these circumstances yield *iso*-valeraldehyde.

This is the point at which my views meet those of Euler and of Kremers. But in my opinion, to derive either *iso*valeraldehyde (Kremers) or methylcrotonaldehyde (Euler) from acetone and acetaldehyde is open to question. These two substances could only derive from the fermentation of sugar, and the amount of sugar in these cells is minute. The aldolisation of aldehydes is a chemical process which must be as easy *in vivo* as it is *in vitro*. The aldolisation of two molecules of *iso*valeraldehyde leads immediately to a terpene with an open chain, and a subsequent internal aldolisation would result in cyclisation.

It will thus be seen that the common origin which Prof. Read recognises for these substances is protoplasmic in nature. It would not be in the least astonishing to find that most of our terpenes are derived from leucine through the intermediate stage of *iso*valeraldehyde. If only one of the many terpenes were produced by this method, the others could derive from it by aldolisation, methylation, hydration, oxidation, and other recognised natural processes.

Our present knowledge of the problem indicates the desirability of further investigation, and the results of Prof. Read's chemical work will be awaited with interest. I shall myself continue the work on the biological side.

A. LEEMANN
(Plant Pathologist to the Botanical Survey of South Africa).
P.O. Box 1086, Pretoria.

Variations of Intensity Distribution of the Auroral Spectrum and the Possible Influence of Sunlight.

IN a letter which appeared in NATURE of Aug. 17, 1929, p. 263, Prof. C. Størmer described some spectrograms, which he, together with Mr. Moxnes, had taken from sunlit auroræ and auroræ in the earth's shadow. From the spectrograms, Størmer draws the conclusion that the intensity of the auroral line relative to that of the negative bands for sunlit auroræ is much smaller than that found for aurora in the earth's shadow.

I do not think that from Størmer's experimental material we can draw any conclusion as to the possible

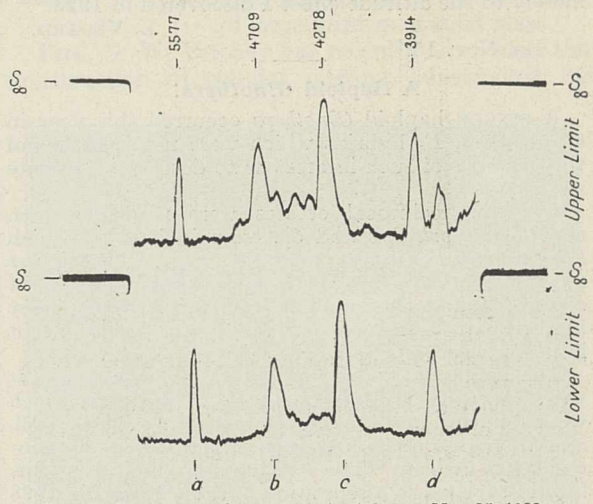

FIG. 1.—Registrams of aurora spectra taken on Mar. 25, 1923. Difference of height about 60 km.

influence of sunlight on the intensity distribution of the auroral spectrum. First of all, the two spectra given by Størmer do not fulfil the conditions which make them comparable, and are necessary for photographic evaluation of changes of intensity distribution, because the two spectra are taken on different plates; but the most serious defect of the material is that one of the spectra is very strongly exposed, while the other auroral spectrum is very weak.

Even in the spectrum corresponding to the earth's shadow the green auroral line has a smaller photographic density than the three principal nitrogen lines. In the spectrum of sunlit auroræ, the weakest of the nitrogen lines, 4709, is just visible on the plate, and then on account of the threshold effect we should expect the auroral line to be extremely faint even if no change of intensity distribution takes place.

Secondly, even if the spectrograms might show an effect qualitatively in the direction indicated by Størmer, we should not be able to take this as an

argument for the effect of the sunlight, for in his experiments an eventual sunlight effect would be mixed with a very considerable variation of intensity distribution, discovered by me in 1923 (*Phil. Mag.*, **46**, p. 577 ; 1923), which was measured accurately under the most favourable photographic conditions (see article on auroræ, " Handbuch der Physik ", Bd. 25, p. 385). It was then found that the intensity of the auroral line relatively to that of the auroral nitrogen lines (4709, 4278, 3914) diminished considerably with increase of height. The effect is clearly shown in Fig. 1, giving registerings of two spectrograms on the same plate corresponding to a difference of altitude of about 60 km. For the lower limit, the auroral line 5577 gives a greater density than 4709, while at the upper limit the densities are inversed. Quantitative measurements gave the result that $\frac{(a/b)\text{ upper}}{(a/b)\text{ lower}} = 0{\cdot}695$ on a pair of spectra from one plate, and 0·76 on a pair from a second plate ; a and b are the intensity of the auroral line and that of one of the nitrogen lines respectively.

Now Størmer's spectra correspond to differences of altitude of 200 km.-300 km., and from the variation with altitude alone we should, in the case considered by Størmer, expect to find $\frac{(a/b)\text{ sunlit}}{(a/b)\text{ shadow}} = \text{about } 0{\cdot}3$, which would mean a very great intensity variation. Thus, even if it had been possible from Størmer's material to conclude that the sunlit aurora gave a relatively weaker auroral line, this effect might be due merely to the altitude effect I discovered in 1923.

L. VEGARD.

Oslo, Nov. 15.

A Haploid *Œnothera*.

A SINGLE haploid *Œnothera* occurred this year in a culture of F_1 hybrids which were non-viable, and this result is of such interest as to deserve a separate record.

In 1927 reciprocal crosses were made between *Œnothera rubricalyx* and *Œ. eriensis*, both of which have fourteen chromosomes. *Œ. eriensis* × *rubricalyx* gave a uniform F_1 with the red pigmentation of *rubricalyx* and the small flowers of *eriensis*. They bred true in F_2 and were strongly patroclinous except in flower size.

The reciprocal cross, *rubricalyx* × *eriensis*, made at the same time, produced a potful of seedlings which were yellowish in colour, developed a little chlorophyll, and then promptly died when their stored nourishment was used up. The striking non-viability of this hybrid type led to a repetition of these crosses in 1928 with the same results. The *rubricalyx* × *eriensis* gave from one capsule 21 small and feeble seedlings, all of which died off simultaneously, showing a lethal effect. From another capsule, obtained by crossing different individuals of the same two species, 85 seedlings were obtained. They behaved in the same way as the preceding, except that two of the seedlings managed to survive for a time and one lived long enough to be planted out. It reached maturity and belonged to a new type, very much dwarfed and completely sterile as regards pollen and seed production.

It was predicted that this plant might be a haploid, and such has proved to be the case, as it has only seven chromosomes in its somatic cells. The plant showed the red pigmentation of *rubricalyx*. Its leaves were small, narrow, and rather pointed, and these were regarded at first as resemblances to *Œ. eriensis* ; but it seems more probable that these are characters pertaining to haploid *rubricalyx*.

As regards the origin of this haploid mutant, it appears to have developed parthenogenetically from a *rubricalyx* egg under the stimulus derived from the foreign pollen tubes of *eriensis*. The great bulk of the seedlings, which were non-viable, appear to have been true (diploid) hybrids with *eriensis*.

The first haploid sporophyte in higher plants was discovered by Blakeslee in 1922 in the offspring of *Datura* plants which had been subjected to low temperature at about the time of fertilisation. Other cases of haploids have since been found in *Nicotiana*, *Triticum*, *Crepis*, *Solanum nigrum*, and recently in the tomato. They have usually resulted, like the above, from crosses between two distantly related species with a high degree of interspecific sterility. In the present instance, the sterility appears to be complete when the cross is made one way, while the reciprocal cross produces plenty of viable seedlings.

A full account of this haploid mutant will be published later. R. RUGGLES GATES.

King's College,
University of London, Dec. 2.

The Perfect Elasticity of Wool.

THE most striking property of the wool fibre is its ability always to return to its original length after stretching in cold water. If, however, a fibre is steamed in the strained position, it shows no tendency to return to its original length in cold water. So far as I am aware, it has hitherto been found impossible to induce such fibres to return to their original length, although *partial* recovery occurs on re-steaming in the absence of tension. During the course of another investigation, however, I have recently found that fibres which have taken a permanent set of the kind just described, recover the property of perfect elasticity in caustic soda solutions. For example, a fibre which had been stretched and steamed for 15 minutes at 47·4 per cent extension, returned to its original length in 14 minutes in 0·15 *N* caustic soda solution. Contraction does not cease when the original length is attained, but continues beyond this point until a real shrinkage of about 10 per cent of the original length is observed. The rate of recovery increases with the strength of the solution, but is measurable even in 0·01 *N* caustic soda. The discovery opens up a number of possibilities in regard to ' finishing ' processes in the wool textile trade, but of even greater significance is the contribution which it makes to knowledge of the elastic phase in the wool fibre and the changes which it undergoes during stretching and steaming. Complete details of the results and conclusions of the investigation will be described in another place. J. B. SPEAKMAN.

The University, Leeds, Nov. 28.

Continents and Oceans.

As the result of my letter on " Continents and Oceans ", which appeared in NATURE for Nov. 30, several correspondents have directed my attention to Lothian Green's ' tetrahedral hypothesis '. This hypothesis was devised to explain why the continents have oceans at their antipodes, and Prof. J. W. Gregory has given an excellent account of it in his little book entitled " The Making of the Earth ", published in 1912.

I am sorry that I had not seen Prof. Gregory's book before I wrote my letter, as it would have helped me to emphasise the point which I wished to make ; for the object of my letter was not to describe new relationships between the continents and oceans, but to direct attention to the necessity for taking the relationships which I described into account when discussing Wegener's hypothesis. G. C. SIMPSON.

Meteorological Office,
Air Ministry, Kingsway, W.C.2, Dec. 5.

The Proposed New 200-Inch Telescope.

IT is now common knowledge that plans for the construction of a 200-inch reflecting telescope are being worked out at Mount Wilson observatory. This enterprise has been rendered possible by the generosity of the International Education Board, which in May 1928 authorised its executive committee to provide for the construction of an astrophysical observatory equipped with a 200-inch reflecting telescope and auxiliary instruments. The proposed new observatory is to be conducted in close co-operation with Mount Wilson and the increased light-collecting power of the 200-inch telescope should permit further studies of the size and structure of the galactic system, of the spectra of the brighter stars under very high dispersion, and of many other important problems. A short account of the plans for the 200-inch in so far as they have matured will interest many readers of NATURE. More complete details are given by Prof. Hale in an article in the November number of *Harper's Magazine*, the source from which the substance of the present article has been drawn.

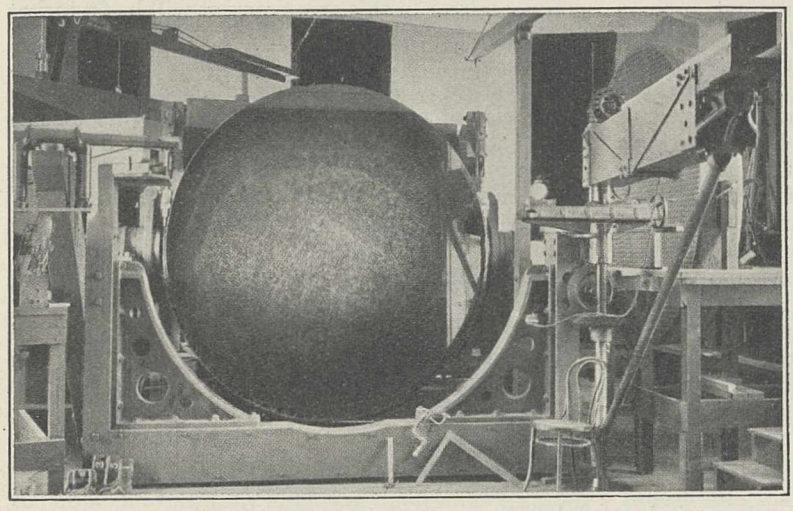

FIG. 1.—The 101-in. mirror in the vertical position for optical testing.

In the construction of the new instrument the experience gained in constructing the present 100-inch instrument at Mount Wilson will naturally be of great assistance, and it will be helpful to recall some of the difficulties met with in the construction of the smaller instrument. The greatest troubles were in the construction of the mirror itself. It is obviously desirable to secure a disc of glass which is free from internal flaws, but in the case of the 100-inch the disc which was finally used was one which was delivered in 1908 and was rejected at the time. It was only after further attempts to produce a suitable disc had failed that the present mirror was figured from this rather unsatisfactory disc. The disc in question was full of bubbles, as can be seen from Fig. 1, which is reproduced from a recent memoir by G. W. Ritchey.[1]

[1] "The Development of Astro-Photography and the great Telescopes of the Future." Publié sous les Auspices de la Société Astronomique de France. 1929.

The chief difficulty in the construction of very large discs of glass arises from the fact that they suffer devitrification during the weeks or months required for the slow cooling known as annealing. This leads to loss of rigidity—a serious defect. Furthermore, glass is a poor conductor of heat and consequently the outer parts of a large silver-on-glass mirror change in temperature more rapidly than the inner. The curvature of the surface is thus affected, and this means that the stellar image, instead of being nearly a point, may often be expanded into a much less brilliant disc. This defect can in the case of existing mirrors be partially removed by the provision of constant temperature water jackets and a similar plan might conceivably be adopted in the case of the 200-inch, but the difficulties clearly increase with size. It seems probable that a limit has already been reached in the construction of large mirrors of solid glass.

Prof. G. W. Ritchey has recently advocated the construction of cellular mirrors, constructed by building up a kind of honeycomb from thin glass plates, and this plan has been considered at Mount

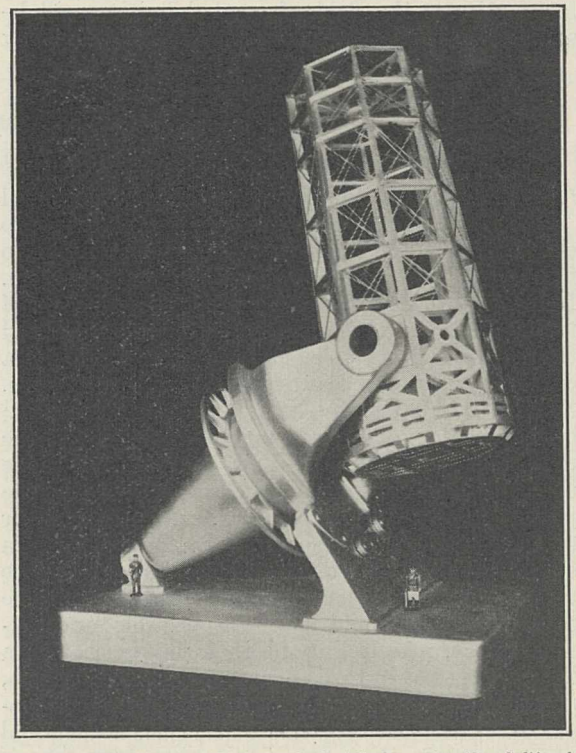

FIG. 2.—Tentative model of 200-inch telescope for the California Institute of Technology. Made by the Warner and Swasey Company after preliminary designs by E. P. Burrell and Francis G. Pease.

Wilson by Prof. Hale and his collaborators. Its adoption, however, has not been favoured, on account of the difficulty of figuring with optical perfection the thin glass faces and the edges of the honeycomb structure. In addition, doubts have been entertained as to the optical permanence of a heavy cemented structure subjected to wide ranges of temperature.

The plan which at the present moment appears most promising to the astronomers concerned is to make the mirror of fused quartz, a substance which possesses a very small temperature coefficient. The process consists of fusing a mass of nearly pure silica in a circular electric furnace which constitutes the mould. The disc thus obtained contains a large number of small bubbles, but it can be ground to the approximate curvature of the mirror desired and then coated to a sufficient thickness with perfectly transparent quartz free from bubbles. The final figuring is then carried out on the surface of this clear layer. The quartz composing the clear layer is sprayed on to the hot disc by means of multiple oxy-hydrogen burners. A 22-inch disc has already been constructed in this way, and it is now proposed to make a 60-inch mirror before finally embarking on the construction of the 200-inch mirror itself.

With regard to the figure of the mirror, it has been decided to construct it with a focal length of 55 feet, that is, with a focal ratio of f 3·3. The use of such a small focal ratio will give an immense concentration of light, but in common with all short focus mirrors the field of good definition will be small. It is proposed to remedy this defect by the use of a correcting lens, designed by Dr. F. E. Ross, which will be placed immediately in front of the photographic plate at the principal focus of the 200-inch mirror. Dr. Ross has in addition to this computed a correcting lens which will, it is hoped, reduce the equivalent focal ratio to f 2·2. Provision will also be made for a Cassegrain arrangement with an equivalent focal ratio of f 10. The convex mirror in this arrangement will be 60 inches in diameter.

The telescope will be mounted equatorially. The problem of the mounting will be an engineering enterprise of no mean dimension, and the lessons learnt and the difficulties met with and overcome in the mounting of the existing 100-inch telescope will doubtless be invaluable in this connexion.

Considerable attention is being paid to the selection of a suitable site. It is highly important that the efficiency of the 200-inch should not be impaired by poor seeing arising from atmospheric tremors. The experience gained with the 100-inch has shown that at Mount Wilson itself a 200-inch telescope could be depended upon to show a gain in keeping with its increased size. It is, however, probable that a still better site can be found in California, and the possibilities are being explored by observations at various sites with portable telescopes.

One of the proposed models for the 200-inch telescope, which is now on exhibition in the building of the National Academy of Sciences, Washington, D.C., is shown in Fig. 2. It should be mentioned that the plans include the provision of an adequate laboratory and workshop. W. M. H. G.

The Locust Problem.

By Dr. A. D. IMMS, F.R.S.

THE theory of the phases of locusts, advanced by B. P. Uvarov in 1921, is now well known to entomologists and has proved a fertile stimulus to further investigation of this important problem. It recognised the existence among these insects of two definite or extreme forms—one gregarious and the other solitary — which are connected by a continuous series of less defined transitional forms. Messrs. B. P. Uvarov and B. N. Zolotarevsky[1] have recently discussed certain aspects of the problem, in the light of new observations made by S. A. Predtechensky in Russia, and by the junior author in Madagascar. Although their remarks apply more especially to the well-known species *Locusta migratoria*, these authors believe that a standard phase nomenclature, applicable to all species, would be both possible and advantageous. According to their interpretation a locust can exist in three unstable biological phases, namely, a solitary one, *phasis solitaria*: a gregarious one, *phasis gregaria*, and a transitional phase between these two which they term *phasis transiens*. These phases differ from each other in morphological and colour characteristics, on one hand, and in biological features (mainly behaviour) on the other. Whether it will prove possible to distinguish such phases solely by the convenient method of examining their morphological characters, can only be determined by studying the whole series of phases of a given locust in a specific locality.

