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The Practice of Forestry in the British Empire.

THE practice of forestry as a science has been a plant of slow growth in the British Empire. Many reasons have contributed to this cause, the chief being the facility with which we have been able to obtain our requirements, either by imports from closely adjacent forests belonging to our Continental neighbours, as in Great Britain, or from the existing primeval forests, as in India and the great Dominions and Colonies. Forestry as a science on a par with agriculture has long been known and practised in many of the great European States. A study of the methods employed and the comparative ease with which forest property, both belonging to the States and to private proprietors, is managed and protected, will show that not only the people on the countryside, but also even the dwellers in the towns, and the great industrial classes, understand the value of forest property and to some extent the aims of a forest policy—that, in effect, the forest, in the economy of the countryside, has an equal value with the tracts devoted to agriculture.

Many motorists from Great Britain annually make the journey from the north to the south of France and pass through great tracts of forest, either in State or private ownership and managed with an efficiency which has long been unknown, or at least unpractised, in Britain. They will have remarked upon the absence of fences. Boundary ditches there may be, or hedges, but little in the nature of the artificially constructed fences so necessary at present in Great Britain if the forest areas are to be safeguarded from a public to whom their economic value to the nation at large is unknown, and from that pest the rabbit. During the War thousands of men and women from the British Empire must have seen some of the forests of France, but very few possessed even the little knowledge of forestry practice which would have enabled them to recognise the differences which underlie the management in France and in Britain; or to have appreciated one of the most essential necessities for the successful practice of forestry in a country—that the public should be so far educated as to understand its true value to themselves and therefore to respect and help in the protection of forest areas.

It is unfortunately a not uncommonly accepted idea in Great Britain that a proper conservation of forest tracts means entire closure and the prohibition of picnic parties, and so forth; or that the introduction of rational management into such areas of forest as have come down to us from early times in the form of Crown forests, *e.g.* the Forest of Dean, New Forest, etc., entails their destruction as beauty spots or what are

termed ' playgrounds ' for the public. The controversy which recently took place in the press in connexion with certain beautiful spots in the New Forest—old decrepit woods of admittedly great beauty and picturesqueness—is a case in point. It has had its counterpart in the past in the case of other beauty spots in Great Britain, and even outside Great Britain in other parts of the Empire. The enunciation of such opinions, often by men whose names carry weight with public opinion, incontestably proves that what may be termed a forestry ' sense ' is at present lacking in the British public and, it may be added, in the Empire public, if we except perhaps India. The growth of this forestry ' sense ' can only arrive with the young generations and through the schools ; it is an asset for the future that some schools in Great Britain and the Empire are introducing the teaching of the elements of forestry and its potential value into their curricula.

The love, which is strong in the British, for the maintenance of beauty spots and old woods, is a perfectly natural one and an attribute which any race may be proud to possess. Where trees and woods, however, are in question, it will be conceded that, unlike old historic buildings and famous ruins, no Government department, such as that for the protection of Ancient Monuments, with which the late Lord Curzon was so closely identified, both in India and Great Britain, can maintain them in perpetuity. Each succeeding generation which clamours to maintain untouched, for example, the afore-mentioned old woods in the New Forest, is merely assuring the disappearance from England at no distant date (though they themselves may not live to see it) of one or more famous beauty spots. Yet, as the Continent of Europe well shows, to those possessing the education and knowledge to be able to see and appreciate the management of such problems, it is quite possible to put in practice a method of management which, whilst assuring the minimum of change in artistic values, for forestry and the cult of trees is a lengthy business, will preserve for future generations what the present ones are enjoying.

This is but one aspect of the practice of forestry science, far removed from the commercial aspect, but one in which, owing to the interest aroused, it is of the first importance that the present generations should endeavour to make themselves acquainted with—if only in the interests of their future posterity and the maintenance of many beautiful spots and regions in Great Britain.

That the introduction of and practice of scientific forestry within the Empire has come to stay appears assured from the fact that the Prince of Wales is setting an example to the country by his personal interest in the subject. As president of the Empire Forestry Association, he delivered an address at the annual meeting in March last. As would be expected from the Prince of Wales, he dealt with the matter from the Empire point of view. He alluded to the ten-years planting programme of 150,000 acres undertaken by the Forestry Commission in Great Britain, which it was hoped to complete within the next three years ; he then discussed the present position of forestry in South Africa and the planting schemes being carried out in that country to provide its population with " the conifers which Nature has denied them," and the work upon which Canada, Australia, and New Zealand are engaged.

Perhaps as great and, in some cases, greater advances have been made in the many forestry services, some already of considerable age, under the Colonial Office in the Malay States, Nigeria, Gold Coast, Kenya and the other East African colonies, and elsewhere. But the greatest of all, in point of progress, is the case of India. The first scientific forest service inaugurated in the British Empire was commenced in that country more than sixty years ago. A paper dealing with the practice of forestry read in the north of Great Britain a short time ago commenced with the sentence, " Forestry is a new industry which is happily growing up within the Empire, and nowhere more rapidly than at home." In the past, and at the present day, the Empire has often been accused of working in water-tight compartments, and the practice of forestry is no exception to the rule. India is the only country within the Empire at the present day in which it can be said that forestry as a science, occupying its place in the economy of the countryside and in the true interests of the people as a whole, has become recognised and appreciated alike by the statesman, the cultivator, and to a considerable extent by the more educated of the public outside the great towns. The *Journal of the Empire Forestry Association*, to the value of which the Prince of Wales alluded in his address, has clearly exhibited to the trained forest officer the position which forestry science and practice has attained in India—a position which in some parts of the country vies with the best to be seen on the Continent of Europe. A study of the lines of management and work in the Indian forests and the research work which has been carried out, especially in connexion with the utilisation of tropical timbers, will be as useful to many of our Empire forest officers as the studies they have made in Europe.

It would not be in the true interests of forestry in Great Britain to say that, within the short space of time which has elapsed since the Forestry Bill was passed by Parliament some seven years ago, the industry—or, to give it its true name, since the industrial is but one side

of the business—the science of forestry has as yet made great strides. A beginning has been made, but forestry cannot hope to take its real place in the economy of the nation or of the Empire as a whole until the public has become educated and has accepted its aims and objects, alike from the economic and amenity points of view.

E. P. STEBBING.

Science and Psychical Research.

The History of Spiritualism. By Sir Arthur Conan Doyle. In 2 vols. Vol. 1. Pp. xiii+342+8 plates. Vol. 2. Pp. vii+342+8 plates. (London, New York, Toronto and Melbourne: Cassell and Co., Ltd., 1926.) 42*s.* net.

THE recent publication of two large volumes entitled "The History of Spiritualism" by Sir Arthur Conan Doyle is perhaps a suitable occasion on which men of science may once again turn their thoughts in a direction in which many more of them are probably interested than would be willing to admit it. Spiritualism is a cult, a faith, or perhaps even a full-blown religion, the central tenet of which is sufficiently well stated by Sir Arthur (vol. 2, p. 263) in the following words:

"A belief in the existence and life of the spirit apart from and independent of the material organism, and in the reality and value of intelligent intercourse between spirits embodied and spirits discarnate."

Spiritualism as a religion does not come within the confines of the subjects which a scientific periodical like NATURE may appropriately discuss. But right through the warp of Sir Arthur's book, though by no means carefully distinguished, and most certainly very unscientifically handled, runs the woof of psychical research, which is, or at any rate purports to be, the *scientific* study of what are called *supernormal phenomena*. These phenomena are of two kinds—(*a*) *physical*, such as telekinesis, or movement of solid objects without contact; independent voice, or the production of sound recognisable as that of the human voice and recordable objectively on a dictaphone; the formation of the substance known as ectoplasm or teleplasm; psychic lights and cold breezes; formation of structures invisible except by the reflection of ultra-violet rays; and so on: (*b*) *mental*, such as clairvoyance, clair-audience, automatic script, telepathy and other similar types of phenomena not involving the use of material objects.