The solitary phase consists of isolated individuals and is represented where no swarms exist, or have existed, within at least one preceding generation. The transient phase is not represented by any definite form, but by a continuous series of transitional forms between the solitary and gregarious phases. Such a series may be observed either (*a*) when the transformation is from the solitary phase towards the gregarious phase, when it may be termed *phasis congregans*; or (*b*) the tendency is in the opposite direction, when it is termed *phasis dissocians*. These two phases are, therefore, essentially of a biological nature, but it appears that it may be posssible to distinguish them also by minor details of structure and colour. The gregarious phase is that assumed when individuals form dense and extensive emigrating swarms (Fig. 1). Recent studies of *Locusta migratoria* have shown that, although this species is a very

[1] Phases of Locusts and their Interrelations. *Bull. Entomological Research*, **20**, pp. 261-265, Oct. 1929.

definite unit, it exists as three subspecies, namely, *rossica* in Central Europe and possibly Western Europe, *migratoria* (*sensu str.*) in south-east Russia and *migratorioides* in the tropics and subtropics. Each of these subspecies may pass through the three phases already mentioned, but it is possible that all may not prove to be equally polymorphic. The application of this theory to other species indicates that, in the past, the solitary and gregarious phases being in most cases so distinct they have hitherto not been recognised as such. Great confusion has naturally resulted, since they have been regarded as distinct species under separate names. From the practical point of view of locust control it is, obviously, of prime importance to study the behaviour of these insects in the light of Uvarov's theory. The theory lends a new interpretation of the causes of locust outbreaks, and by directing research along a defined course it will co-ordinate investigation, hitherto largely prosecuted blindly in the hope of eventually alighting upon some solution of the problems concerned. It opens up the possibility that transformation of locusts into the gregarious phase may sometimes be circumvented, and the location of the breeding grounds of the latter phase may lead to the destruction of immense numbers of potentially harmful individuals. This aspect of the subject is fully discussed in Uvarov's recent treatise [2] on locusts, which has already been noticed in these columns.

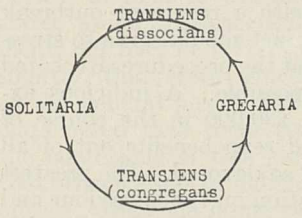

FIG. 1.

On April 29 of this year the chairman of the Committee of Civil Research [3] appointed a scientific sub-committee of ten members under the chairmanship of Sir Henry Miers, with the following terms of references:

"To consider and report on:

(*a*) Means for the mass destruction of the Desert Locust *Schistocerca gregaria* Forsk.

(*b*) Methods for ascertaining the reasons for the periodic swarming of this species with a view to its control."

The depredations of the Desert Locust are of immediate concern to the Empire, since an enormous area of British Africa is periodically affected besides Palestine, Transjordania, and Iraq. In Kenya, for example, it is mentioned that £50,000 has already been spent on control and relief measures with respect to an outbreak of this insect which is still continuing at the present time. The Kenya government has now taken power to prohibit all exports of foodstuffs from the territory, and the Legislative Council has passed a resolution authorising expenditure up to £200,000 to the Food Control Board to enable it to discharge its function.

As a preliminary step the Committee of Civil Research has issued two reports of the Locust Sub-Committee which were presented to Parliament in July 1929. In the first report it was recommended that the collection of information from all available sources respecting the habits and behaviour of the Desert Locust should be proceeded with forthwith. This information should be collated and distributed to the territories affected by the insect in question. In order to effect this scheme, it was recommended that financial arrangements should be made to enable the Imperial Bureau of Entomology to commence this work. In its second report the Sub-Committee drew up a draft scheme of the research it deemed necessary to be carried out, and stress was laid upon the possibility of employing aeroplanes for purposes of reconnaissance and perhaps also for the destruction of locusts. It recommended that colonial governments, interested in this specific locust problem, should be communicated with and invited to indicate whether they would assist by contributing to the cost and by providing local facilities if a proportional Imperial contribution could be arranged. It also suggested that communication, in a similar sense, should be made for the purpose of obtaining the views of the Government of India. With the object of obtaining the fullest information possible respecting the Desert Locust, it is further suggested that inquiries should also extend to foreign territories affected by the insect in question.

About the middle of the present year evidence of the enormous destruction occasioned by the Desert Locust in Palestine had come to hand in the form of an article by Mr. G. E. Bodkin,[4] Government Entomologist. The history of locust invasions in Palestine indicates that these visitations have occurred in recent years with remarkable regularity. Thus 1865, 1878, 1890, 1902, 1915, 1928 are marked by visitations of this insect—an unvarying period of 12-13 years elapsing between the events. The year 1915 was a most disastrous one, and in the Jaffa district alone damage to the extent of about £200,000 is stated by Mr. Bodkin to have resulted from locust depredations. Since the destruction was practically universal in Palestine the damage in the whole country reached a colossal figure. The suffering endured by the population, as it happened, was alleviated to a marked degree by the War, which involved the occupation of Palestine by the British army. The large supplies of food thus brought in, and the liberal payment for services rendered, helped the population at a time when it was demoralised by the destruction of a means of livelihood.

Palestine was visited by another invasion in 1928, and the chief facts respecting this event are recounted in Mr. Bodkin's article. It appears that there were three successive waves of invasion, but, by comparison with the event of 1915, they were but light. Ability to anticipate such an occurrence resulted in very little serious damage being incurred. The appearance of the Desert Locust in Hauran and in Egypt the previous year gave timely

[2] "Locusts and Grasshoppers." London, 1928.

[3] Committee of Civil Research. Locust Sub-Committee. First and Second Interim Reports. London. H.M. Stationery Office, 1929. Price 3*d*. net.

[4] "The Locust Invasion of Palestine during 1928." *Bull. Entomological Research*, **20**, pp. 123-139, Aug. 1929, with 3 text figs. and 3 plates.

warning, and preparations for a control campaign the following year were soon embarked upon. Consequently, 1928 was the first time that locust invasions in Palestine were combated with an adequate organisation of material, equipment, and personnel. The campaign was assisted by the drought, which rendered the ground unsuitable, for the most part, for the insects to lay many of their eggs.

The nature of the control measures that were applied can only be briefly mentioned here. The destruction of the winged locusts, prior to egg-laying, means the elimination of hordes of potential young locusts, and Mr. Bodkin describes a type of flame-thrower devised for this purpose. These machines did good service at night owing to the habit of the Desert Locust of clustering in dense masses at that time. The arming of large numbers of villagers with hand nets resulted in further destruction, and they also assisted by encircling swarms of gravid locusts, and slowly driving them to a common centre, to be exterminated by use of flame-throwers. The methods prosecuted were so efficient that most of the egg-laying became restricted to the Jericho district. The resulting young locusts or 'hoppers' were destroyed by spraying with kerosene emulsion, and later by fire and by means of arsenicals. Mr. Bodkin's instructive and timely report should do much to encourage those who have to encounter the same menace in other lands. It is evident that adequate preparation, and the application of the right measures coupled with a knowledge of specific locust behaviour, were collectively responsible for the good results achieved.

The Palestine outbreak is directly related to a much more formidable and simultaneous invasion by the Desert Locust of the southern Sudan, Kenya, and Tanganyika Territory. The duration of this menace cannot be foretold with certainty, but it appears probable that it will continue until 1931. The reports of the Committee of Civil Research synchronise, therefore, with a recurrent outbreak of first magnitude. This fact should serve to stress the urgency of carrying out the procedure advocated with as little delay as possible. A judicious expenditure of £20,000 or £30,000 in the course of four or five years should reap benefits out of all proportion to the money so devoted. The greatest need is for exact information on the behaviour and habits of the Desert Locust, and the co-ordination of such information from as many sources as possible. Without this knowledge, we shall be merely groping in the dark for many years to come simply because there is no adequate foundation to work upon.

Irradiation and Health.

THAT exposure to sunlight or some source of ultra-violet, luminous, or heat rays has a beneficial effect upon general health has been claimed by many competent observers. That insolation is of great value in the treatment of various forms of tuberculosis may be taken as well established, although the cooling power of the open air, as well as the sun's rays, plays a part in the favourable effects produced. Again, that vitamin D is formed from ergosterol in the skin when the latter is exposed to ultra-violet light has been definitely shown, as well as the development of an increased bactericidal power in the blood, after suitable irradiation of the same organ. But whether such effects are accompanied by an increase in the resistance of the body to infection has not been satisfactorily demonstrated, in spite of a very general impression that suitable exposure to a source of light does improve the general health. Colebrook [1] has therefore submitted this question to an experimental study, and at the same time has investigated the influence of light upon the rate of healing of a purely local infection.

In the first investigation the influence of light upon the health and development of school children was studied: their ages ranged from five to seven years, and the period of observation extended from August 1927 to March 1928. They were divided into three groups, upwards of a hundred children in each: one acted as a control, the others were exposed, clad in bathing slips only, three times weekly to a direct current long-flame carbon arc lamp; in one of these the light from the lamp was screened by glass, so that only rays longer than about 3342 A. reached the children. The dosage aimed at was one which would just fail to give an erythema reaction on the skin of a child of average sensibility: it was gradually increased by diminishing the distance of the child from the lamp, by increasing the time of exposure, and also the output of the lamp. Pigmentation of the skin was produced in a number of the children by the treatment. The groups were selected to be as similar as possible as regards ages and types, and it was considered that the home conditions were, on the average, also similar in the groups and were such that any benefit due to the irradiation would be easily seen and not counteracted by a poor home environment.

The progress of the children was followed by recording height and weight at intervals, by frequent observations of the occurrence of chilblains and colds, or other infections, and by noting the subjective impressions of the medical officer, teacher, and parent. The results were, in brief, that exposure to light had almost no beneficial effects whatever: in fact, the advantage was usually to the control group as compared with the lamp groups, or to the screened lamp group as compared with the unscreened. However, as regards progress in schoolwork, exposure to light, especially the screened lamp, appeared to be of favourable influence, whilst the unscreened, and

[1] Medical Research Council. Special Report Series, No. 131: Irradiation and Health. A: Ultra-Violet Irradiation of School Children; B: Irradiation of Varicose Ulcers. By Dora Colebrook. Pp. 47. (London: H.M. Stationery Office, 1929.) 1s. 6d. net.

to a certain extent the screened, lamp seemed to exert at first a stimulating effect on increase in weight, although this stimulus was only temporary in its action, and the period of increased growth was followed by one of relatively decreased growth rate, so that at the end of the experiment the advantage was with the control group. As regards infections, the evidence was definitely against the exposure to light having any favourable effect, but, for what they are worth, the subjective impressions of teachers and parents were in favour of the lamp groups.

It thus appears that, except for a possible temporary stimulating effect upon growth, exposure to light is without influence upon bodily states which are susceptible of objective measurement, but may be taken to improve, although only slightly, that state which can only be described as the general health and well-being. It may be emphasised that these conclusions only apply to the conditions of this particular experiment, and that other sources of light, etc., might have different effects; that the home conditions of the children were uncontrolled (though probably sufficiently similar in all the groups), and finally, that the control group differed from the others not only in not being exposed to light, but also in not sharing the necessary routine incidental to this exposure, such as withdrawal from lessons, dressing and undressing, and exposure to the different temperature of the lamp room as compared with the class room.

In the second study, Colebrook investigated the influence of ultra-violet light from mercury vapour lamps upon the healing of varicose ulcers: either the leg up to the knee or the ulcer itself only were irradiated; between treatments only a simple dressing and bandage were applied. For controls, a series of cases was treated with Unna's zinc oxide and glycerine paste. The result of the investigation was that the cases treated with light of very varying intensities responded much less satisfactorily than those dressed with the paste: the difference was most marked in the case of the ambulant patients, indicating that any benefit seen under light treatment in patients kept in bed was probably largely due to the accompanying rest and not to the light. No difference was observed in the course of healing between irradiated and unirradiated areas of the same ulcer, other conditions being the same for both: and finally, relief of symptoms was not obtained during light treatment but was a marked feature in the patients treated with Unna's paste.

Obituary.

DR. HAROLD WAGER, F.R.S.

DR. HAROLD WAGER, whose death occurred on Nov. 17, had shown his interest in science at an early stage in his career. In 1885 he was associated with Mr. Auberon Herbert as private secretary, an association which led to their collaboration in the production of a paper in the *Contemporary Review* upon "Bad Air and Bad Health", which afterwards appeared (1894) as a pamphlet. From 1886 onwards Wager went to the Royal College of Science, where he was a regular attendant at Dr. D. H. Scott's classes upon botany, and is still remembered by the latter as one of his most brilliant students.

In 1888, Wager was appointed demonstrator in biology in the Yorkshire College at Leeds. Since that date, although he has not always resided at Leeds, he has been so much identified with both science in Yorkshire and with the Yorkshire College —and afterwards the University of Leeds—that he is generally recognised as one of the most distinguished of a very remarkable band of scientific naturalists of the county of the broad acres. In 1894 he married Winifred Miall, the only daughter of Prof. L. C. Miall, the first and only professor of biology in the Yorkshire College.

On the outbreak of the War, with the consent of the Board of Education, Dr. Wager voluntarily undertook the direction of the Department of Botany during the absence of Prof. J. H. Priestley upon war service. After the armistice he remained for some time in contact with the Department, in which he held an honorary lectureship, and it was with regret that the University Council recently received his resignation of that post when he found himself unable to keep in touch with the activities of the Department.

Through his early association with Dr. D. H. Scott, some of Wager's earliest scientific papers were upon plant anatomy, including a paper, in collaboration with Dr. Scott, upon the floating roots of *Sesbania aculeata*, but throughout his career Wager showed a catholic diversity of interest—every subject open to experiment and observation in the scientific spirit being of appeal to a man with the temperament of the naturalist and observer, and the training and technique of the student of science. He first established his scientific reputation by a long series of papers upon the cytology and life-history of the fungi, which were published during the years 1889–1900. Early in the new century he was also making observations upon the cytology of the blue-green algæ, the Cyanophyceæ; but what distinguished Wager as a student of such problems was that he never lost interest in the growing plants in the field. As a result his specialist studies of these two groups have the very unusual accompaniment that he has published in the *Naturalist* keys to the determination of species of Oscillatoria and Phormidium, and also a very useful guide to the determination of genera of the Agaricaceæ.

This interest and sympathy with the field of work of the naturalist, coupled with his specialist knowledge of technique in fields usually outside the naturalist's province, made Wager a great influence in deepening and extending the contribution of Yorkshire naturalists to biology. Under his

chairmanship the annual mycological forays of the Yorkshire Naturalists' Union have done very successful work in promoting interest in these plants, and in adding to our knowledge of the Yorkshire species. In 1913, as president of the Union, he devoted his address to a brief résumé of his observations upon the movements of free-swimming micro-organisms, a fascinating subject which showed him at his best, alike as a naturalist and as a brilliant manipulator of microscopic living organisms, alive to the fact that the infinitely small amongst living creatures still have to obey physical laws.

On the occasion of the meeting of the Yorkshire Naturalists' Union in Leeds in 1914, the University conferred upon him the honorary degree of D.Sc. in recognition of his great contribution to science and his distinguished association with the study of natural science in Yorkshire. In 1904 he had been elected a fellow of the Royal Society.

Dr. Wager's severance from academic laboratories, upon his appointment as one of H.M. Inspectors of Secondary Schools, in no way diminished his scientific activity. With simple laboratory appliances, but with an almost uncanny *flair* for microscopic manipulation, he continued to carry out observations in various fields of biology, and in particular turned his attention to a number of problems of plant physiology. His photographs through the lenses of the leaf epidermis were as beautiful a demonstration of the capacity these cell wall structures showed to focus objects, as his experiments were to show that Haberlandt's views as to the function of the 'ocelli' needed revision. He also made numerous observations upon the leaf pigments and other plant pigments, many of which, probably, have never been fully embodied in his published writings.

These unremitting scientific labours were a daily accompaniment to Wager's conscientious fulfilment of his duties as an inspector of schools. The result was, naturally, that the teacher of biology in the school, apt to have recourse to the easier path of instruction through text-book and diagram, was constantly being reminded of the wide gap that may exist between the formal description and the object awaiting the unprejudiced regard of the observer. Just as the amateur naturalist, seeing in Wager a kindred spirit, was led by his example to take more pains and extend the range of his scientific technique, so the professional teacher was encouraged to leave routine repetition of second-hand facts, to observe for himself, to become, in fact, a naturalist, and thus to develop a new enthusiasm which rapidly communicated itself to his pupils.

During Wager's long association with Yorkshire, he learnt to love the Yorkshire dales. It was in his cottage in Lyttondale that he died after a short illness, and he was laid to rest in the little churchyard at Arncliffe amongst associations that were always dear to his memory, and to those of his many Yorkshire friends. There they will like to think of him—at rest in surroundings that were always congenial to his spirit.

Sir Sainthill Eardley-Wilmot, K.C.I.E.

The death of Sir Sainthill Eardley-Wilmot on Nov. 13, at Henley-on-Thames, removes a great forester who spent forty-seven years of his life in the service of his country. Eardley-Wilmot was the fourth son of Augustus Hillier Eardley-Wilmot, and was born on July 17, 1852. He joined the Indian Forest Service in December 1873, after having spent three years undergoing his forestry training in Germany. There can be little doubt that some aspects of this training had a considerable influence on Eardley-Wilmot's subsequent career: for he was able to appreciate to the full the advantages, as also the weaknesses, of a purely German training, when strictly applied, to the very dissimilar and varying conditions of the sub-tropical and tropical forests. Wilmot was appointed to the old North-West Provinces and Oudh, spending the first sixteen years of his service as an executive officer in charge of several forest divisions in the Provinces. In 1890 he was promoted to administrative rank and passed the following eight years as Conservator in Oudh, where his organising ability, combined with his great professional knowledge, radically changed the management of the forests by introducing a more scientific conservancy and earned him the encomiums of the local government.