Many years ago, when this question of psychical research was brought to his notice, Huxley replied, "Supposing these phenomena to be genuine, they do not interest me." We are sorry to be obliged to have to record so unscientific a remark from so great a man, and even sorrier to have to admit that Huxley's attitude is still that of the great majority of biologists at the present day. The opinion of any man, however great, or of any body of men, however influential, on a subject which they deliberately refuse to investigate, either because it "does not interest" them, or because of a preconceived idea that the phenomena involved are necessarily fraudulent, is really not worth much. It is a sad commentary on human nature that, even at the present day, when the reality of some at least of these phenomena has surely been put beyond the shadow of a doubt by the work of such men as Lodge and Richet, no scientific man can take up the study of psychical research without 'losing caste' and undergoing either secret or more or less open persecution from his fellows. Truly, we have not got very far from the Middle Ages after all, and there is a very real danger that organised science in the twentieth century is taking its seat in the very chair from which it once drove the medieval church. "E pur si muove" applies equally to the movement of the earth round the sun or to the movement of a levitated table upwards against gravity without visible support. The former was no more incomprehensible and no less anathema to the medieval church than the latter is to-day to organised science. But the spirit of to-day is different from that of the past, and martyrdom no longer wins many converts. Modern Galileos may undergo persecution for what they hold to be the truth, but the modern world will soon forget them in the hurry and rush of modern life, and the truths for which they suffer will perish with them unless they can be presented in such a form as to appeal to the reason of mankind.

It is just here that a great danger lies. The history of the world is full of evolutionary failures; for every organism, Nature selects a path from which there is no turning back. The advance of science during the past seventy years has been definitely along the road to materialism. Though the pace has somewhat slackened and many an anxious glance is now being turned backwards, yet the impetus is still driving us forward mainly in the same direction. For hundreds of years mankind looked to religion to lead them along the right path. Now, in the western world, their gaze is fixed on science. It is certain that, for the next hundred years at any rate, where science leads, there mankind will follow. Are we, the men of science, the leaders of mankind, so absolutely sure of the path along which we are travelling?

Pilate's question "What is Truth?" has never yet been answered, and perhaps it never will be. It is, however, the duty of science to search diligently for truth and to leave no avenue unexplored in which it may be found. The broad highway may lead us to

destruction, even if it appears well marked out and easy to travel upon. The neglected side-path, foul with mire and overgrown with noxious weeds, may be the real entry into the Promised Land, for which we are searching. But because of the foul mire, and because of the noxious weeds, organised science refuses to explore this side-path, in spite of the fact that a few brave spirits, more adventurous than the rest, a Crookes, a Lodge, a Richet, have penetrated into the thicket and returned to report both progress and promise.

The present writer cannot claim the experience either of a Lodge or a Richet in the study of psychical research. His interest in the subject is one of comparatively recent growth and arises chiefly from dissatisfaction with the adequacy of present-day biological theories to explain life in acceptable terms. He can, however, claim sufficient experience to be able to say, with both Lodge and Richet, that a clear case has been made out for psychical research, and that it is the duty of science to recognise the genuineness of the phenomena and to attempt to explore them. Fraud exists, and always has existed, in all branches of human affairs. It is even blatantly active in biology, to judge by the remarks passed quite recently by leading British and American biologists on the work and character of a certain Austrian professor. Let fraud and cheating be exposed, certainly, wherever it exists; but is that any reason for refusing to accept as a recognisable branch of science any subject in which fraud has been found?

It appears to the writer that the best avenue of approach for men of science to make on this subject is the study of the so-called physical phenomena. Either these are entirely fraudulent (that is, due to conscious or subconscious cheating on the part of the medium), or else they extend the realm of physics beyond the boundaries explored at present. Take, for example, one of the simplest and most easily experienced of the physical phenomena, that of *cold breezes*, which generally precede any manifestation of greater energy in a séance. It has been maintained that this effect is purely subjective, that the sitters imagine they feel the cold owing to the tense situation created in the mental atmosphere of the séance room. In the National Laboratory of Psychical Research, two very accurate thermographs have recently been installed. One of these is placed against the wall of the room, far from the sitters, while the other records the changes which occur in the temperature of the closed cage of the Pugh table in which phenomena occur during sittings with the medium Stella C. in red light.

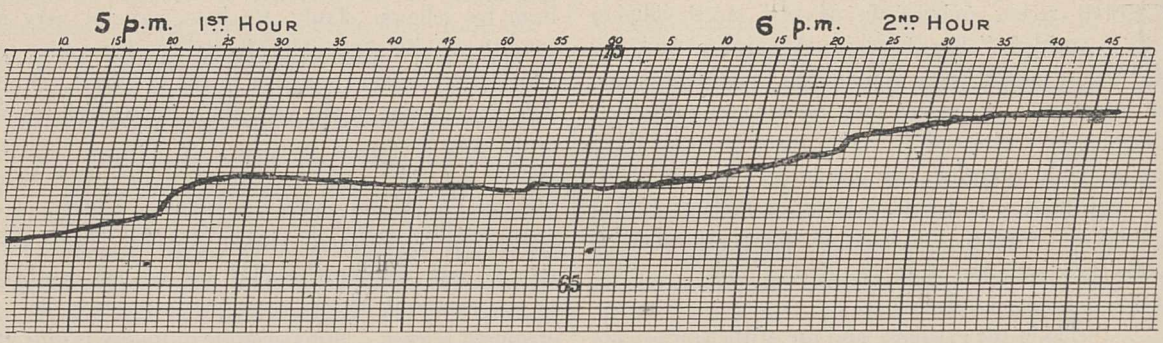

FIG. 1.—Thermograph record inside Pugh table. Temperature at 5.10 P.M., before beginning of séance, 67° F. Red light throughout.

5.23 P.M. Stella goes into trance. Marked rise in temp.
5.30 to 5.55 P.M. Steady fall in temp.
5.55 P.M. Electric bell with contact inside closed cage was rung vigorously four times within a minute or two. Note irregularity in thermograph record.
6.24 P.M. Bright light flashed inside cabinet.
6.29 P.M. Zither pushed partly out of opening in Pugh table.
6.33 P.M. Two very fine blue flashes inside Pugh table.
6.42 P.M. Stella comes out of trance.

Note.—Cold breezes preceded each of these phenomena. Other phenomena were also recorded at 5.39, 5.42, 5.48, 5.51, 5.58, 6.01, 6.05, 6.07, 6.10, 6.16, and 6.18 without any sudden variation of thermograph record.

The control thermograph record taken separately on the wall of séance room, about 10 feet from the medium, showed a steady rise in temperature without any marked changes in gradation from 67° F. at 5.10 P.M. up to 69·5° F. at end of séance.

Normally, when a number of people sit in a closed room, the temperature mounts steadily upwards; this is also the case for the temperature of the séance room as recorded on the wall during a sitting. But the record of the temperature inside the Pugh table shows a steady rise at first, followed by a fall during the production of supernormal phenomena, as in the accompanying record (Fig. 1); there are also several marked sudden changes at points where special phenomena occurred. These careful experiments prove the objective nature of the cold breezes and present us with a purely physical problem, which is surely worth solving. It is not an extravagant hypothesis which finds an explanation for the production of 'supernormal' physical phenomena in the withdrawal of heat from the circle of sitters, such heat being turned into some other form of energy, possibly of a kind not yet investigated officially by science!

The so-called 'physical' phenomena of mediumship

should be of interest to biologists as well as to physicists, because, if they are genuine, they offer an avenue towards the study of the control and manipulation of matter by mind which is at present unique in its character. The invisible operators who apparently control the more striking phenomena of mediumship claim that they are able to draw out from the organism of the medium 'psychic stuff,' by the moulding of which they can produce at will the phenomena of independent voice, levitation, materialisations of portions of their personalities, and so on. We who have seen these things done under conditions precluding deliberate fraud are not fools, but in full possession of keen faculties. Every man who witnesses these phenomena and becomes convinced of their reality has only two choices before him. He can, as numbers have done, keep quiet and say nothing about it, thereby preserving the respect of his fellow-scientists and committing the sin against the Holy Ghost, namely, turning his back on truth when he has recognised it; or he can, like Sir Oliver Lodge, speak out the truth boldly and allow his reputation to drop in the estimate of his fellow-men. The writer ranges himself alongside Sir Oliver, well knowing what is in store for him in consequence. This article is a plea for a wider and more generous outlook on the part of science towards these phenomena. Science has nothing to fear from fraud; it need only go on applying its experimental method to any problem, and a solution will shape itself in time, either in the form of an overwhelming proof of the fraudulent production of the phenomena, or pointing towards the existence of genuine supernormal results.