It was during this period that, as a result of sylvicultural studies carried out in the forests, Eardley-Wilmot wrote a series of important papers entitled "Notes on the Regeneration of the Sál (*Shorea robusta*)"; "Notes on Sál Forests"; "Notes on Improvement Fellings"; "Sál Coppice Forests of Oudh"; "Notes on the Treatment of Shisham (*Dalbergia Sissoo*) and Khair (*Acacia Catechu*) in the Sub-Himalayan Tracts"—all of which were published in the Appendix Series of the *Indian Forester* in the nineties of last century. They formed a very valuable addition to the scanty knowledge at the time existing on the sylvicultural characteristics of these species. From 1900 until 1902 Eardley-Wilmot was in Burma, and in February 1903 was appointed to officiate as Inspector-General of Forests, and afterwards confirmed.

Apart from numerous activities in administrative directions, notably the improvements he was able to get effected in the emoluments of officers of the Department of all grades, and the steps he took to improve the forest education of the executive and provincial staff of the Department in India, Eardley-Wilmot's greatest achievement was connected with the inauguration of the Imperial Forest Research Institute at Dehra Dun. At the time Eardley-Wilmot passed through Calcutta *en route* for Burma, the then Inspector-General of Forests, Mr. B. Ribbentrop, was endeavouring to obtain the consent of Government to the appointment of a forest officer to take up special research work in forest entomology. Eardley-Wilmot was keenly interested in this new departure. The appointment applied for was made for two years, and I myself took up the work. At the end of the period the question of continuing the work was undecided. I was in charge of the Indian Museum as officiating

superintendent, and Eardley-Wilmot came back to Calcutta from Burma. This was in February 1903; and the first of many conversations then took place between the Inspector-General of Forests and myself on the subject of the formation of a Forest Research Institute. Lord Curzon was Viceroy, and once Eardley-Wilmot had obtained his sympathetic consideration, the matter went through and the Institute was inaugurated in 1906, six research posts being filled by officers selected from the Forest Department. The Inspector-General often said that his reply to the query as to where he was going to obtain his research officers, "From the Department, sir", pleased the Viceroy almost more than any other incident in connexion with the new departure. For Lord Curzon was the Viceroy who really commenced the introduction of the scientific expert into India, and it proved a difficult work at first to obtain suitable men. The research officers were appointed and commenced work. But there were no buildings and no equipment. All that had to come. The opening by the Viceroy of the greatly enlarged Forest Research Institute at Dehra Dun (NATURE of Nov. 16, p. 778), but six days before Eardley-Wilmot's death, is a witness to the enormous value of the step taken in 1906.

Eardley-Wilmot left India in 1908 on furlough, retiring from the service in 1909. His work was not finished. For he was appointed in 1910 as one of the Commissioners of the newly formed Development Commission, forestry being his special charge. With his Indian experience behind him, he determined that forestry education was one of the first lines to take up in Great Britain. Grants for this purpose were made to various institutions. Edinburgh received a grant from the Development Commissioners of £10,000. The larger part of this grant was made with the object of erecting suitable departmental buildings (we only had two cellars in the old University buildings at the time), the University Court adding a similar sum. A further grant was offered to enable a chair to be established, and this sum also eventually materialised. At the end of five years as a Development Commissioner, Eardley-Wilmot was appointed forestry adviser to the Commission and held the appointment for five years. At the end of this period the Forestry Commission came into being and took over charge of forestry work from the Development Commission. This ended Eardley-Wilmot's active life as a forest officer.

It is perhaps too soon to adjudicate correctly upon the value of Eardley-Wilmot's ten years' work for forestry in Great Britain and Ireland. The Development Commissioners had no executive powers; grants were given in the interests of afforestation and a commencement had been made with the introduction of a system of co-operation between landlord and State in the formation of new plantations on a profit-sharing basis. For the purpose of this review of Eardley-Wilmot's life's work, he will be remembered for the part he played in bringing the Forest Research Institute into being in India, and—what he himself would value as a still stronger claim—he will be remembered as a fine forester and magnificent sportsman. His "Forest Life and Sport in India" is regarded as a classic as much from the scientific forestry viewpoint as from a natural history and sporting one. He also published two other books, "The Life of a Tiger" and "The Life of an Elephant", both of which gave evidence of a close study of the lore of the jungle. E. P. STEBBING.

MR. W. R. BOWER.

THE death occurred at his home at Huddersfield, on Nov. 20, of Mr. William Richard Bower, who was for more than thirty years head of the Physics and Electrical Engineering Department of the Huddersfield Technical College.

Mr. Bower was born at Southampton and received his early education at the Taunton School and the Hartley College in that town. Gaining a national scholarship, he proceeded to the Royal College of Science, London, of which he became an associate and later a member of staff. Before the commencement of his long period at Huddersfield in 1896, he served on the staffs of the University College of Wales, Aberystwyth, and Brighton Technical College. He was a fellow of both the Physical Society and the Institute of Physics, and, after his retirement, received the honorary title of emeritus professor of physics at Huddersfield Technical College. His breadth of knowledge, attention to detail, and great experience as an experimentalist gave a marked impress to his teaching and brought him the warm affection of his students.

Amongst Mr. Bower's early activities at Huddersfield was the practical application of X-rays, in which he was a local pioneer; many and varied were the cases then brought to the College for examination. Later, as a writer, he was joint author of Bower and Satterly's "Practical Physics" and author of "Primary Physical Science" which appeared last year. He was especially interested in optics and published papers illustrating the application of graphical and geometrical methods.

Mr. Bower's steadiness of aim, disinterested sincerity, and great capacity for administrative work led him to take active interest in the Association of Teachers in Technical Institutions. He served on the national executive of this body for many years, and, at a critical period in the history of the teaching profession, became president of the Association and a member of the Burnham Committee. His judicial temper and unfailing courtesy made him an invaluable negotiator.

WE regret to announce the following deaths:

Dr. Charles Chilton, lately professor of biology and Rector of Canterbury College, New Zealand, an authority on the crustacea of New Zealand and the Antarctic regions, on Oct. 25, aged sixty-nine.

Dr. F. W. Dootson, lecturer and demonstrator in chemistry in the University of Cambridge, on Dec. 12.

Admiral of the Fleet Sir Henry Bradwardine Jackson, G.C.B., K.C.V.O., F.R.S., a pioneer in the development of wireless telegraphy, on Dec. 14, aged seventy-four years.

News and Views.

ON Dec. 23 occurs the centenary of the birth of the distinguished French chemist Paul Schutzenberger, who was born at Strasbourg in 1829. The son of a professor of law, Schutzenberger took the degree of M.D. at Strasbourg, was for a short time assistant to Persoz (1805–1868), the professor of chemistry in the Paris Conservatoire des Arts et Métiers, and for some years a professor at Mulhausen High School. Returning to Paris in 1865, he became assistant to Balard at the Collége de France, succeeded to Balard's chair in 1876, and from 1882 was also Director of the municipal École de Physique et de Chemie. In 1888 he was elected a member of the Academy of Sciences in the place of Debray, and he died at Mézy, Seine et Oise, on June 26, 1897. The following year his bust was placed in the École de Physique. Schutzenberger paid particular attention to industrial chemistry, especially of colouring matters, and was known for his long researches on the constitution of alkaloids and of the albuminoid bodies. He also prepared a new series of platinum compounds. His works included his book on fermentations (1875) and a treatise on general chemistry in seven volumes. Towards the end of his life he adopted the view that the elements had been formed by some process of condensation from one primordial substance of extremely small atomic weight; and expressed the opinion that atomic weights within narrow limits are variable.

WE have received from the Department of Research in Terrestrial Magnetism of the Carnegie Institution of Washington the following statement relating to the loss of the non-magnetic research vessel *Carnegie*, referred to in our issue of Dec. 7, p. 883: "The survey yacht *Carnegie* and her scientific equipment were completely destroyed in the harbour at Apia, Western Samoa, on the afternoon of Nov. 29, 1929, following the explosion of gasoline while it was being stored on the vessel. Capt. James Percy Ault, in command, and one cabin boy were killed, the engineer and mechanic were seriously injured, and three of the sailors hurt. The scientific members of the staff, with the exception of W. C. Parkinson, second in command, are expected with Capt. Ault's body at San Francisco about Dec. 19. Mr. Parkinson is remaining at Apia temporarily, from which place he will proceed later to take charge of the Watheroo Magnetic Observatory in Western Australia. The *Carnegie* was the property of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington and had completed about 45,000 nautical miles of her seventh cruise at the time of the accident. Since launching in 1909 she had traversed in all oceans from 80° north to 61° south, a total of nearly 300,000 nautical miles. The data gathered form valuable contributions to the science of geophysics, including terrestrial magnetism and electricity, oceanography, and meteorology."

THE new research vessel, the R.R.S. *Discovery II.*, a description of which appeared in our issue of Nov. 23, p. 798, has been loading at St. Katherine's Dock, London, and on Dec. 10 she was inspected by H.R.H. the Duke of Gloucester, who evinced great interest in the vessel and her equipment and made a short speech to the officers and crew. On the following day the Discovery Committee held a reception on board the vessel, and on Dec. 12 she was visited by King Haakon of Norway. The *Discovery II.* sailed on the morning of Dec. 14, and in a month's time will be at work on the whaling grounds of South Georgia.

LAST summer, Prof. G. Elliot Smith attended as an official representative of Great Britain the Pan-Pacific Science Congress held in Java, and on Dec. 9 he delivered a public lecture at University College, London, describing his experiences. He said that the recent achievements of the Dutch in Java are worthy of careful consideration by everyone interested in colonial administration, and especially in the application of science for the welfare of mankind. As Mr. Ormsby-Gore, referring to Java, said in his recent report, "It certainly affords the most remarkable example in the world to-day of the application of science to the development of the tropics. . . . The significance of Java has never been fully appreciated in Great Britain or in the other parts of the Empire." In Java scientific research is regarded not as an expensive luxury but as the vital and essential condition of social and economic prosperity, if not of existence itself. Much important work is being accomplished in both pure and applied science, and not only are the results of research being used for administrative purposes, but in addition the spirit of scientific inquiry inspires the attitude of the government. In no department is the effect of this interest more vividly revealed than in the affairs of the people themselves. No visitor to Java can fail to be impressed by the happiness of the teeming multitudes of well-behaved people—the population of Java roughly equals in number the people of Britain. This is in large measure due to the study of the peoples and their customs and beliefs. The understanding of the mentality of the people of Java which has emerged from the interest in and the scientific study of their history and institutions has enabled their rulers to respect the desires of the population and preserve institutions and customs which mean much to them and do not interfere with orderly government.

APART from these considerations, Java is for the anthropologist a land of intense interest. As the home of the earliest-known member (*Pithecanthropus*) of the human family and of the tree-shrews, tarsiers, lorises, and a variety of monkeys and apes, the Netherlands Indies provide an epitome of man's ancestry. They form the avenue whereby representatives of the most primitive surviving races of men wandered to their homes in Australia and Melanesia respectively. Centuries later, the most adventurous Argonauts of early times made their way through the Archipelago to the scenes of their greatest maritime achievements in Polynesia. Java is the new Atlantis not only in the Baconian sense as the one country where science promises to be the inspiration of

administration, but also in the fact that it is the most important cultural link with the New World. The Malay Archipelago, forming a widely spread group of islands occupying the only means of access to the Pacific Ocean, has throughout the ages acted as a sieve which has retained certain of the elements of the many cultural streams passing from the west out into the great ocean. Repeatedly one sees, not merely on the ancient monuments but also amongst the living population, scores of interesting survivals of the ancient civilisations of China and India, Greece and Mesopotamia, Crete and Egypt, forming an integral part of the modern culture. Inscribed upon the old Indian temples of the eighth and later centuries of the Christian era, there are scores of ornamental designs and other architectural devices the dependence of which upon India and Greece is generally admitted, but which are also assumed by many to be distinctive features of the Maya culture of Central America.

AT a meeting of the Royal Society of Edinburgh on Dec. 2, Prof. V. Gordon Childe read a paper on the early colonisation of northern Scotland as illustrated by the recent discoveries in Orkney. He summarised the variations in climate known to have taken place in Europe since the last Ice Age, pointing out that the most flourishing periods of prehistoric and early historic civilisation in Caithness and Orkney coincided with what should on current climatological notions have been peculiarly unfavourable epochs. On the other hand, historical circumstances lent significance to the position of these lands at the mouth of the North Sea in 'neolithic' times, during the Roman occupation of Britain and in the Viking age. Prof. Childe described the new culture revealed at Skara Brae, Orkney, as the result of divergent specialisation in an isolated area. It was compared in turn with that of each of the periods when Orkney participated actively in the general current of cultural progress. Many features of the architecture of the village can be traced in the 'neolithic' chambered cairns, but the pottery at least is derivable from a definite group found in Scotland during the Bronze Age. The brochs and their culture were examined in great detail, but it is concluded that there are no significant points of contact. The inference is that the village was anterior to the brochs or else represented a renaissance of a purely native culture after the civilisation of the broch builders had fallen into decay. The native culture itself would be derived from the first neolithic colonists coming from the Atlantic, perhaps mixed with Beaker folk from Central Europe. The broch builders represented an entirely new stock, certainly Celtic, but coming immediately from the Western Isles.

IN a Friday evening discourse on Dec. 13 at the Royal Institution by Miss D. A. E. Garrod, on cave excavation in the Near East, it was stated that until the last few years the study of prehistoric remains in Palestine has been practically confined to the collection of material from surface sites. In 1925, Mr. Turville-Petre, excavating on behalf of the British School of Archæology in Jerusalem, discovered a skull of Neandertal type associated with an Upper Mousterian industry in the Mugharet-ez-Zuttiyeh, north of the Sea of Galilee. In 1928 the British School carried out excavations in a cave near Shukba, in the western Judæan hills, where an Upper Mousterian industry resembling that of the Mugharet-ez-Zuttiyeh was found underlying a Mesolithic level, hitherto unknown in Palestine. In the autumn of 1928 a carving on bone, which appeared to be prehistoric, was discovered in a sounding made by the Palestine Department of Antiquities in the Mugharet-el-Nad, at the western foot of Mt. Carmel, and in 1929 this cave was excavated by the British School, in collaboration with the American School of Prehistoric Research. The outer chamber of the cave was much disturbed, but the inner chamber, which was untouched, contained five prehistoric levels, as follows: 1, Mesolithic; 2, 3, 4, Upper Palæolithic; 5, Mousterian. The Mesolithic represents a slightly later stage of the Shukba industry. In the Upper Palæolithic layers northern African and European influences alternate, the industry of 2 being Capsian, while 3 and 4 contain an Aurignacian of European type.

PROF. H. FREUNDLICH, who delivered the second Liversidge lecture before the Chemical Society on Dec. 12, took as the subject of his discourse "Surface Forces and Chemical Equilibrium". Speaking with delightful clarity and fluency, he said that surface reactions are of the greatest importance in technical and biological processes, but that since these reactions are generally very complicated, it is worth while to examine our knowledge concerning the simple case of a chemical equilibrium being influenced by surface forces. Sir J. J. Thomson's treatise on the application of dynamics to physics and chemistry appeared to him to be the true successor of Gibbs' thermodynamical papers, from which the chemist may still derive many suggestions. Prof. Freundlich first referred to the phenomena accompanying the separation of chloroform by the action of alkali on chloral hydrate, and then extended the inquiry to surfaces of solid substances, illustrating quantitative aspects of the adsorption of fatty acids by charcoal and siloscen, and discussing Frumkin's observations on the adsorptive behaviour of charcoal exposed, respectively, to hydrogen or oxygen. When speaking of the work of Deutsch on the colour change of indicators, Prof. Freundlich showed the striking change of colour of an acid solution of malachite green when shaken with an indifferent liquid such as benzene, and demonstrated the production of a deep red colour when a solution of the colourless base of the dye rhodamine O dissolved in benzene is shaken with water.

ADSORPTION of dyes on silver halides was next discussed by Prof. Freundlich, who also described the experiments of Deutsch and Fajans on the formation of a red precipitate at the interface when a solution of sodium eosinate and silver nitrate is shaken with benzene, pentane, or even air, the equilibrium being shifted in the direction of the undissociated and less soluble salt. Undissociated salt is also formed on the surface of the silver halide, and hence the colour change is the same at all interfaces. Other non-reversible reactions at interfaces result in the forma-

tion of an acid soap on the surface of soap solutions, and in the denaturation of proteins when their solutions are shaken with air or other gases. Prof. Freundlich's experiments with Juliusburger on the bromoethylamine—dimethyleneimine transformation in the presence of animal charcoal were illustrated by curves showing the extent of the adsorption of the four substances (the bases and their hydrobromides) concerned in the process, and the effect of the charcoal on the reaction velocities. It was shown that the equilibrium is displaced in such a way as would be expected from Thomson's relation, the formation of capillary active substances being favoured, and that a substance may be more stable at an interface than in homogeneous solution under similar conditions. Concluding with a consideration of the significance of interfaces in biological problems, Prof. Freundlich said: "The fact that substances are formed at interfaces, and are stable there, which are rather rare under the same concentrations without the interfaces may account for the extraordinary structure of many substances which are biologically important. . . . I should not be surprised if the great difficulty which we meet in trying to explain the nature of enzymes is partly due to similar causes. They may be very unstable and active organic substances, perhaps even organic radicals, which are stabilised because they are adsorbed at a suitable interface, but are able to react very energetically in intermediate reactions with other substances also adsorbed on these interfaces."

THE presidential address of Engr. Vice-Admiral Sir Robert Dixon to the Institute of Marine Engineers on Dec. 10 was an authoritative review of the trend of marine engineering during the last few years. As his career as a student began in 1882, and from 1922 to 1928 he was Engineer-in-Chief of the Fleet, Admiral Dixon has been concerned with all the revolutionary changes of the past half-century, while to-day he is actively identified with the development of high pressure steam marine plant. But however much one would like to see steam retain its supremacy the challenge of the oil engine is unmistakable. In the past decade the total tonnage of motor-ships has risen from 700,000 to 6,000,000, and there are ships now running with engines of 20,000 and 25,000 horse-power. It is the high thermal efficiency which has enabled the oil engine to compete successfully with the best steam plant, and if steam is to maintain its position in our mercantile marine the improvements suggested by Admiral Dixon as to mechanical firing, large water-tube boilers, and higher steam pressures are bound to come. There are inherent possibilities in the steam engine cycle which have not even yet been fully explored.

THERE are many factors in the problem of what is the best type of machinery for any particular ship, two of which are weight and fuel consumption. The steam machinery of the *Empress of Canada*, said Admiral Dixon, weighs 380 lb. per s.h.p., while in the *Duchess of Bedford*, built six years later, it was only 282 lb. The corresponding figure for the *Nelson* and *Rodney* was 100 lb., for the *Hood* 81 lb., for the 10,000-ton cruiser 45 lb., and for destroyers, 33 lb. Early Diesel engines weighed 450 lb. per b.h.p., but in a modern liner the weight is only 155 lb., while large submarine engines working on the single-acting four-stroke cycle have been built weighing only 50 lb. per h.p. As regards oil consumption in motor-ships, this runs from 0·4 lb. to 0·44 lb. per horse-power per hour, while in the oil fired steam vessel *Duchess of Bedford* it is 0·57 lb., and this could possibly be reduced with the latest machinery to 0·5 lb. Boiler oil is, of course, cheaper than Diesel oil, and coal is far cheaper than either. The address showed that Admiral Dixon has great faith in the power of our designers to meet the needs of the time, while towards the end of his address he threw out the pregnant suggestion that even the screw propeller as we know it to-day may be superseded, for "the experiments with modern high-speed pumps and hydraulic devices suggest that such a device, comprising possibly a multi-bladed system, is not outside the bounds of possibility".

LAST summer the Institution of Electrical Engineers was specially invited to visit the Pyrenees and inspect the interlinked group of electric generating companies which supply power to the Midi Railway and the chemical and metallurgical factories in the south of France. On Nov. 4 the technical lessons to be learned from this visit were discussed at the Institution. The hydro-electric power developed in south-west France amounts to 340,000 kilowatts, and this is supplemented by 122,000 kilowatts generated by thermal stations. All the generating companies, including the Midi Railway Company, are interconnected electrically. They are controlled by a central organisation. A 'load-dispatcher' located at Tarbes is in telephonic communication with all the stations and works. Arrangements made with the works only allow them to be supplied with current at times convenient to the generating company. By this means the latter can arrange so that it only supplies at practically full load, and so the charge for power is very low. The plants are so designed that they can be put in or taken out of service at short notice. Formerly, for example, calcium carbide furnaces required a fortnight to get into full operation; now they only require about three days. Works which can utilise surplus power during flood seasons get it very cheaply. In the Valleé d'Ossau, every effort is made to utilise all the power available. Three generating stations are installed. The highest station utilises the fall between 6400 feet and 3670 feet. The next uses the fall to 2372 feet; and the lowest, the station at Hourat, uses the fall from the middle station to 1681 feet above sea-level. The change over to electricity does not seem to have benefited the railway much, but it is a national gain to obviate the purchase of foreign coal.

THE Electrical Contractors' Association has done useful work in publishing a little book entitled "Electrical Installation Work." Reasons are first given why architects and the public should take greater interest in the electrical equipment of buildings. The uses of electricity are now so varied that the lighting load taken by a consumer is often only a fraction of his total supply. In addition, the public supply of

electricity is passing through a period of radical change and development. The standard voltage for domestic supply has now been fixed at 230 and low-pressure direct current systems are gradually being converted into alternating current systems at this pressure. The illumination now demanded is often ten times as great as the average illumination ten years ago. An electric fire takes as much current as a hundred of the old 8-candle-power carbon filament lamps and an electric cooker may take as much as 400 of these lamps. Modern electric wiring, therefore, has to be installed with much greater care than the systems used twenty years ago. If it is done by a reputable firm which belongs to the Contractors' Association, the consumer can be reasonably certain that the risk of shock has been reduced to a minimum and that the fire risk is almost negligible. It is advisable that all extensions of the wiring should only be done by competent wiremen. It is a comparatively simple operation to add a few lamps to a circuit, but this must only be done when it is certain that the existing wires can safely carry the existing load. The greatest caution should be used in connecting eliminators and rectifiers for use with radio receiving sets to the house mains. When head phones are used there is a risk of shock. It is best to have the 'all electric' receiving sets installed by an electrical contractor.

THE ordinary signalling systems used on railways suffer from two defects. They depend on the engine driver observing an optical, or acoustic signal, and they depend also on his acting in the way indicated by the signal. The possibility of error by the human element therefore comes in twice. Several systems of signalling have been devised which can, when necessary, automatically bring the train to rest or reduce its speed. The drawback to most of these systems is that they depend on an elaborate network of wires and apparatus on the track, and supervision of them is consequently expensive. A revolutionary system of optical signalling is at present working on several hundreds of miles on the German State railways between Munich and Berlin. An account of this system is given in the *Electrical Times* for Dec. 5. On the front of every locomotive is fitted a powerful lamp which continuously throws a narrow beam of light almost vertically upwards. On the signal posts beside the track a specially designed mirror is fixed which reflects the beam on to a circle of which the middle of the lamp lens is the centre. A number of selenium cells are placed at intervals round the circumference of this circle and for various positions of the mirror different cells are illuminated. Each of these cells gives a different signal to the engine driver. A perforated disc driven by a motor breaks up the light stream into 600 light impulses per second and the apparatus only responds to this interrupted light. This prevents it being actuated by other light sources. The driver's recognition of the signal is not a momentary glimpse. It remains under his observation until either he acts on it or, if he has waited too long, the brakes automatically stop the train.

THAT there is room for an authoritative periodical dealing with metallurgy in all of its rapidly developing phases and forming a link between research and the industry there can be little doubt. Even as an avenue of publication, auxiliary to the journals of the recognised metallurgical societies, there is scope for such a paper. In so far as *Metallurgia*, the first issue of which has just made its appearance, can fulfil these functions, it deserves, and will receive, a whole-hearted welcome. We have in Great Britain nothing of the standing of say *Stahl und Eisen* or the *Revue de Metallurgie*, and the gap in our metallurgical literature is one which should be filled. Among the contents of this first number are Parts I. of articles on refractory materials, the principles and uses of wire ropes, and the heat-treatment of metals by electrical means. Other subjects dealt with include tungsten carbide tools, the Ford foundry at Cork, acid-resisting steels, bearing bronzes, etc. It is clear, therefore, that the producers have in mind the needs of the engineer as well as those of the metallurgist himself. Among forthcoming articles which are announced may be mentioned the discussion of high chromium irons and steels, welding, light alloys, casting methods, etc. The get-up of the paper is excellent, the diagrams and illustrations are both exceedingly well reproduced, and the venture is one which will be watched with the greatest interest and goodwill.

AN essay by Mr. G. G. Coulton entitled "Modern Faith", which deals with "the spiritual problems confronting the younger generation", appears in the December number of the *Realist*. Although fifty years ago doubt about the tenets of the accepted religion often needed a good deal of courage, "at present doubt is unquestionably the line of least resistance for a young man". Yet, though the line of least resistance may be the true line, "the thoughtful mind will be on its guard against it". As Fénelon said, "He who fears excessively to be duped deserves to be duped, and he nearly always does get grossly duped". Mr. Coulton is inclined to take Renan's view that very few people are entitled to criticise Christianity. "No man has a moral or intellectual right to treat Christianity as negligible unless he has attentively faced its history and its present position in society, and found solid reasons for supposing that its past and present hold over men can be explained away." It may be natural, but it is highly regrettable, that the best minds should alienate themselves from the life of religion because of "the crudity and falsehood of certain religious manifestations". A similar policy of abstention from politics is equally disastrous, and is becoming quite as common. We may affect to despise Christianity, yet in it "there is one characteristic which is removed by a whole horizon from vulgarity. It has always been specially rich in that type which we understand under the name of *saint*". These are things which the present generation is too apt to overlook, in natural reaction from the excessive claims, and sometimes the false pleas, of earlier Christian generations. The phenomenon of Christianity, whether as a historical influence in Europe or as a not extinct power to-day, deserves at least as much attention "as we who cannot understand relativity render willingly to Einstein's theory".

THE inadequate harmony between the cultural and scientific points of view is also the theme of Prof. Lancelot Hogben's article in the same issue of the *Realist*, though he treats the subject from a very different aspect. He pleads for "a new humanism which takes as its starting-point the position of man in the physical universe as it is apprehended through the medium of scientific method". He is of the opinion that such a strictly scientific humanism ought to have been the goal of the Renaissance, which somehow got sidetracked into literary and philological studies, neglecting those developments of Greek science which had taken place under Arabian influence during the thirteenth century. The sudden collapse of this Arabian culture certainly presents interesting problems. Renan attributes it to the philosophers having been courtiers, so that when sovereigns became fanatics for Mussulman orthodoxy, the *savants* disappeared and their manuscripts were burnt. It is clear that Prof. Hogben underestimates the difficulties of basing a rich culture purely upon the natural sciences. It is not only that, as Sir James Jeans has recently reminded us, "the ultimate realities of the universe are at present quite beyond the reach of science, and may be—and probably are—for ever beyond the comprehension of the human mind". A yet more fundamental difficulty is that science cannot supply that *qualitative* point of view which is the first condition of any consistent attitude to life. We must have values, but science would cease to be science if it introduced them. Prof. Hogben's hostility to metaphysics has caused him to simplify unduly the problems which he strives to solve. But his plea for the study of the *history* of scientific research, as well as of its methods and results, is one for which we have every sympathy.

THE eighty-sixth meeting of the American Association for the Advancement of Science will take place on Dec. 27–Jan. 2 at Des Moines, Iowa. According to a preliminary programme which has appeared in *Science*, this is only the seventh occasion on which the Association has held its annual meeting west of a line joining Chicago, St. Louis, and New Orleans, and is the first time that it has met at Des Moines. The new president of the Association is Dr. Robert A. Millikan, director of the Norman Bridge Physical Laboratory, California Institute of Technology, Pasadena, and his address will be entitled "The Alleged Sins of Science". The retiring president, Prof. Henry Fairfield Osborn, president of the American Museum of Natural History, New York City, will speak on "The Discovery of Tertiary Man". A general session of the Association will be devoted to the economic aspect of the present status of scientific workers. A general exhibition of apparatus, materials, and books relating to science will be open during the meeting.

AMONG recent appointments in the Colonial agricultural services are the following: Mr. F. W. Hall, plantation manager, Agricultural Department, Uganda, to be assistant director of agriculture, Gambia; Mr. J. R. Mackie, deputy assistant director of agriculture, Nigeria, to be assistant director of agriculture, Nigeria; Mr. R. W. R. Miller, senior agricultural officer, Tanganyika Territory, to be director of science and agriculture, Barbadoes; Mr. W. Cook, to be entomologist, Agricultural Department, Gold Coast; Mr. J. Wright, to be mycologist, Agricultural Department, Gold Coast; Mr. A. B. S. Ransford and Mr. E. W. Gaddum, to be assistant agricultural officers, Kenya; Mr. A. V. Gibberd, to be superintendent, Agricultural Department, Nigeria; Mr. R. J. Sutton, to be produce inspector, Nigeria; Mr. R. H. Fraser, to be agricultural officer, Northern Rhodesia; Mr. H. M. Heald, to be agricultural officer, Department of Agriculture and Forests, Palestine; Mr. B. J. Hartley, Mr. J. Robertson, and Mr. F. R. Sanders, to be district agricultural officers, Tanganyika Territory; Mr. C. W. L. Fishlock, to be agricultural officer, Uganda. Some recent appointments made by the Secretary of State for the Colonies in the forestry services are: Mr. J. R. Ainslie, deputy director of forests, Nigeria, to be director of forests, Nigeria; Mr. N. V. Brasnett, assistant conservator of forests, Kenya, to be conservator of forests, Uganda; Mr. G. W. Chapman, to be assistant conservator of forests, Cyprus; Mr. G. C. Beaven, to be assistant conservator of forests, Gold Coast; Mr. I. D. S. Cameron, Mr. P. C. Lancaster, and Mr. K. R. MacDonald, to be assistant conservators of forests, Nigeria.

MESSRS. Newton and Co., 72 Wigmore Street, London, W.1, have sent us a copy of their catalogue of optical lanterns, epidiascopes, and other projection apparatus. This includes kinematographs, and projection polariscopes and spectroscopes, lamps, resistances, screens, and so on. It is worth while noting that lanterns can be hired, with or without an operator.

THE Annual Report for 1928 of the Rockefeller Foundation by the president, Mr. George E. Vincent, has been published. It records and surveys the world-wide activities of the Foundation in the realm of public health and preventive medicine and in the cause of public health education. The merging of the Rockefeller Foundation and the Laura Spelman Rockefeller Memorial into a new corporation to be known as the Rockefeller Foundation is also reported. The new Foundation's activities will now include not only public health, but also the advancement of knowledge in the medical sciences, in the natural sciences, in the social sciences, and in the humanities.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A pathologist and bacteriologist in the Giza Memorial Laboratory, Cairo—Sir Holburt Waring, 37 Wimpole Street, W.1 (Dec. 30). Clinical assistants (senior and junior) in the Medical, Surgical, and all Special Departments of the Royal Free Hospital—The Secretary, Royal Free Hospital, Gray's Inn Road, W.C.1 (Jan. 4). A principal and professor of medicine at the Veterinary College, Patna—The Secretary to the High Commissioner for India, General Department, 42 Grosvenor Gardens, S.W.1 (Jan. 15). A senior clinical assistant and clinical tutor at the Royal Infirmary of Edinburgh (Ophthalmic Department) and two clinical assistants—The Superintendent, Royal Infirmary, Edinburgh. Civilian education officers in the R.A.F. Education Service—The Secretary, Air Ministry, Gwydyr House, Whitehall, S.W.1.

Research Items.

Early Man in India.—In a report by Col. Seymour Sewell and Dr. B. S. Guna (*Memoirs, Archæol. Survey*, No. 35, App. 5), the bones excavated at Nal, in Baluchistan, by Mr. H. Hargreaves of the Archæological Survey and attributed by Sir John Marshall to the chalcholithic age, are described and their possible affinities discussed. Of two crania described by Sir Arthur Keith, one, the 'Sialkot' skull, probably belongs to much the same period as the bones from Nal. These consist of fragments representing thirteen individuals, of whom some were children. With the human remains were bones of birds and mammals, part of a large and remarkable bone pin, and some fragments of pottery. Part of an adult skull was found. The greater part of the left side of the skull is missing, as is the lower jaw. It is markedly dolichocephalic, having the low index of 70. This may be due to a slight posthumous flattening. A crescentic piece of flatly ground limestone was wedged at the back of the hard palate. It is suggested that this is an early form of the Indian custom of placing a gold coin in the mouth and of other methods of occluding the mouth and nostrils to prevent the escape of the soul. The teeth are large and well formed, but very much worn down by a hard diet. The long bones show the flattening usually attributed to life in a mountainous region. Owing to the scarcity of types of this early period, it is difficult to suggest physical affinities. The closest resemblance is to the dolichocephalic type from Kish, except that the Nal skull has a much higher vault. Of the two types found at Mohenjo-Daro, the dolichocephalic also resembles the Kish type, but the brachycephalic appears to be Mongoloid rather than Armenoid, as has been suggested for the Kish brachycephal.

Skull of Ornithorhynchus.—Dr. Kesteven and Mr. Furst (*Jour. Anat.*, vol. 63, pt. 4, pp. 447-472, July 1929) give the first complete description, in the English language, of the skull of the platypus, based on a series of nine skulls, from a fœtal skull measuring 25 mm., to the skull of an old adult. Such a complete series has enabled the authors to work out the development of the skull, and to correlate features of the early skull with those of the adult. They show, among other features, the extent and situation of the presphenoid and ethmoid ossifications, and have discovered that the squamosal bone is excluded from sharing in the formation of the inner wall of the cranial cavity. They believe that an independent lachrymal bone is present as a separate entity in the youngest skull, and is still recognisable up to a skull measuring 65 mm. A discussion on the significance of the alisphenoid lamina of the periotic bone is added by the senior author.

Migration of Sea Animals to Land.—Mr. A. S. Pearse ("Observations on Certain Littoral and Terrestrial Animals at Tortugas, Florida, with special reference to Migrations from Marine to Terrestrial Habits." Papers from the Tortugas Laboratory of Carnegie Institution of Washington, vol. 26, No. 6) makes some interesting experiments and observations on the ability of certain littoral animals to live in fresh water and on land. In their natural surroundings the sea animals of the Dry Tortugas have little or no opportunity to migrate to fresh water, but there are several crabs and hermits which are adapted for living in more or less dry situations. These form a series which inhabit all grades from sea to land, culminating in the land hermit, *Cenobita diogenes*, which lives far from the shore and can do without gills at all, as the author has shown by experiment. Crabs that have migrated landwards show a progressive lessening of gill volume, sometimes developing respiratory tufts on the lining of the branchial cavity. As is stated, "An ideal animal is air-breathing, water conserving, swift, and internally stable". As an example of such an animal that has migrated from the sea, the crab *Ocypode* is instanced, which is swift, aggressive, more or less diurnal, and spends most of its time on land. It is omnivorous and a scavenger, and has lost a third of its gills and developed branchial tufts. An interesting point about this crab is the absence from its gills of parasitic mites which occur on some of the other land crabs. The habit which *Ocypode* has of bathing at intervals in the sea is given as the reason. A separate paper by the author in the same publication (No. 6) describes two of these mites which are new to science.

Experimental Research on Freshwater Plankton.—An important summary of research methods in freshwater plankton laboratories is given in Band 6, 1929, of Dr. August Thienemann's "Die Binnengewasser", which is wholly occupied by Dr. Einar Naumann, Director of the Swedish Limnological Laboratory of Aneboda, in his "Grundlinien der experimentellen Plankton-forschung". The author explains the aims of these laboratories, giving particulars of all researches in every aspect. Throughout, the importance of ecological work is emphasised, and details of methods both in field and laboratory are fully discussed. The laboratory at Aneboda is first briefly described as an example; all terms which have to do with limnological study are defined, and figures of apparatus and tables of reagents for analysis of the plankton, both living and dead, are given. Further sections discuss suitable waters for the laboratory, testing methods, and the regulation of the chemical constituents of water, including the estimation of *p*H, lighting and heating, plankton as food, and the feeding of the plankton organisms; finally, details of plankton culture both in the laboratory and in the open, and problems of plankton research. The cladoceran *Daphnia magna* is very much used in these researches, besides copepods, rotifers, and unicellular organisms, both plant and animal. The whole work is extremely useful to all those who have anything to do with limnological studies.