The mind of man seems to have reached out so far in recent years that it has almost succeeded in exploring the entire limits of its own cage. Is it to rest in the belief that there is nothing at all outside that cage, or may it, so to speak, extend a cautious paw outside the bars and begin to feel its way towards a realisation that there may be another world outside? Psychical research may perhaps afford the only possible way of exploring the unknown territory outside the cage.

R. J. TILLYARD.

Civil Aviation in the United States.

Civil Aviation: a Report by the Joint Committee on Civil Aviation of the U.S. Department of Commerce and the American Engineering Council. Pp. xvii + 189. (New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd., 1926.) 12*s.* 6*d.* net.

IN Europe rapid developments have been made in the application of aircraft to commercial uses. In the United States, however, air transportation, in spite of many conditions naturally favourable, has not achieved a development commensurate to the opportunities.

The Department of Commerce and the American Engineering Council, recognising this deficiency, have for some time past gathered information relating to this matter. A joint committee was formed in June 1925, to make a comprehensive survey of the economic aspects of aviation throughout the world, and to recommend the measures necessary to encourage a national development of commercial aviation in the United States. All available sources of information on this subject have been examined by the committee, including the attitude of American business interests and the experience of aircraft operators.

In the report before us, which here deals comprehensively with the situation, the committee lays down first and foremost the development of the commercial side of aircraft as of vital importance both to industry and to national defence. Whilst stressing the fact that development must mainly depend on private initiative and enterprise, the committee maintains that provision of facilities essential to this development is a public responsibility, and, if these facilities are provided, direct subsidies to civil aviation in the form of money grants are both unwise and unnecessary.

Certain fundamental difficulties, the committee maintains, are retarding the development of this venture in the United States. Broadly speaking, they are intimately associated with the lack of an established Government policy to encourage civil and industrial uses of aircraft; with the lack of commercial aircraft and equipment best adapted to commercial operation; and with the consequent want of public and business confidence and support.

After due consideration of the large part played by the commercial department and by big businesses in this field, the committee recommends a number of far-reaching proposals which, if adopted, would undoubtedly make a ground-work for a vast new development eminently suited to the geography of the United States. It is proposed that Congress should enact a civil aeronautic law providing for the establishment of a Bureau of Civil Aeronautics in the Department of Commerce; that is to say, it is to be completely dissociated from the military or naval wing. It would be the function of this bureau, among other duties, to regulate civil air navigation, license pilots, and inspect machines; to develop, establish, and take over air routes and facilities, and generally to encourage and promote the aircraft industry on the civil side.

The committee, moreover, recommends that the several States should authorise their municipalities to acquire landing fields out of public funds and to lease them when necessary. Great stress is laid on the fact

that the Government should not undertake any non-military flying activities, but that it should be left entirely within the scope of private operation. Even air mails, forest patrol, agricultural, entomological, and coastguard services, aerial photography, map making, etc., should be conducted by private agencies under contract wherever possible. Much assistance, however, is expected from the Government departments; the war, naval, and other departments are to permit the use of Government landing fields and to provide facilities for commercial operations. The Post Office should retire from the ownership and operation of air mail routes as soon as it is possible to contract with responsible private operators. The purchases of Government aircraft are to be arranged to conform to a definite and continuous programme which will give the greatest aid to the industry, and State encouragement is to be extended to the exportation of commercial aircraft.