Japanese Bryozoa.—Mr. Yaichurô, Okada, in his "Report of the Biological Survey of Mutsu Bay, 12. Cheilostomatous Bryozoa of Mutsu Bay" (*Science Reports of the Tôhoku Imperial University*, 4th Series (Biology) Sendai, Japan, vol. 4, No. 1, Fasc. 1, February 1929), continues his survey of the Bryozoa. This is one of the contributions from the marine biological station at Asamushi, Aomori-Ken, and is the second paper on this group by the same author. In the present instalment only the Cheilostomata are described, twenty-seven species in all, six of which are apparently new. These latter include one species of *Ellisina*, two of *Caberea*, one of *Lepralia*, and two of *Micronella*. In *Costazzia costazi* Audouin, which was very common, it was noticed that the zoœcium exhibits a variable outer configuration, forming frequently a cubical mass, infrequently a discoidal convex thickened mass, and occasionally an encrusting mass. So far as these outer characters are concerned they might be regarded as distinct species, but from the characters of the zoœcium they are found to agree and are therefore all included under one species.

Appearance of *Phormia* in *Calliphora* Cultures.—Prof. E. A. Bogdanov (*Nautchno-Agron. Zhurnal*, Moscow, No. 7-8, 1929) records some very interesting observations on the appearance on six separate occasions of the fly *Phormia coerulea* in the pure cultures of the *Calliphora erythrocephala*. The conditions of breeding of the latter (for genetic studies) were such that a contamination of the culture by the eggs of *Phormia* is considered exceedingly improbable. Moreover, the *Phormia* flies obtained in the laboratory differed physiologically from the wild flies of the same species, which could not have happened if they were their direct descendants. The main feature of the laboratory-bred *Phormia* is their inability to propagate further, while the wild fly is extremely prolific; other characters of the laboratory flies indicate also a considerable degree of degeneration, generally in the same direction as in the case of other mutants of *Calliphora*. Very remarkable is the fact that some females of the laboratory *Phormia*, though unable to propagate with their own males, produced fertile progeny with the males of *Calliphora*, and the hybrids of the first generation were indistinguishable from the normal *Calliphora*; thus the laboratory *Phormia* proved to be completely recessive to *Calliphora*. This can only occur in a case of a true mutation. In the following generations there was no uniformity, and most of the flies were pathological, but clearly belonging to *Calliphora*; in one case, however, a *Phormia* was obtained in the second generation. The author does not insist that the transmutation of one genus into another has actually taken place and is prepared for some other explanation. His main object in publishing the observations is to attract the attention of other workers on *Calliphora*, since it is probable that when similar cases are observed, they are attributed to an accidental contamination and not investigated in detail.

Newer Tertiary Fossils from the Dutch East Indies.—Collections of Newer Tertiary fossils from the Dutch East Indies are described by F. Siemon (*Ber. Naturf. Gesell. Freiburg i. Br.*, Bd. 29). One series was obtained on two expeditions, in 1907 and 1909–10, from the south-west of Dutch New Guinea in the regions drained by the North River, the Bibis River, and the North-west River. Twenty-two species of mollusca, two being new, with a few corals and foraminifera, as well as a selachian (*Carcharias gangeticus*, Müll.) are recorded and tabulated from Miocene and Pliocene deposits. Two text maps and half-tone figures from photographs of the new species accompany this part. Another series of fossils was collected by Prof. G. G. L. Kimmerling in the neighbourhood of Cheribon in Java, and these are dealt with station by station. In age they range from the Eocene upwards.

Observing Sea Temperature.—In discussing the reliability of various methods of taking the surface temperature of the sea (*Journal of Washington Academy of Sciences*, vol. 18, No. 20), Mr. E. F. Brooks notes that, with all its faults, the bucket method affords the only practical method for general use. It is useful, therefore, to note some of the sources of error that are likely to occur. The first source of error is that the bucket is unlikely to have the same initial temperature as the water: this may mean an error of 0·1° C. Then, again, the water sample may be cooled by evaporation and conduction. The conduction cooling can be prevented by a rubber covering two to four millimetres in thickness. Evaporation is less easy to check and may account for a fall in temperature of 0·5° C. The thermometer generally used has a metal case which may have an appreciable effect, but the case can be removed and this error thus obviated. A quick responding thermometer is advisable to prevent the likelihood of a false reading, and for the same reason the thermometer should be read while in the water. A few other minor sources of error are noted. Mr. Brooks also shows that experiments have proved that in calm weather the temperatures at the surface and at a depth of 5-8 metres vary within 1·5° C. In rough water, however, there is little difference, and a thermograph attached to the condenser intake should give reliable surface temperatures.

Afforestation and Stabilisation in Granada.—The publication of the *Instituto Nacional de Investigaciones y Esperiencias Agronómicas y Forestales* (Año 2, Núm. 3, Madrid, 1929) contains several articles of interest. To a country possessing so little forest as is the case in Spain, one of the most important is a project for the correction and stabilisation of certain tracts of land in the Province of Granada, by J. M. Garcia Nájera, a mountain engineer. The author, after briefly discussing points justifying the scheme, proceeds to describe the geology of the area and the causes of instability. The primary cause, probably dating back several centuries, was the ruthless disafforestation practised, accompanied by and completed by fire and the pasturage of animals—especially goats. The engineer of course regards the matter from the point of view of the conditions actually existing, and they demonstrate the necessity of governments considering this question of erosion and denudation in mountain regions due to the absence of protection by existing forests. For present neglect will not only prove directly injurious to the descendants of the existing populations practising wasteful methods of utilisation, but will also result in heavy expenditure, which Spain is now undertaking in the stabilising work herein dealt with. The author discusses the various possible means for dealing with the instability and his proposed solution. This involves the construction of a main dyke, channels for intercepting water, embankments and trenching work and general drainage schemes. Lastly, plans of afforestation are dealt with and the establishment of rain gauges on the area. The article is illustrated with some excellent photographs and several plans depicting the works to be undertaken.

Repulsion of Atomic Kernels.—In the November number of the *Journal of the American Chemical Society*, W. M. Latimer has considered organic rearrangements from the point of view of the change in the repulsion of the atomic kernels which results from the chemical change and has arrived at the following conclusions. The great majority of rearrangements take place with a decrease in the inter-kernel repulsion energy; a few occur with no change in repulsion energy and are then regarded as resulting from a state of high activation of the molecule, and the product is a mixture of the two forms. Rearrangements with an increase in repulsion energy are rare and invariably accompanied by complex redistributions of electrons in the molecule. The observations are in accordance with the following premise: if there are several possible arrangements of the atoms in a molecule which have the same number of electrons per atom and satisfy equally well the tendencies of the more electro-negative elements to complete their octets of electrons, that form will be the most stable which gives a minimum of repulsion between the atomic kernels.

Permeameters, Rods and Strips.—The general principles of permeameters for testing rods and strips of iron by the use of a yoke to provide a return path for the magnetic flux are well known. The main diffi-

culty of such apparatus is to approximate sufficiently closely to the condition of uniform magnetisation which is assumed in the formulæ. To effect this, various means for compensating for lack of uniformity have been devised. With a uniform specimen, complete uniformity of magnetisation involves equality of magnetic potential and absence of magnetic leakage. The Iliovici permeameter tests the first condition and the modified form of Picou permeameter the second. In the November issue of the *Journal of the Institution of Electrical Engineers*, C. E. Webb and L. H. Ford describe precision permeability measurements on straight bars and strips in the region of high permeability. The construction of a yoke apparatus to give magnetising forces up to $H = 3000$ on straight samples 25 cm. long and up to $H = 5000$ on straight samples 10 cm. long is described. Search coils are used to measure the magnetising force and the conditions for satisfactory compensation for leakage are determined. It was found that solid bars were less liable to the effects of stress than sheet samples, but slightly bent or twisted specimens clamped between flat blocks give rise to serious errors. When search coils are wound directly on the sample, sheet material rings are very liable to be stressed. The errors due to variation in the reluctance of the path of the magnetic flux can be avoided by limiting the number of strips in the sample to ten, provided that they be accurately cut to a uniform width. For values of H greater than 15, the effects of stress and variation of reluctance become negligible.

Reactions of Atomic Hydrogen.—The action of atomic hydrogen prepared by Wood's method on a number of organic compounds has been studied by Urey and Lavin, whose results are published in the November number of the *Journal of the American Chemical Society*. Atomic hydrogen is, on the whole, a rather mild reducing agent. It reduces azoxybenzene at least partly to azobenzene and azobenzene partly to hydrazobenzene, with aniline as a final product. Certain solid dyes are reduced to colourless compounds which are partly oxidised again to the coloured form on exposure to air. Benzoic acid and acetamide catalyse the recombination but are not noticeably reduced. Atomic hydrogen recombines in the presence of formic acid. A small amount of formaldehyde is produced, probably due to the decomposition of the acid by heat into water and carbon monoxide and the subsequent formation of the aldehyde from carbon monoxide and atomic hydrogen. Acetaldehyde is polymerised to paraldehyde.

Vapour Pressure of Rubber Jellies.—In the October number of the *Journal of the Chemical Society*, P. Stamberger describes experiments on the vapour pressures of rubber jellies in three solvents ; benzene, chloroform, and carbon disulphide. Up to a certain concentration the rubber causes no appreciable vapour pressure lowering, but beyond this the lowering increases rapidly with concentration. This result is quite different from that with 'true solutions' (molecular dispersions), for which a linear relation with concentration holds up to high concentrations. The results with different samples of rubber agreed, thus suggesting that rubber is probably a definite hydrocarbon and not a mixture of hydrocarbons of different degrees of polymerisation. The results are interpreted on the lines of the formation of solvated layers and not swelling by capillary forces. During the first stage of the process it is assumed a layer of solvent molecules is formed around the rubber particle, leaving free solvent to exert the normal vapour pressure. In the solvated layer solvent molecules exhibit vapour pressure lowering. The results are shown to favour the assumption that the rubber molecules are long chains, and this type of molecule seems to be characteristic of substances which show swelling.

Liquid Crystals and Chemical Constitution.—The property possessed by certain chemical compounds of forming liquid crystals has been studied by D. Vorländer, who attempts in two papers in the November issue of the *Berichte der Deutschen Chemischen Gesellschaft* to correlate this property with certain deductions as to the relative orientations of two or more long chains of atoms to one another. It is shown that the non-appearance of liquid crystals in such derivatives of urea and thio-urea as are obtained by introducing two *p*-amino-*p'*-ethoxyazobenzene groupings into the molecule may be due to the angular divergence of these two long groups, which are linked together by the carbonyl or thiocarbonyl group at an angle of 109°. When, however, these compounds are converted to the corresponding di-imide by removing water (or hydrogen sulphide), this divergence disappears, since the double linking of each nitrogen atom to the central carbon atom results in a linear configuration –N=C=N– and the compound can exist in the liquid crystalline condition. This evidence is confirmed from a study of the esters which trimesic acid and the three phthalic acids produce with such lengthy chain compounds as *p*-phenetoleazophenol. The star-shaped orientation of the trimesic esters and the angular divergence (60°) of the chains in the ortho-esters seem to preclude the possibility of liquid crystal formation. The meta-esters with a divergence of 120° melt to liquid crystals which persist only over a short temperature-range, whilst the para-esters, in which the two chains are said to lie in a straight line, are described as supra-crystalline, that is to say, the liquid crystalline condition is so stable that the amorphous liquid state is not even attained.

Voltage Control of Large Alternators.—One of the difficulties which electrical engineers have to overcome is to maintain the voltage constant at an alternator's terminals when large loads are suddenly thrown on or off. An alternator requires direct current excitation, and its voltage is regulated by varying the current given by a direct current machine. The magnetic circuit of the alternator does not respond instantaneously to a change in the exciting current. The magnetic circuits of large machines store a large amount of energy, and consequently there may be a lag of a second or two in responding to the changes of the exciting current made necessary by sudden changes in the load. H. W. Taylor discussed the voltage control of large alternators in a paper read to the Institution of Electrical Engineers on Nov. 28. Voltage control is now required to be automatic within one or two per cent of its normal value. The author discussed the action and reaction of the two machines. In certain cases the alternator voltage is unstable, as, for example, when the load consists of a large overhead network on a light load or unloaded underground cables. In these cases the voltage can rise to a high value. Methods are given in the paper for computing the curve of falling voltage when a sudden load is thrown on the circuit. Modern voltage regulators act only on the field circuit of the exciting dynamo. The alternators have such large exciting currents that it would be impracticable to operate the very heavy contact pieces that would be required to vary their magnitude. An interesting oscillograph record is given of the transient variation in the field current when a change in the nature of the load changes the magnetic flux of the machine.

British Museum Expedition to British Honduras.[1]

By T. A. JOYCE.

THE objective of the British Museum Expedition to British Honduras this season was the group of ruins situated between the Pusilha and Joventud branches of the Mojo River in British Honduras. A preliminary investigation of the area had been made in 1928 by Capt. E. L. Gruning, Dr. T. Gann, and Mr. H. Clive-Smith. The primary objects this year were to bring back as many as possible of the inscribed stone stelæ; to excavate a cave which gave indications of having been used as a pottery dump; to survey the main site so far as possible; to carry on excavation in the numerous mounds; and to prospect for other ruins in the neighbourhood. I was accompanied by Capt. E. L. Gruning, who undertook supervision of transport; and by Mr. Robert Ashton, who looked after the commissariat.

The expedition sailed on Jan. 31, and reached Punta Gorda, the jumping-off place, on Feb. 23, leaving for Pusilha on Mar. 4.

The cave appears to be a natural cavity in a limestone outcrop of some size, on the summit of which were a series of low mounds. Some of these mounds were excavated, but yielded no results beyond fragments of coarse domestic pottery, and the natural inference is that they were hut foundations. Entrance to the cave was made laterally from the lower level, but the opening here may be of comparatively late date, and produced by the fall of a large tree tearing away the side of the cavern. A kind of 'chimney' leads from the cave to the surface of the outcrop. It seems probable that this chimney was the original means of access to the cave, and that the ancient inhabitants of the village erected on the summit of this outcrop used this 'oubliette' as a convenient dump for broken and discarded pots. Yet it is quite possible that the cave was also, in a sense, a sacred place, because traces of five burials were found there. However, these burials may be intrusive.

The cave measures some 33 feet in length, and at its widest transverse diameter, 12 feet. Excavation carried down to the rock floor showed that the deposit measured some 10 feet in depth. The contents of at least one-half of the cave were removed in layers of approximately 1 ft. 6 in. to 2 ft. in depth. The soil in the cave was heavy and sticky from the surface to a depth of about 3 feet. Below that it was fairly crumbly, and easier to work and search.

When half the cave had been partially excavated to the depth of about 7 feet, it became apparent that the archæological strata were not horizontal but curvilinear, the richest finds appearing immediately under the chimney. It is evident, therefore, that the greater part of the remains had been thrown down the chimney, forming a mound.

The results may be summarised as follows: The main bulk of the remains discovered consisted of pottery fragments of great variety. The greater portion consisted, naturally, of coarse domestic ware, so-called 'ollas' and dishes. But there was an unusually high percentage of bowls and tripod plates painted in slip, and frequently bearing hieroglyphic inscriptions. The quality of paste is extremely variable, ranging from a rather thick and friable ware to a very thin, hard, and perfectly fired pottery. The slip decoration comprises two or three shades of red, yellow, orange, and black. Most of the designs are outlined in the last.

Occasionally a peculiar grey colour is incorporated in the design, a grey which verges on blue, especially when it is combined with one of the more brilliant reds. Certain fragments, few in number, show the remains of a thick turquoise-blue slip, rather coarse in quality, which was evidently applied to a completed pot and subjected to a secondary firing. This slip, which bears a remarkably close resemblance to the blue slip characteristic of Mexican Toltec ware, is for the most part imperfectly fired, and only survives in patches. This secondary slip, in a colour (and material) which has usually been associated with the Toltec period of Mexico, appears only in the lower strata of this cave, and seems to have been more or less experimental. There can be no question that the pottery of this cave antedates the Toltec period by centuries, and there is not the slightest indication of Mexican influence throughout the complex.

A chocolate-coloured ware, deepening to black, with impressed or incised ornament, thin walls and well fired, appears in small quantities in most of the layers. Incised and 'fluted' ware came from the lower strata. Engraved pottery (on which designs had been carved after firing, or at least sun-drying), also belonged to the lower strata.

The depth of the deposit provided six strata, of 1 ft. 6 in. to 2 ft. each, and these were numbered from 1 to 6 in a downward direction. By far the richest stratum was the fourth, in which examples of practically every style were found. The top stratum, consisting in the main of comparatively recent vegetable humus, was poor in remains apart from coarse domestic pottery. The remains characteristic of the deepest three strata include bowls of rather thick ware, painted with designs in black on yellow. So far as my knowledge goes, this ware has not been found at any other site. Here, too, were found fragments of polychrome ware, many of them well fired, ornamented with series of stepped coils or frets, a design which appears to have gone out of fashion in later times. The same statement is true of the fluted ware. The use of the peculiar grey slip, mentioned above, appears to start in the fourth stratum and continue until the second, while the turquoise-blue slip, probably involving a second firing, belongs to the fourth and fifth. The incised ware, though comparatively scanty, belongs to the third, fourth, and fifth strata, but the rare engraved fragments only to the fourth and fifth.

Decorative motives derived from the vegetable world have hitherto been regarded as very rare in Maya art; but the Pusilha potters made great use of a design resembling a twisted liana with dependent buds. This design, which lasted from the fifth to the second stratum, is particularly characteristic of the site and is more frequently met than any other. Another 'vegetable' design, of flower-petals, is also found in the second, third, and fourth strata.

Associated with these upper strata (second to fourth) is a very interesting class of ware in which the designs, usually formal, are painted in a singularly brilliant red on a buff ground. Some of this ware is magnificent from a technical point of view. In many cases the paste is marvellously thin and light, perfectly fired; and the slip-decoration is so highly burnished that it gives the illusion of a glazed surface. The rare pale grey slip appears on vessels of this class, emphasising details; and some of the vases show a stippled ornament in red, which must have been applied by means of a stiff-bristled brush or its equivalent.

As regards the animal world, figures of monkeys are shown on fragments from the fourth and fifth

[1] From a paper read at a special meeting of the Royal Anthropological Institute on Dec. 10.

strata, and also birds. The finest piece of painting was a single fragment, which in style recalls the art of Palenque, discovered in the sixth stratum. A number of tiny bowls, of very rough ware, often in the form of birds or animals, were found in the middle strata. These may have been votive offerings, or, more probably, children's toys.

As regards the plates, tripod and plain (with a simple ring foot), the ware is thicker and coarser than that of the bowls, and the feet, where present, are of the cascabel pattern, hollow, and enclosing a small clay pellet which forms a rattle. The rims are usually surrounded with a band of painted design, based on textile art, or the 'twist-and-bud' pattern, often supplemented with a row of glyphs. The centre is usually occupied by a formal design (often cruciform), but sometimes by the figure of an animal or snake or human being.

Apart from fragments of *metates* and *manos* (the tripod slabs and rollers used in grinding maize), stone remains were remarkably few, and represented by only three spear-blades of flaked chert. Obsidian flakes and cores were found in quantities.

A remarkable bone pendant was discovered in the second stratum. This is formed from the ascending ramus of the right mandible of a human lower jaw. The condyles have been filed off, and just below the notch a hole has been pierced for suspension. The exterior surface is covered with relief carving, the main feature of which is four glyphs arranged in a square. This object, which is probably an amulet, is, I believe, unique.

Objects of worked shell are rare, and limited to a few beads. The most interesting is a large spiral shell, which had been rubbed down on two sides, so that the remaining portion represents the central longitudinal section. Small river-shells, some pierced for suspension, were found in quantities.

New Sundial in the Royal Botanic Gardens, Kew.

SOME months ago a beautiful pillar which had come from the old Kew Bridge, and had been presented to the Royal Gardens by Mr. George Hubbard, was set up in the grounds of Cambridge Cottage. Prof. Vernon Boys, having learned from

FIG. 1.—New sundial in the Royal Botanic Gardens, Kew.

the Director that a sundial was required to stand on this pillar, generously offered to provide one which would be worthy of the position. Prof. Boys has designed a dial and made it himself. It is now in place and can be seen and proved by the public (Fig. 1).

Nowadays a sundial is generally regarded as a mere ornament to a garden, and if it is in error by a few minutes nobody minds. After all, the dial gives local apparent time and it is too much trouble for most people to ascertain the correction necessary to obtain Greenwich mean time. Prof. Boys has no patience with such slackness. He has aimed at getting the time to the nearest minute. Not only is his dial made with the greatest precision; it carries an inscription on the southern or upper cube which

FIG. 2.—'Dial' of the Kew sundial.

gives in clear figures the correction to be applied to deduce Greenwich mean time from Kew apparent time on any given day of the year. This is contained in a table of 88 entries calculated from the equation of time of next year (a year half-way between two leap years), for each day, to which the time corresponding to the longitude of Kew has been (algebraically) added. Any member of the public by adding the correction of the actual day to the time shown by the sun, or subtracting as the case may be, will have Greenwich mean time.

The dial itself is not of the conventional type (Fig. 2). In fact it is doubtful whether the word 'dial' is strictly appropriate. Perhaps we should say that there are six dials. Prof. Boys had adapted a design which is to be found occasionally in churchyards. The dial is built up with five blocks arranged in the form of a Greek cross. When the dial is in position the plane of the cross is parallel to the equator, so that the outer edges of the cubes which form the arms are parallel to the earth's axis. The shadows of these outer edges fall in succession on the adjacent arms of the cross. The graduations which serve for telling the time are along the edges. Gun-metal has been used for the cross and its stand. The central block is a cube; the other four blocks which form the arms of the cross are 3 in. long and $2\frac{7}{8}$ in. wide. The accurate machining of these blocks is a necessity of the design.

The engraving was done for Prof. Boys by Mr. H. Routledge, who is the engraver responsible for the finest work on Admiralty charts. After the divisions and lettering had been engraved, each part of the dial was exposed to very dilute hydrogen sulphide and ammonia for about two minutes. The black was cleaned off the flat surfaces with Water-of-Ayr stone and the engraved work was left black. The effect is very pleasing.

The five blocks which form the dial are mounted on a trapezium-shaped support at the inclination appropriate for Kew. How the parts are held together is not apparent. The support is attached to the stone pedestal in a neat way. Four bolts are cemented into the pedestal. After the nuts were screwed on to these bolts, melted tin was poured into little pits surrounding the nuts and hides them from sight. No one will be tempted to unscrew the bolts and appropriate the sundial.

The precision with which a sundial can be used is limited by the lack of sharpness in the shadow of the gnomon. Theoretically, the width of the penumbra should be equivalent to two minutes on the time scale. It is found that time can be read to a minute on the new dial. Probably the reading corresponds fairly closely with the middle of the penumbra and is therefore in accordance with the intention of the designer. By a curious chance the sundial has been placed in the only part of the Royal Gardens from which a public clock is clearly visible. The clock of Kew Church can be seen over the wall of the Gardens and it will be possible to regulate the clock by direct comparisons with the dial.

It will be seen from Fig. 1 that the dial is well balanced on its pillar and looks handsome as well as businesslike.

The history of the dial and the stone column which supports it is engraved on the sloping face of the trapezium-shaped support and is as follows:

"This Dial, Designed, Constructed & Erected by C. V. Boys, F.R.S., was presented by him to The Royal Botanic Gardens, Kew. Engraved by H. Routledge. The Stone Column taken from Old Kew Bridge was presented by George Hubbard, F.S.A., the capital and base were supplied by H.M. Office of Works. A. W. Hill, F.R.S., Director. 1929."

Visitors to the Gardens who are interested in sundials should remember to look at the dial which was put up by William IV. to commemorate Bradley's observations at Kew House. The pedestal of this sundial bears the King's monogram very skilfully carved. The dial itself was made by Tompion.

Filterable Viruses.[1]

THE invisible multiplying bodies generally known as filterable viruses are among the most interesting things in biology to-day, partly because they are the cause of many diseases in animals and plants, and chiefly because they seem as if they might in the end prove to be some of the transitional forms between live and dead matter. Knowledge about them is moving so quickly that it is difficult to know at any moment where we are, and the compilation which Dr. E. B. McKinley has put together will be welcomed as a useful attempt to summarise all we know of them up to date.

Dr. McKinley deals rather fully with the virus diseases of man, animals, fowls, fishes, and insects—about fifty in number—and has a chapter on typhus and the other *Rickettsia* diseases, in which the organisms are just visible. Under each disease he gives an adequate summary of the behaviour of the virus, and, going through them, one cannot but feel that we have to do with what is really a natural group of agencies, though they are distinguished from better known agencies, such as bacteria, mainly on the point of size.

These summaries necessarily contain only a selection of what has been said about each virus, and the selection of the compiler is naturally influenced by his point of view. Dr. McKinley writes mostly as a systematist and he nowhere notices Sanfelice's work on epitheliana contagiosum of fowls, his separation of a nuclo-proteid which would reproduce the disease on inoculation into a fresh animal and his fundamental suggestion that a virus might be a chemical substance which influenced cells in such a way that they produced more of it.

The account of the virus diseases of plants is far less satisfactory: it is not clear whether the author meant it to be as complete as that of the animal diseases or not: it certainly is not. This is rather unfortunate, for plants show clearly some important points which are not so plain in animals, as, for example, the possibility of a host containing large quantities of virus without showing any symptoms of disease, as potatoes often do. The modes of transmission in the plant diseases are also curious, for while some of them, for example, tomato mosaic, are easily conveyed by contact or inoculation, others, such as aster yellows, can be passed from one plant to another only by insects and artificial inoculation fails. The animal diseases such as yellow fever, which are normally conveyed by insects, can be transmitted equally well by a hypodermic syringe. It seems as likely that we shall get a just view of what viruses really are from a study of those of plants as from those which affect animals: the Rous cancer virus and the bacteriophage are also very significant: both of them are dealt with by McKinley.

Another section discusses the vexed question of invisible forms of ordinary bacteria, for which there is a good deal of evidence not to be lightly dismissed, and finally the strange 'inclusion bodies' are described and abundantly illustrated. These large intracellular, often intranuclear, objects are present in many, though not all, of the animal and plant diseases, and they have a characteristic appearance which may be put to useful purposes in diagnosis, for example in rabies. They may represent some form or stage of the virus itself, but they are more probably peculiar cell-reactions: their specificity recalls that of plant-galls, and contrasts strongly with the relative uniformity of the tissue reactions of animals to different bacillary parasites.

[1] "Filterable Viruses and Rickettsia Diseases." By E. B. McKinley. *Philippine Journal of Science*, vol. 39, pp. 1-416, 70 plates; 1929.

Radio Communication in the British Navy.

THE history of the development of radio communication in the British Navy is of great interest. From a paper on "Naval Wireless Telegraph Communications", by G. Shearing and Captain Dorling, which was read to the Institution of Electrical Engineers on Dec. 4, we learn that Admiral Jackson experimented with radio waves so far back as 1896. In 1899, with the help of Marchese Marconi, ranges up to 50 miles were obtained. In 1909 a crystal detector was first used, and in 1914, immediately prior to the War, valve reception was passing out of the experimental stage. During the War, arc and spark systems were generally used, but the thermionic valve system soon made them obsolete. The six months' cruise of H.M.S. *Renown* in 1927 provided opportunities for testing the capabilities of short-wave working on long ranges. With the exception of three days, communication was easily maintained with Whitehall.

The British Navy is divided up into squadrons, which are normally situated in distant seas under the orders of a Commander-in-Chief. There are squadrons, for example, in China, the East Indies, Africa, America, and the West Indies. Each naval area has one or more land radio stations which act as terminal points for the traffic to and from the Admiralty and as distributing and collecting centres for ships in the vicinity. If no commercial stations are available the naval stations are also used for communicating with merchantmen. They have a range varying from 1000 to 2000 miles and can also be linked up with the cable and land-line systems. The advent of the short-wave system has now made it possible for ships in any part of the world to communicate directly with each other and with the Admiralty at certain times of the day.

To obtain the results given above, H.M. ships of the cruiser class are fitted with a 12-kilowatt transmitter for long waves and an 8-kilowatt transmitter for short waves. Valve transmitters are always used. The long-wave apparatus has a range of about 1500 miles. In addition, they have two or three sets of receiving apparatus for long and short waves, besides direction-finding sets and fire-control radio sets. All the standard apparatus used is robust and simple to handle. It is proof against vibration and shocks from gunfire and has to be trustworthy under all climatic conditions. In the battle fleet, the commander must be able to transmit his orders to any unit of the force and be in touch with the Admiralty at the same time.

The striking feature of a modern fleet action is the speed at which everything happens. If the two fleets are approaching one another at a speed of between 40 and 50 miles an hour, then even with aircraft reconnaissance the time between first sighting the enemy and joining action may be only about an hour. The valve transmitters used after the War generally used frequencies between 60 and 3000 kilocycles, that is, wave-lengths between 5000 metres and 100 metres. The introduction of short waves, however, has modified the requirements very considerably. Their advantages for long range working at distances from a few hundred miles up to world-wide range during certain hours of the day are well known. It has been necessary, therefore, to arrange for the fitting of attachments to the existing sets capable of transmitting on a band of waves from 4300 to 21,500 kilocycles in breadth (wave-lengths of 70 metres to 14 metres).

Antarctic Meteorology.

AFTER considerable delay, due principally to lack of funds, it was found possible in 1923 to undertake the tabulation and reduction of the several series of meteorological observations taken by the Australasian Antarctic Expedition of 1911–14. The first two (Series B, Vols. 3 and 4) of four contemplated volumes are now published.[1] Another volume is to deal with the records taken during a winter at Queen Mary Land and the observations made on the aurora during the antarctic and sub-antarctic courses, and the last will contain a discussion of the figures.

The Macquarie Island station functioned after the return of Sir Douglas Mawson's Expedition, but owing to War conditions was closed down in December 1915. It has not since been found possible to reopen it. The monotony of the climate does not suggest that very important data would be obtained from its continuance, however valuable it might be in forecasting. Temperature ranged within a few degrees of 40° F.; precipitation occurs on most days in the year and strong westerly or north-westerly winds prevail. The rainfall records are not so complete as the other data, which are very full.

Vol. 4 covers a period of 22½ months at Cape Denison on Commonwealth Bay, the headquarters of the expedition. These data are most important in their contribution to the study of the antarctic climate and particularly to the well-known antarctic blizzards. Sir Douglas Mawson chose a thoroughly uncomfortable but most valuable site for his station. He arranged for all observations to be taken every six hours, except during the latter part of the second year, when the screen thermometer was read only once a day. In addition to the detailed tables, the meteorological journal of the expedition is printed.

Mr. Madigan rightly says that the wind is the outstanding characteristic of Adélie Land. So far as records go, Commonwealth Bay would appear to be the windiest place on earth. The mean hourly wind velocity for the whole period of 22 months was 44·2 miles per hour. It may be recalled that 43 miles per hour is a gale on the Beaufort scale. In February 1912, which was the calmest month, the average velocity was 26·2 miles per hour. Wind velocities were taken with a Robinson cup anemometer, except for short periods when they were visual owing to the instrument being damaged by the wind.

The wind blew mainly from the south-south-east and south and was generally very steady, so that after some practice the explorers abandoned crawling and walked on their feet in 90-mile currents of air, leaning on the wind. There were occasional periods of calm and variable winds, but these were apparently local, for the wind could frequently be heard roaring on the plateau to the south, and to the west of the station drift snow could be seen sweeping down to the sea. Local whirlwinds from the north sometimes interrupted the short calms.

Mr. Madigan does not discuss the antarctic atmosphere circulation, but we hope he will do so in the final volume of the series.

[1] Australasian Antarctic Expedition, 1911–14. Scientific Reports. Series B, Vol. 3: Meteorology. Tabulated and Reduced Records of the Macquarie Island Station. Recorders: G. F. Ainsworth, H. Power and A. C. Tulloch. Reduction and Tabulation of Data, by Direction of H. A. Hunt, and under Superintendence of B. W. Newman. Pp. 544+4 plates. 40*s*. Vol. 4: Meteorology. Tabulated and Reduced Records of the Cape Denison Station, Adélie Land. By C. T. Madigan; with an Appendix by W. E. Bassett. Pp. 286+viii+2 plates. 30*s*. (Sydney: Alfred James Kent, 1929.)

University and Educational Intelligence.

BIRMINGHAM.—At a degree congregation held on Dec. 13, the degree of M.D. was conferred on John William Field for a thesis entitled, "A Study of the Dietary of the Tamil Cooly of the British Malaya, with special reference to the influence of Vitamin A, Starvation of Physique, and Resistance to Disease"; and on Cyril John Polson for a thesis on "Observations upon the Metabolism of Iron in the Animal Body". The degree of D.Sc. has been awarded to Francis Eric Keep for a thesis on "The Geology of the Shabani Mineral Belt, Belingwe District", and other reports of the Southern Rhodesia Geological Survey.

BRISTOL.—On Dec. 13, Mr. Winston Churchill was installed as Chancellor of the University. After the ceremony, the honorary degree of LL.D. was conferred, among others, on Mr. Churchill and on Dr. T. F. Sibly, vice-chancellor of the University of Reading.

CAMBRIDGE.—A meeting of the electors to the Drapers professorship of agriculture will be held on Friday, Jan. 17. It is proposed that the stipend of the professor shall be £1200 a year in addition to £200 as head of the Department. The administrative duties of the professor include co-operation with the Ministry of Agriculture and Fisheries, which gives financial support to the School of Agriculture and maintains a number of agricultural research institutes closely associated with it. Candidates should communicate with the Vice-Chancellor on or before Tuesday, Jan. 7.

The Director of the Solar Physics Observatory has appointed Mr. C. P. Butler to be first senior observer and Mr. W. Moss to be second senior observer.

Mr. W. B. R. King, Magdalene, has been reappointed assistant to the Woodwardian professor of geology.

Mr. L. C. G. Clarke, curator of the Museum of Archæology and Ethnology, has been elected to a non-stipendiary fellowship at Trinity Hall.

GLASGOW.—The chair of geology in the University, recently vacated by Prof. J. W. Gregory, has now been filled by the appointment of Mr. E. B. Bailey, of H.M. Geological Survey. Prof. Bailey is one of the most distinguished of Scottish geologists. He has played an important part in the work of the Geological Survey during recent years and is particularly well known for his studies on Carboniferous igneous rocks and his unravelling of the complicated geological structure of certain parts of the Western Highlands—notably the Island of Mull and the Ben Nevis–Glencoe district. In the period of the War, Prof. Bailey also played his part, and was awarded the Military Cross, the Légion d'Honneur, and the Croix de Guerre with Palm.

ACCORDING to the twelfth report of the Technical Optics Committee of the Imperial College of Science and Technology and the Advisory Council in Technical Optics to the London County Council, for the year ending July 31, 1929, the teaching at the Imperial College and at the Northampton Polytechnic has be co-ordinated by the adoption of the same symbols, and it is proposed to provide at the latter a two-year day course in addition to the one-year course provided hitherto. At the Imperial College ultra-violet microscopy is to be developed for regular users of the microscope and research work on colour vision, resolving powers of objectives, and the ruling of gratings is to be continued. Prof. A. O. Rankine has been appointed Director of the Department. The number of students is about 20, and the annual cost about £5000.

Calendar of Patent Records.

December 22, 1818.—The hobby-horse, the forerunner of the bicycle, was the invention of Baron von Drais, and was introduced into England by Denis Johnson, coachbuilder, of Long Acre, who was granted a patent for it on Dec. 22, 1818, under the title of "a machine for the purpose of diminishing the labour and fatigue of persons in walking and enabling them at the same time to use greater speed, which said machine he intends calling 'the pedestrian curricle'". One of his machines, built for a Duke of Marlborough, is now in the Science Museum.

December 23, 1801.—The jacquard loom takes its name from Joseph Marie Jacquard of Lyons, who was granted a patent in France on Dec. 23, 1801, "pour une machine destinée à suppléer le tireur de lacs dans la fabrication des étoffes brochées et façonnées". The specification states that the inventor first made a machine of the type in 1790 and that at the date of the patent more than four thousand were in use in the neighbourhood of Lyons.