Whilst much of the report is thus concerned with the part to be played by private owners, under security and assurance which is to be granted to those who are thus encouraged to invest their capital in the industry, scarcely any mention is made of that form of research and development which would be vital to maintain such an industry in the forefront of technical and scientific knowledge. There does occur a bald statement that the Government should carry on fundamental aeronautical research in the interests of civil aviation, but, unlike the other sections of the recommendations, this aspect does not appear to have been expanded, or its far-reaching implications grasped. From the point of view of the corresponding industry in Great Britain, it will be an interesting experience to watch how these proposals work themselves out in practice.

Military Explosives and Gases.

Explosifs, poudres, gaz de combat: leçons professées à la Faculté des Sciences de Lille. Par Paul Pascal. Pp. viii + 296. (Paris: J. Hermann, 1925.) 35 francs.

THIS book embodies the lectures delivered by Prof. Paul Pascal, of Lille, to candidates for the French Service des Poudres. While in Great Britain the Royal Naval College and the Artillery College afford specialised instruction to combatant officers in the subject matter of these lectures, in France this is also obligatory for chemical engineers destined for employment in the Government factories.

The first part of the book deals with the different aspects of explosive reactions, such as the temperature and pressure of explosion, its propagation on one hand by the explosive wave, and in the case of propellants by rapid burning, along lines which have been developed by the French masters in this subject, such as Berthelot, Vieille, Sarrau, and Le Chatelier.

The second and third parts deal with the manufacture of explosives, together with the properties of several of the more important ones. Naturally, in a book of this size, manufacturing details cannot be exhaustively given, and the treatment is sometimes unequal. At the same time, several of the processes used in Great Britain are accurately described, such as the displacement process for making nitroglycerine of Nathan, Thomson and Rintoul, and the displacement process for making nitrocellulose of the Thomsons.

The production of explosives derived from aromatic hydrocarbons was greatly hampered by France's loss of territory containing coke ovens, and acknowledgment is made of the assistance afforded by Great Britain in sending over benzol, the partition being roughly that while we kept the toluene to ourselves, France was supplied with the benzol from which were made phenol and its derivatives so largely used in French explosives during the War.

The occurrence of isomerides in the nitration of toluene is clearly described, as well as the large-scale methods for making trinitrotoluene. Thus attention is directed to the important features of the process developed in Great Britain, such as the detoluation of the waste acids and the process for continuous nitration of mononitrotoluene, a sketch of a nitrating vessel used here in the large factories being included. Mention is also made of the purification of the trinitrotoluene by alcohol and by sodium sulphite, although the principle of the latter process, which was developed first in France, is not described. As would be expected from the use of nitronaphthalenes in France for many years, their manufacture is fully illustrated, as is also that of synthetic phenol and its nitro derivatives, including a sketch of a continuous nitration process developed in this country for picric acid.

The manufacture of nitric peroxide and its use in aerial bombs, in which the fuel for this oxidising material was kept apart until the bomb was launched on its flight, are also described, this being a type of bomb that was used to some extent by the French when it was desired to have a very violent local effect.

Sections are devoted to the manufacture of gunpowder and also to the mixture of ammonium nitrate with the nitronaphthalenes, but little is said of the British Service high explosive amatol (ammonium nitrate and trinitrotoluene), the use of which it is understood the French were contemplating on a larger scale towards the end of the War.

Under smokeless propellants a description is given of the methods of manufacture of Poudre B, and the

French views are stated as to the stabilising action of amyl alcohol and diphenylamine. As a war measure these substances were sometimes omitted, and the nitrocellulose propellant was tinted red as a distinguishing mark. While the composition of British cordite MK. I. is correctly given, cordite M.D., which superseded it, is not mentioned; the composition, however, is given of cordite R.D.B. adopted by Great Britain for land service during the War, as it utilised the solvent ether-alcohol instead of acetone which was impossible to obtain in the quantities required. There is a short section on the preparation and properties of the initial detonants, mercury fulminate and lead azide.

The fourth part deals with gases used in warfare, and after a short statement as to their first employment and subsequent tactical use, proceeds to describe the different natures of 'gas,' lachrymatory, toxic and vesicant, sternutatory, etc., and the manufacture of various types. The longest description is given to mustard gas, for the making of which the different processes are compared; the French method of reacting on ethylene with a mixture of chlorides of sulphur approaching sulphur dichloride in average composition and dissolved in carbon tetrachloride is given in some detail.