December 23, 1834.—The hansom cab is named after Joseph Hansom, whose first patent was granted on Dec. 23, 1834. The original cab was in the form of a sedan chair slung between large wheels with the driver's seat on the roof in front and a door at the back, the well-known construction being introduced with a second patent two years later granted to Gillett and Chapman, to whom the first had been assigned. A company was formed and started with 50 cabs, but was forced to compete with many imitators, in spite of several favourable verdicts in the courts.

December 24, 1836.—The name of Bennet Woodcroft will always be associated with the great reform of British patent law and practice that was brought about by the Amendment Act of 1852. Upon the passing of the Act, Woodcroft was appointed to the post of superintendent of specifications in the new department, and it was mainly through his enthusiasm and exertions that so many needs of the inventor were quickly met by a liberal interpretation of the new Act. To him is due the printing and indexing of the patent specifications, and he was also primarily responsible for the institution of the Patent Office Library and of the Science Museum. Before his association with the office, Woodcroft was a prolific inventor. One of his patents, dated Dec. 24, 1836, was for a process of printing calico with indigo, in which, to avoid the rapid oxidation which takes place, the operations were carried out in an atmosphere of coal gas.

December 24, 1866.—An early self-excited dynamo was that for which a British patent was applied for by Cornelius and Samuel Varley on Dec. 24, 1866. Two electro-magnets of horse-shoe form and two bobbins mounted on an axis are so arranged that when the bobbins are rotated they act simultaneously between the poles of the two magnets, a commutator serving to join up the whole into one continuous circuit. The residual magnetism is used to start the action. The application was not completed, but a patent was granted for the same invention on a second application made six months later.

December 24, 1877.—Edison's first United States patent for the phonograph was applied for on Dec. 24, 1877. The machine had a metal drum provided throughout its length with a fine spiral thread, over which a sheet of tin-foil was tightly pressed. A needle attached to a mica diaphragm rested on the tin-foil and recorded the sounds thereon. The specification describes the use of a clockwork motor, but the original machine made by Edison, which for some time was on loan to the Science Museum, South Kensington, was operated by hand.

Societies and Academies.

LONDON.

Society of Public Analysts, Dec. 4.—**A. P. Laurie**: The methods of examining pictures. An outline was given of the composition of the different pigments used for old illuminated MSS. and oil paintings, and methods of sampling by means of a micro-borer and examination by means of a microscope polariscope were described; a summary of micro-chemical tests for the various classes of pigments was given. The use of X-ray photography and ultra-violet rays was discussed, and it was shown how an examination of the brush strokes in an oil painting, considered in conjunction with the chemical and optical properties of the pigments, enabled a judgment to be formed as to whether the whole work had been produced in one studio and at the same period.—**S. Glasstone** and **J. C. Speakman**: The quantitative analysis of mixtures of nickel and cobalt. Electrometric titrations of nickel and cobalt solutions with potassium cyanide, with nickel and cobalt indicator-electrodes, respectively, have established the soundness of the theoretical basis of the Rupp and Pfennig method of determining these metals. A modified iodimetric method has also been developed for determining small amounts of cobalt in the presence of nickel.—**J. C. Baird** and **J. H. Prentice**: The changes with age of the hydrogen ion concentration of egg white and egg yolk. Determinations of hydrogen ion concentration by means of a quinhydrone electrode indicated that the normal *p*H value of fresh egg white is approximately 8·6, and that there is a rapid rise in the course of the first week of storage to a level of about *p*H 9·0, at which figure the reaction remains fairly constant. The fresh yolk has a reaction of approximately *p*H 6·0, which in the course of ten weeks rises to about 6·2. The refractive index of the egg white is constant at about 1·360.

PARIS.

Academy of Sciences, Nov. 12.—**Pierre Weiss, R. Forrer, and F. Birch**: The magnetisation to saturation of the nickel-cobalt alloys and the atomic moments of nickel and cobalt.—**de Sparre**: The necessity of taking into account the contraction on setting in the calculation of the work in armoured concrete.—**N. Lusin** and **W. Sierpinski**: The classes of the constituents of an analytical complementary.—**Georges Bouligand**: The successive fronts of an ensemble of points.—**A. Magnan** and **A. Sainte-Laguë**: New experiments on the resistance to the progress of fish in water. The experiments were carried out on 22 species of dead fish loaded so as to fall in water under the action of gravity: the motion was followed with a kinematograph. For most fishes the resistance was found to be constant, but with one, the ray, the resistance increased with the velocity.—**René Audubert**: The influence of the nature of the electrolyte on the potential of inversion of the photovoltaic effect.—**Mme. Ramart-Lucas**: The comparative stability of isomers according to their absorption spectra. The relation between the absorption in the ultra-violet and structure of the diaryl derivatives of ethylene and ethane. The ultra-violet absorption curves differentiate the structures of isomers with more certainty than any other physical property.—**G. Baeckeroot**: The presence of fossils of Aquitanian age in the scattered quartzite grits at the surface of the Moselle plateau.—**F. Labrousse** and **J. Sarejanni**: Changes of reaction and phenomena of oxido-reduction observed in the course of the development of some fungi. The increasing alkalinity of the culture medium shown by certain fungi is not due to the formation of ammonia. As regards the reducing power, all the fungi studied except one (*Thielavia basicola*) decolorise cresyl blue.—**Sébastien Sabetay**: The presence of β-ionone in a natural product. Commercial essential oil of *Boronia megastigma* contains a good proportion of β-ionone.—**A. Babes**: The thymus and growth.

CRACOW.

Polish Academy of Science and Letters, Oct. 7.—**Lad. Natanson**: The theorem of the Eiconnel and Fermat's principle.—**K. Kordylewski**: The variable star YY Sagittarii. The elements are calculated from 436 observations taken during 1925–29.—**J. Pagaczewski**: The variable star 259.1928 Cassiopeæ. The provisional elements calculated from 118 observations on 32 nights during 1928–29.—**J. Mergentaler**: The variable star XX Cephei. The provisional elements deduced from 147 observations during 1929.—**Wlad. Gorczynski**: The high values and energy losses of the solar radiation observed in desert regions and on tropical mountains.—**L. Chrobak**: Contribution to the technique of the X-ray examination of easily deformable crystals.—**Mlle. A. Dorabialska**: The application of the adiabatic microcalorimeter to measurements of the quantities of heat emitted by uranium, thorium, and radioactive minerals. The instrument used was capable of measuring thermal effects of the order of 10^{-4} to 10^{-5} calories per hour, and was applied to measuring the radiation of U_3O_8, ThO_2, and pitchblende.—**K. Dziewonski** and **T. Waszkowski**: Researches on α-methylnaphthalene.—**Mme. T. Cyge**: Anatomical and ecological studies on the leaves of indigenous orchids.—**K. Mielczarek** and **W. Brykalski**: The pollen analysis of Iwiec peat bog.—**Mlle. I. Toruwska**: Studies on the life of the iron bacteria.—**L. Ejsmont**: The two genera of Schistosomatides of birds.—**Z. Szantroch**: The histogenesis of the nerve ganglia of the heart.—**B. Dybowski**: Contribution to our knowledge of the Siberian seal.—**B. Dybowski**: The Polychætes of Lake Baikal.

LENINGRAD.

Academy of Sciences (*Comptes rendus*, No. 17).—**D. Beliankin**: Chemical degeneration of dinas. Analyses of a dinas brick subjected more than 600 times to the action of a furnace showed a considerable increase in Fe_2O_3, Fe_2O_5, and MnO, apparently received from the gases in the furnace.—**L. Lozina-Lozinskij**: The phenomena of chemotaxis in connexion with the choice of food by infusoria. The chemotactic reactions and the reactions of ingesting food particles have apparently a common physiological basis. Chemical properties of the substance used in the experiment have the same effect on the reactions of locomotion, digestion, and even of division, namely, either increasing or decreasing the rate of all these functions.—**A. Tsvetkov**: Changes in the coloration of apatites submitted to heating. If apatites are heated to 1700° C., regular changes in colour are observed, there being a definite colour corresponding to each stage of temperature. This is an unreversible process.—**S. F. Tsarevskij**: Contribution to the classification and distribution of the lizards of the genus *Phrynocephalus*. A study of the cranial characters permitted the author to evaluate them from the point of view of systematics, which so far have been based on external features only. *Ph. ludovici* Mocq. is regarded as identical with *Ph. axillaris*, and *Ph. erythrurus* Zugm. identical with *Ph. lidskii* Berd.—**J. Argentinovskij**: A new cinnabar ore deposit in the Urals. The new deposit has been discovered 118 km. north-west of Sverdlovsk (Ekaterinburg). The veins of the ore are included in quartz porphyrite. This is the third known deposit of cinnabar in the Ural mountains.

ROME.

Royal National Academy of the Lincei: Communications received during the vacation.—**A. Angeli and Z. Jolles**: Reduction of normal diazo-hydrates. The formation of hydrocarbons from the corresponding normal diazo-hydrates by the action of weak reducing agents indicates that an unstable compound, such as phenyldi-imide, is formed as an intermediate step in the change. That this is actually the case is shown by the formation of s. benzoylphenylhydrazine when the reduction is effected in presence of benzaldehyde. Various other reactions are explainable similarly. The transformation of the normal diazohydrate into the compound $C_6H_5 . N : NH$ by reduction renders it probable that the hydrate has the structure, $NH : NO . C_6H_5$. It is possible to remove, not only the oxygen atom, but also, by the action of nitroxyl, the iminic residue from the diazo-hydrate.—**D. Th. Egoroff**: *W* congruences with regulated focals.—**M. Kourensky**: The method of integration of the equation to the partial derivatives of the second order with a single unknown function and two independent variables.—**A. M. Bedarida**: The theory of ideals of a finite algebraic body (3).—**B. Colombo**: Bianchi's problem regarding Lamé families.—**B. de Finetti**: Functions with aleatory increment.—**E. Raimondi**: A new phenomenon of aerodynamics.—**C. Cannata**: The ballistic hypothesis and the verification of the law of areas in the orbits of telescopic double stars. Any possibility of verifying the ballistic principle on the basis of observations on telescopic doublets is out of the question.—**M. Tenani**: Theoretical-experimental considerations on the course of the tides in the Adriatic (2). Experimental verification has been attained, in the case of the Adriatic Sea, of deductions previously drawn from theoretical considerations. This result, together with the calculation, of considerable practical importance, of the longitudinal displacements of the water during the day through the Straits of Otranto, confirms the possibility of extending analogous considerations and calculations to other seas.—**B. Rossi and G. Bernardini**: The photographic action of low-speed electrons. Using oiled Eastman plates, Kenneth Cole and other observers have found that low-speed electrons with velocity lower than that corresponding with 25 volts have no detectable effect on the photographic plate. By means of a special arrangement, the authors are able to photograph electrons with velocity 17·5 volts with ultra-sensitive Cappelli plates. Since the energy possessed by these electrons still greatly exceeds that necessary to affect a silver bromide granule, it is not improbable that this limiting voltage is capable of further reduction.—**F. de Carli**: Viscosity isotherms of binary mixtures (3): the system nitrobenzene-stannic chloride. Thermal analysis of this system confirms the formation of only one complex compound, $C_6H_5NO_2$, $SnCl_4$, melting at about $-11°$ C. The density isotherm for 15° reveals a sensible increase in volume, which denotes a dissociating action, probably due to the nitrobenzene. The viscosity isotherms for 15° and 25° exhibit distinct maxima, but the greatest divergences from the calculated values are shown by solutions containing about 50 per cent of nitrobenzene, whereas the compound formed contains 31·18 per cent. Thus, the maximum of viscosity is displaced towards the more viscous component, a phenomenon which is manifested by liquids in which the complex is highly dissociated. It may be, however, that molecules of the composition $2C_6H_5NO_2$, $SnCl_4$ exist in a stable form in the liquid state but decompose on solidification.—**G. Charrier**: Condensation of 1-amino-2-phenylazonaphthalene-4-sulphonic acid. Dehydrogenation of this acid, suspended in nitrobenzene, by means of an acetic acid solution of chromic anhydride, yields a sulphur-containing condensation product exhibiting the characters of a polycondensed ditriazole derivative. To this is attributed provisionally a constitution analogous to that of naphthylene dioxide, from which it may be theoretically derived by replacing the two oxgyen atoms by two SO_2 groups and attaching the 2-*N*-phenylated triazole nuclei, in the 1- and 3-positions of the triazole nucleus, in the 1- and 2-positions of the two naphthyls.—**E. Pace**: Organo-aromatic derivatives of boron. Descriptions are given of the methods of preparation and properties of: borophenyl chloride, $C_6H_5BCl_2$; phenylborine or boroaniline, $C_6H_5BH_2$, which readily oxidises in the air, giving monophenylboric acid; and borobenzene, $C_6H_5 . B : B . C_6H_5$, which decomposes in the air to form a pasty mass, probably boro-oxybenzene.—**G. Sani**: The reducing activity of roots of the Gramineæ (3): reduction of calcium nitrate. The reduction of calcium nitrate by maize roots is inhibited by the presence of small proportions of potassium hydroxide, chloroform, or formaldehyde, and also by heat or desiccation. In small quantity citric acid enhances the effect, but sulphurous acid is without influence. During the reduction the reaction of the medium changes from acid to alkaline, the alkaline product or products probably being the active agent in arresting the change.—**M. Anelli**: Covering phenomena in the Emilian Appenines.—**R. Savelli and N. Soster**: Sudden variations in the leaf form of *Cannabis sativa* L. Hemp exhibits two distinct variations of leaf shape, characterised by the replacement of the normal palmate type by a single margin, one being pinnatifid (lobed) and the other entire (simple leaf). The former represents a stable mutation, recessive with respect to normal, whereas the second must be regarded as a non-fixable sport, which affects whole plants or parts of plants and arises as a reaction to abnormal stimuli, with no necessary relationship to the pinnatifid form.—**Giulio Cotronei and Aldo Spirito**: Zoological constitution and grafting (1): Experiments with Anura and Urodela.—**Aldo Spirito**: Processes of regeneration and of regulation in the encephalic region of the embryos of Urodela (3). With *Triton cristatus*, at the stage of primary optical vesicle not yet introflexed, it is possible, by means of a technique outlined, to realise the regeneration of a more or less marked, entire prosencephalic wall. Such regeneration is followed by regulation phenomena which induce the formation of parts comparable with cerebral hemispheres, but neither with Anura nor with Urodela do the dimensions of the regenerated parts reach those of the corresponding normal parts.—**P. Pasquini and A. della Monica**: Regeneration of the crystalline in the larvæ of Anura. The faculty of regeneration possessed in the eye of Urodela, by the cells of the iris for developing a crystalline, is extended to Anura (*Rana* and *Bufo*), in the eye of which analogous phenomena are exhibited as a result of the removal of the normal crystalline: mainly the proliferation and consequent spreading of the leaflets of the iris, which lead to the metaplastic formation of a new lens. The latter is at first continuous with the iris, usually with the upper edge, but exceptionally also with the lower edge, but later becomes independent.—**M. Curzi**: A pseudo-rotting of the caryopsis of wheat. A sample of Arditi wheat, which had undergone auto-heating in the ear after reaping, was found to be attacked by *Acremoniella thermophila* n. sp., which is capable of developing between 30° and 52° C.

SYDNEY.

Linnean Society of New South Wales, Oct. 30.—A. Jefferis Turner: Revision of Australian Oenochromidæ (Lepidoptera) (1). The Oenochromidæ display considerable variation in structure and, being the most primitive Geometrites, they throw much light on the phylogeny, not only of the group as a whole, but also of the constituent families. In this first part of the revision, sixty-four species belonging to ten genera are dealt with, two genera and ten species being described as new.—Rev. H. M. R. Rupp: Variations in certain orchids. Attention is directed to frequent variations of *Dendrobium speciosum* Sm., and a form approaching *D. gracilicaule* F. v. M. is described as a new variety. Points of distinction are given between the northern form of *Prasophyllum intricatum* Stuart, and the typical form of the southern States. A red-flowering form of *Pterostylis ophioglossa* R. Br., confined to high gullies in stony hills, is described as a new variety.—Frederick H. S. Roberts: A list of the Australian Bombyliidæ of the subfamilies Exoprosopinæ, Anthracinæ, and Bombyliinæ in the German Entomological Museum, Berlin. The subfamily Exoprosopinæ is represented by the genera *Hyperalonia* Rond. (7 species), *Exoprosopa* Macq. (1 species), *Villa* Lioy (4 species), and *Pseudopenthes* Roberts (the genotype). The genus *Anthrax* of the Anthracinæ is included, two species being represented. Of the Bombyliinæ, *Bombylius* Linn. has two species, *Systoechus* Loew two species, and *Sisyromyia* White two damaged specimens.—A. M. Lea: Descriptions of new species of Australian Coleoptera (20). Forty-seven new species of the families Mordellidæ and Curculionidæ.—J. R. Malloch: Notes on Australian Diptera (22). Notes on members of the genera *Celetor*, *Dasyortalis*, *Duomyia*, *Euprosopia*, *Pterogenia*, *Naupoda* and *Lamprogaster* of the family Ortalidæ. A new subgenus of *Duomyia* and a new species of *Lamprogaster* are described.

VIENNA.

Academy of Sciences, Oct. 17.—F. Heritsch: The tectonic position of the Hochwipfel- and Nassfeld-facies in the carboniferous of the Carnic Alps.—A. Stock and W. Zimmermann: The vapour pressure of mercury at low temperatures.—F. Hernler: The three isomeric nitro- and amino-phenyl-1-dimethyl-3, 5-triazoles-1, 2, 4, and some of their salts.—L. Kober: Structural elements of the east and south Carpathians.—F. Blank and F. Urbach: Sols in crystals. To elucidate the formation of crystal-sols the solubility of gold in molten alkali halides was explored.—O. Abel: Explanation of the crawling tracks in the sandstone of Greifenstein near Kierling in the Wienerwald. Observations on the seashore of the South African coast in Algoa Bay near Port Elizabeth and in False Bay near Muizenberg in August and September of this year have led to complete explanations. The ebb-tide leaves a fine hard sand on which *Bullia* snail-shells leave their tracks.—A. Thiel: Sensitiveness and resistance to alkalis in phthaleins and sulphophthaleins.—H. v. Euler and B. Jansson: Catalytic hydrogen peroxide decompositions by metallic compounds.—G. Bredig, S. R. Carter, and M. Enderli: The equilibrium of carbon dioxide evolution from formic acid and its potential.—C. Neuberg and Max Scheuer: Detection and isolation of methyl-glyoxal formed biochemically as dioxime.—E. Berl and H. H. Saenger: The system N_2O_5-HNO_3.