Sections are also devoted to compounds of arsenic, their physical constants, such as density and vapour tension; in some cases figures are given illustrating methods of manufacture of these bodies.

This book should prove of interest to the technical expert, not only from the presentation of its subject matter, but also as it gives reasoned views sometimes at variance with those held in Great Britain. While the explosive subjects are treated in a manner suitable for the students to whom they are addressed, there would seem to be insufficient information on the properties of the explosives. Thus the book would have been more valuable if it had included some collected information giving the heat produced on detonation of the different types of explosives and their chemical stability, their sensitiveness, rates of detonation, and explosive effects.

Our Bookshelf.

Manual of the New Zealand Flora. By T. F. Cheeseman. Second edition, revised and enlarged by the Author. Edited by W. R. B. Oliver. Pp. xliv+1163. (Wellington, N.Z.: W. A. G. Skinner, 1925.) n.p.

THE appearance of the long-expected second edition of Cheeseman's manual is most welcome, and, as the editor remarks, "the present edition of the manual will long remain the standard work on the flora." It is much to be regretted that Mr. Cheeseman died before the work was completed; but his full notes on the unfinished portions have enabled Mr. Oliver to complete the book according to Mr. Cheeseman's original ideas.

The value of the new edition is shown in the fact that 192 additional species, the greater number of which are new to science, are enumerated therein. In the family Compositæ alone 40 additions have been made, while in Scrophulariaceæ 25 new plants have been recorded, 19 of these being included in the genus Veronica. All but one of these latter belong to the very critical section Hebe (now considered a separate genus). A useful feature is Mr. Oliver's continuation of the history of botanical discovery in New Zealand, covering the years 1905–24, in which he gives references to the more important work done on the flora and cites broadly the places of publication. The list of Mr. Cheeseman's publications is an apt tribute to the writer of the manual, and at the same time valuable for purposes of reference. The lists of introduced species and native names have also been revised and enlarged and are of great value to the student. It is to be hoped that a fuller treatment of the former will not be long delayed.

In the body of the book the most notable feature is the replacement of Bentham and Hooker's system by that of Engler and Prantl in the arrangement of the families. Although this brings the manual into line with many modern floras, it is doubtful if such an alteration is advisable at the present time, when systems of classification are again under consideration. It is also rather a pity that the sub-kingdoms, classes, and sub-classes are not separated from one another adequately in the text, in accordance with the synoptical key given in the appendix.

In detail the arrangement of the text follows closely that of the first edition. One difficulty which is encountered in working with the manual in herbaria is the absence of collector's numbers in the enumeration after each species, but this, of course, does not arise in the field. Nevertheless, with the exception of a few minor mistakes, especially in the references, the general arrangement and finish of the book reach a high standard.

In spite of the many additions, the book has been kept within approximately the same compass by a slight enlargement of the pages, so that the whole volume is still easily handled.

Ticks: a Monograph of the Ixodoidea. By George H. F. Nuttall, C. Warburton and L. E. Robinson. Part 4: *The Genus Amblyomma.* By Dr. L. E. Robinson. Pp. xii+302+8 plates. (Cambridge: At the University Press, 1926.) 20*s.* net.

THE genus Amblyomma is by far the richest in species of the genera of ticks, comprising many forms remarkable for the beauty of their ornamentation. Dr. L. E. Robinson considers the number of valid species to be eighty-six. Although not of such great importance as carriers of disease as some other genera—for example, the cattle ticks (Boophilus), also the genera Rhipicephalus and Dermacentor—the genus Amblyomma includes several forms very injurious to domestic animals. The South African 'Bont tick' (*Amblyomma hebræum*) is the principal transmitter of heartwater—

a disease frequently fatal to sheep, goats, and cattle. This tick and some allied species are known to cause very severe ulcerating sores, sometimes leading to the loss of one or more udders of the host. Pyæmia and other complaints of horses due to soil-infesting organisms are also believed to ensue from the bites of *Amblyomma variegatum* and allied forms. Live-stock infested with these ticks sometimes suffer greatly from loss of blood and 'tick worry' due to the large number of parasites present. The larvæ of *Amblyomma cajennense* —a common tick in the West Indies, Central and South America—are a great plague, freely attacking man and domestic animals.