Oct. 24.—H. V. Graber: Geological and petrographical researches on the Upper Austrian and Bavarian primitive rocks.—H. V. Graber: Mixed rocks from the Upper Austrian and Bavarian primitive rocks.—A. Dadieu and K. W. F. Kohlrausch: Studies on the Raman effect (5). The Raman spectrum of organic substances, C=O and C=C double-linkages, halogen derivatives; 27 substances were examined. An attempt was made to connect frequency with molecular structure.—S. Loewe and H. E. Voss: Preparation, properties, and testing of a male sexual hormone. A search for a male counterpart of the female thelykinin. The active substance is possibly soluble in water and weak acids as a colloid, freely soluble in alcohol, ether, and oil. Stable in aqueous solution for twenty-four hours, in organic solvents for at least some weeks. Not species-specific, preparations from testicles of ox and guinea-pig acting on mouse like mouse-products. The aqueous preparations lead to fatal general poisoning. The publication made now is a transcript of a communication deposited until seal in 1927, but now announced because others are publishing the effects of testis extract injection.—R. Singer: Progress and result of a botanical expedition to the Caucasus in 1929. The south-west region was explored: Gultschj, Kunjum, Schariwzek, Zuzchurtu, Taurari. The primitive forest finds its limit at 2000-2400 metres. A provincial museum at Sugdidi and a botanical garden near Batum proved helpful.—A. Steinböck: Hydrobiological work in the Tyrol alps. Alpine lakes were explored at and above 2000 metres. The fauna included Turbellaria and trout.—M. Beier: Results of a zoological expedition to the Ionian Islands and the Peloponnesus (1) and (2).

Oct. 31.—M. Beier and F. Silvestri: Results of a zoological expedition to the Ionian Islands and the Peloponnesus (3). Thysanura.—R. Kloimwieder: The tubular cells of Fumariaceæ, especially those of the genus *Dicentra*. These cells contain poisonous alkaloids. The plants seldom suffer from grazing or from fungus parasites. Feeding experiments on snails gave confirmatory results.—M. Blau and E. Rona: Communication of the Radium Institute (241). Further contributions to ionisation by H-particles.—K. Zentner: The efficiency of sand-blasts.

Official Publications Received.

BRITISH.

Ceylon Journal of Science. Section D: Medical Science. Vol. 2, Part 3: The Identification of the Land Snakes of Ceylon. By Dr. Lucius Nicholls. Pp. 91-157. (Colombo: Bacteriological Institute; London: Dulau and Co., Ltd.) 3 rupees.

Air Ministry: Aeronautical Research Committee. Reports and Memoranda. No. 1199 (Ae. 360): Skin Friction and the Drag of Streamline Bodies. By Prof. B. M. Jones. (T. 2709 and (a) and (b).) Pp. 12+8 plates. (London: H.M. Stationery Office.) 9*d*. net.

Modern Mining Explosives. Presidential Address delivered October 17th, 1929, by Dr. William Cullen. Pp. 36. (London: The Institution of Mining and Metallurgy.)

Proceedings of the South London Entomological and Natural History Society, 1928-29. Pp. xx+98+13+3 plates. (London.) 10*s*. 6*d*.

Sale of Food and Drugs Acts. Extracts from the Annual Report of the Ministry of Health for 1928-1929 and Abstract of Reports of Public Analysts for the Year 1928. Pp. 15. (London: H.M. Stationery Office.) 1*s*. 6*d*. net.

Society of Chemical Industry: Chemical Engineering Group. Proceedings, Vol. 10, 1928. Pp. 132. (London.) 10*s*. 6*d*.

London School of Hygiene and Tropical Medicine. Report on the Work of the School for the Year ended July 31st, 1929. Pp. 36. (London.)

British Photographic Research Association. Report for the Year 1928-29. Pp. 15. (London.)

International Federation of University Women. Bulletin No. 11: Report of the Fifth Conference, Geneva, August 7 to August 14, 1929. Pp. 155. (London.)

Man and his World in the Light of Emergent Evolution: a Synopsis of the Course of Lectures delivered by Members of the University of St. Andrews under the Adult Education Scheme for Fife and Stirlingshire in 1929-1930. Pp. ii+57. (St. Andrews.)

Canada. Department of Mines: Mines Branch. Investigations in Ceramics and Road Materials (Testing and Research Laboratories) 1927. (No. 697.) Pp. ii+80. (Ottawa: F. A. Acland.)

Journal of the Chemical Society. November. Pp. iv+2425-2661+xii. (London.)

Transactions of the Institute of Marine Engineers, Incorporated. Session 1929. Vol. 41, November. Pp. 687-781. (London.)

Journal of the Indian Institute of Science. Vol. 12A, Part 14: Studies in the Proteins of Indian Foodstuffs. Part 2: The Proteins of the Pigeon Pea (*Cajanus indicus*). By P. S. Sundaram, Roland V. Norris and V. Subrahmanyan. Pp. 193-205. (Bangalore.) 12 annas.

Proceedings of the Royal Irish Academy. Vol. 39, Section A, Nos. 1, 2: The Variation of Curvatures in the Deformation of a Curve in Riemannian Space, by A. J. McConnell; The Displacement or Deviation of Circles in Riemannian Space, by J. L. Synge. Pp. 20. 1s. Vol. 39, Section B, Nos. 3, 4, 5: The Action of Alcoholic Hydrochloric Acid on certain Unsaturated Ketones, by Brian Coffey and Dr. Hugh Ryan; The Constitution of Iso-catechin Tetramethyl Ether, by James J. Drumm, Robert J. P. Carolan and Dr. Hugh Ryan; On 3-4-Dimethoxylbenzyl-3-5-Dimethoxycoumaranone, by James J. Drumm, Sheila M. Maguire and Dr. Hugh Ryan. Pp. 107-123. 1s. Vol. 39, Section B, Nos. 6, 7, 8: Preparation and Oxidation of Flavindogenides, by Dr. Hugh Ryan and George Cruess-Callaghan; Some Derivatives of γ-Anisylidene-Methylethylketone, by Dr. Hugh Ryan, Peter M'Geown and Dr. John Keane; The Condensation of Aldehydes with Benzyl Acetoacetic Ester, by Dr. Hugh Ryan, W. B. Cornelia and Pierse Hurley. Pp. 124-145. 1s. Vol. 39, Section B, Nos. 9, 10: Some Effects of Röntgen Rays on Seedlings, by Dr. Sylvia B. Wigoder and Ruth Patten; Further Study on the Effect of Summer and Winter Temperatures on the Catalase of Pine Needles; a Reply to Criticism, by F. C. Green, M. E. M'Endarfer, O. S. Orth and W. E. Burge. Pp. 146-159+plates 3-4. 1s. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.)

Department of Agriculture, Ceylon. Bulletin No. 85: The Termite-proof Construction of Buildings in Ceylon. By F. P. Jepson. Pp. iv+36+26 plates. (Peradeniya.) 40 cents.

Report on the Administration of the Meteorological Department of the Government of India in 1928-29. Pp. 19+4 plates. (Calcutta: Government of India Central Publication Branch.) 14 annas; 1s. 6d.

Royal Agricultural Society of England. Agricultural Research in 1928. Pp. viii+193. (London: John Murray.) 1s.

Report on the Conditions of Science Teaching in Oxfordshire. Compiled by a Committee of the Oxfordshire Branch of the Incorporated Association of Assistant Masters in Secondary Schools. Pp. 8. (Oxford.)

Royal Agricultural Society of England. Report of the Council to the Annual General Meeting of Governors and Members of the Society, to be held at the Royal Agricultural Hall, Islington, London, N., on Wednesday, December 11, 1929, at 2.15 p.m. Pp. 26. (London.)

Harper Adams Agricultural College, Newport, Salop, 1929-30. Pp. 96. (Newport, Shropshire.)

The National Institute of Poultry Husbandry (Harper Adams Agricultural College), Newport, Salop. A Progress Report of Instructional and Experimental Work in Poultry and Rabbit Husbandry. No. 2, August. Pp. 72. (Newport, Shropshire.)

Proceedings of the Royal Society. Series A, Vol. 126, No. A800, December 2. Pp. 183. (London: Harrison and Sons, Ltd.) 6s.

Proceedings of the University of Durham Philosophical Society. Vol. 8, Part 2, 1928-1929. Pp. 71-159. (Durham.) 5s.

Government of India: Meteorological Department. Magnetic, Meteorological and Seismographic Observations made at the Government Observatories, Bombay and Alibag, in the Year 1924, under the direction of Dr. S. K. Banerji. Pp. v+133+5 plates. (Calcutta: Government of India Central Publication Branch.) 6.10 rupees; 11s.

Foreign.

Ministerio da Agricultura, Industria e Commercio: Directoria de Meteorologia. Boletim Meteorologico, Anno 1923. Pp. viii+218. Boletim Meteorologico, Anno 1924. Pp. viii+224. (Rio de Janeiro.)

Methods and Problems of Medical Education. (Fifteenth Series.) Pp. iv+76. (New York: The Rockefeller Foundation.)

Department of the Interior: Bureau of Education. Bulletin, 1929, No. 14: Statistics of Teachers Colleges and Normal Schools, 1927-1928. Prepared by Frank M. Phillips. Pp. 71. 10 cents. Bulletin, 1929, No. 27: Review of Educational Legislation, 1926-1928. By Ward W. Keesecker. Pp. 20. 5 cents. (Washington, D.C.: Government Printing Office.)

Proceedings of the United States National Museum. Vol. 76, Art. 6: New Species of Buprestid Beetles from Costa Rica. By W. S. Fisher. (No. 2803.) Pp. 20. Vol. 76, Art. 16: Oölites or Cave Pearls in the Carlsbad Caverns. By Frank L. Hess. (No. 2813.) Pp. 5+8 plates. (Washington, D.C.: Government Printing Office.)

Comité National Français de Géodésie et Géophysique. Assemblée générale du 27 mars 1929. Compte rendu publié par le Secrétaire général G. Perrier. Pp. 64. (Paris.)

Wisconsin Academy of Sciences, Arts and Letters. The Fresh Water Mollusca of Wisconsin. By Frank Collins Baker. Part 1: Gastropoda. (Wisconsin Geological and Natural History Survey, Bulletin 70, Part 1.) Pp. xx+507+28 plates. Part 2: Pelecypoda. (Wisconsin Geological and Natural History Survey, Bulletin 70, Part 2.) Pp. vi+495+plates 29-105. (Madison, Wis.)

Meddelelser fra Kommissionen for Havundsøgelser. Serie Fiskeri. Bind 8, Nr. 6: An Investigation of the Stock of Plaice in the Southern Horns Reef Area in the Years 1925 and 1927. By Aage J. C. Jensen. Pp. 63. 4.50 kr. Bind 8, Nr. 7: On the Age and Growth of the Coalfish (*Gadus virens* L.), the Norway Pout (*Gadus esmarki* Nilsson) and the Poutassou (*Gadus poutassou* Risso) in Icelandic Waters. By Bjarni Sæmundsson. Pp. 37. 3.65 kr. Bind 8, Nr. 8: On the Influence of the size of the Stock of Cod upon the Yield of the Herring Fishery in the Kattegat, Belt Sea, and Western Part of the Baltic, and some other Causes of Variations in the Cod and Herring Fisheries. By Aage J. C. Jensen. Pp. 16. (København: C. A. Reitzels Forlag.)

The Rockefeller Institute for Medical Research. Organization and Equipment. Pp. 27+2 plates. (New York City.)

U.S. Department of Agriculture. Technical Bulletin No. 112: Biology of the Cotton Boll Weevil at Florence, S.C. By F. A. Fenton and E. W. Dunnam. Pp. 76. 20 cents. Leaflet No. 48: Reindeer Recipes. By Louise Stanley and Fanny Walker Yeatman. Pp. 8. 5 cents. (Washington, D.C.: Government Printing Office.)

Records of Changes in Color among Fishes. By Charles Haskins Townsend. (New York Aquarium Nature Series.) Pp. 58 (27 plates). (New York: New York Zoological Society.)

Proceedings of the Boston Society of Natural History. Vol. 39, No. 5: Experiments in Bird Migration. i. Manipulation of the Reproductive Cycle; Seasonal Histological Changes in the Gonads. By William Rowan. Pp. 151-208+plates 22-32. (Boston, Mass.)

Zentralanstalt für Meteorologie und Geodynamik. Publikation Nr. 133: Jahrbücher der Zentralanstalt für Meteorologie und Geodynamik. Amtliche Veröffentlichung. Jahrgang 1926, Neue Folge, Band 63 (der ganzen Reihe Band 71). Pp. xx+A42+B54+C44+D7. (Wien: Gerold und Komp.)

Parki Narodowe w Polsce: National Parks in Poland. By Władysław Szafer. Pp. 31. (Kraków: Nakładem Państwowej Rady Ochrony Przyrody.)

Państwowa Komisja Ochrony Przyrody w Polsce: State Commission for the Protection of Nature in Poland. Nr. 8: On the Protection of Nature in Poland during the last Five Years, 1920-1925. By Prof. Dr. Władysław Szafer. Pp. 54. Nr. 24: Loi pour la protection de la nature en Pologne. Par Jan Gwalbert Pawlikowski. Pp. 11. (Kraków: Nakładem Państwowej Komisji Ochrony Przyrody.)

Publikationer og mindre Meddelelser fra Københavns Observatorium. Nr. 66: Formeln und Tafeln zur Bestimmung parabolischer Bahnen. Von Bengt Strömgren. Pp. 146. (København.)

U.S. Department of the Interior. Education Bulletin, 1929, No. 32: Developments in Rural School Supervision. By Annie Reynolds. Pp. v+17. (Washington, D.C.: Government Printing Office.) 5 cents.

The University of Chicago: Publications of the Yerkes Observatory. Vol. 7, Part 1: Radial Velocities of 500 Stars of Spectral Class A. By Edwin B. Frost, Storrs B. Barrett and Otto Struwe. Pp. vii+79. (Chicago: University of Chicago Press; London: Cambridge University Press.)

United States Department of Agriculture. Technical Bulletin No. 86: Imported Insect Enemies of the Gipsy Moth and the Brown-tail Moth. By A. F. Burgess and S. S. Crossman. Pp. 148+6 plates. (Washington, D.C.: Government Printing Office.) 50 cents.

Catalogues, etc.

Calendar for 1930. (London: British Museum (Natural History).)

Scientific Instruments. Pp. 80. (Delft: P. J. Kipp en Zonen.)

Diary of Societies.

FRIDAY, DECEMBER 20.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN (Pictorial Group—Informal Meeting), at 7.—Determination and Isolation of the Picture.

JUNIOR INSTITUTION OF ENGINEERS (Informal Meeting), at 7.30.—W. Challis: Line Signalling on the Southern Railway.

SOCIETY OF DYERS AND COLOURISTS (Scottish Section).—P. Urmston: Modern Machinery in Dyeing, Printing, and Finishing.

PAPER MAKERS' ASSOCIATION (Technical Section, Northern Division) (at Engineers' Club, Manchester).—R. H. Clapperton: The Elimination of Dirt from Paper Stock.

SATURDAY, DECEMBER 28.

ROYAL INSTITUTION OF GREAT BRITAIN (at Institution of Electrical Engineers), at 3.—S. R. K. Glanville: How Things were done in Ancient Egypt (Christmas Lectures) (1): The Elementary Use of Nature.

CONFERENCE.

DECEMBER 20 AND 21.

SOCIETY FOR EXPERIMENTAL BIOLOGY (at London School of Hygiene and Tropical Medicine).

Friday, Dec. 20, 10 A.M. to 1 P.M.—A. D. Ritchie: Reflex Movements in Pecten.—G. S. Carter: Thyroxin and Fertilisation in *Echinus*.—F. C. Stott: Temperature Optima in Invertebrate Digestive Enzyme Reactions.—F. C. Steward: Diffusion of Substances through Membranes of Plant Tissue.—M. C. Pratt: Production of Formaldehyde in Photosynthesis.—H. R. Hewer: Variation in the Genus *Zygœna*.

2.15 to 3.45.—M. Robertson: The Action of Acriflavine on *Bodo caudatus*.—A. B. Appleton: The Nutritional Factor in the Growth and Differentiation of the Skeleton of the New-born Rabbit.—H. G. Newth: The Feeding of Ammocœtes.

3.45 to 5.15.—*Demonstrations:*—Dr. V. J. Wigglesworth: The Formation of the Peritrophic Membrane in Insects.—Dr. P. A. Buxton: Apparatus for Exposing Insects to Known Temperatures and Humidities.—Dr. G. S. Wilson: (*a*) Apparatus for the Continuous Passage of Gaseous Mixtures of Variable Composition through Liquid Cultures of Bacteria; (*b*) Apparatus for the Cultivation of Bacteria in Closed Atmospheres of Known Composition.—Major H. C. Brown and Dr. J. C. Broom: Portable Apparatus for the Determination of Hydrogen Ion Concentration.—Dr. A. Robertson: *Trypanosoma cruzi*, isolated from an Opossum in Honduras.—H. N. Howes: Histological Methods for Investigating the Activity of the Anterior Pituitary.—Dr. G. P. Crowden: (*a*) Audiometers for Testing Acuity of Hearing; (*b*) Whipple's Test for Steadiness of Hand; (*c*) Lehmann-Muller Closed Circuit Metabolism Apparatus.

5.15 to 6.15.—W. Robinson: Problems of Nutrition and Development in some Brown Seaweeds.—V. C. Wynne Edwards: On the Waking-time of the Night-jar.

At 6.15.—Annual Meeting.

Saturday, Dec. 21, 10 A.M. to 1 P.M.—E. A. Spaul: The Distribution of Biological Activity in the Anterior Pituitary.—G. Pincus: Observations on the Living Eggs of the Rabbit.—E. M. Stephenson: The Physiology of Crustacean Chromatophores.—R. H. Stoughton: Cytology of *Bacterium malvacearum*.—G. Fox Wilson: Biology of *Tylenchus dipsaci* in its Relation to Herbaceous Plants.