Clear and concise descriptions of all the known species of Amblyomma are given in this work, and the illustrations are numerous and excellent. A few notes on biology are to be found at the end. Parthenogenesis is recorded as occurring in *Amblyomma dissimile* and *A. rotundatum*. The author is to be congratulated on producing a monograph which will certainly be of the greatest value to all scientific workers interested in the Ixodoidea, and will no doubt for many years remain the standard work on the genus Amblyomma.

A. S. H.

Die Kriegsschauplätze 1914–1918 geologisch dargestellt. In 13 Heften. Herausgegeben von Prof. Dr. J. Wilser. Heft 2 (zu Heft 1 gehörig): *Lothringen.* Von Prof. Dr. E. Kraus. Mit einem Beitrag (Abschnitt Jura) von Dr. W. Klüpfel. Pp. viii+212+4 Tafeln. 24 gold marks. Heft 3: *Zwischen Maas und Mosel.* Von Prof. R. Lais. Pp. iv+116. 13·50 gold marks. Heft 13: *Südostmazedonien und Kleinasien.* Von Prof. Dr. O. H. Erdmannsdoerffer, Prof. Dr. Cl. Lebling, Prof. Dr. K. Leuchs, Dr. K. Osswald, Dr. A. Wurm. Pp. v+114+4 Tafeln. 18·60 gold marks. (Berlin: Gebrüder Borntraeger, 1925.)

THE conception of a series of volumes portraying the geology of the War areas as such has little to commend it either from the scientific or from any other point of view. Apparently numerous geologists were attached to the German Imperial staff to advise on such matters as water-supply, building materials, and the laying of mines; in the present volumes the results of their investigations are brought together.

Of the three now before us, the first two deal with areas of the western battle front, and give a fairly detailed account of the local stratigraphy and tectonics; there seems to be but little new matter, the contents being mainly a digest of information long ago published elsewhere. The volume on south-east Macedonia and Asia Minor consists of a series of articles recording the original observations of several geologists, who give most attention to tectonic structure; a few are accounts of hurried traverses, but a number of districts are surveyed in some detail.

The Effects of Inanition and Malnutrition upon Growth and Structure. By Prof. C. M. Jackson. Pp. xii+616. (London: J. and A. Churchill, 1925.) 30*s.* net.

PROF. JACKSON'S book is a systematic review of the subject of inanition, which term he uses to indicate the lack of food or of any food-stuff which is essential to the living organism. The general outline is on a strictly anatomical basis, the effects of starvation and malnutrition being considered separately for each system of the body. There are also included chapters on the effects of inanition on plants, protozoa, and the higher invertebrates. The book is singularly complete. The author not only gives the results of his own researches into the subject, but reviews in the widest possible manner the literature of the last fifty years. He classifies the various states of inanition according to their character, degree, duration and severity, and mode of occurrence, and discusses fully the results of experimental starvation and the observations of morbid anatomists on cases of clinical malnutrition and deficiency diseases. Being a study from the morphological aspect, the book is of theoretical rather than practical interest to the physician, but it will be warmly welcomed by the pathologist and biologist. It is well indexed, and a very full bibliography is included.

The Works of Aristotle. Translated into English under the Editorship of Prof. W. D. Ross. *Categoriæ* and *De Interpretatione*, by E. M. Edghill; *Analytica Priora*, by A. J. Jenkinson; *Analytica Posteriora*, by G. R. G. Mure. Pp. 348. (Oxford: Clarendon Press; London: Oxford University Press, 1926.) Paper, 6*s.* net; cloth, 7*s.* 6*d.* net.

THE monumental work of the English translation of all the writings of Aristotle by the Oxford Aristotelian Society, under the editorship of Prof. W. D. Ross, has received its latest accession in this volume, which contains four of the logical treatises. They constitute the work of Aristotle which is usually placed at the beginning and about which there is the least difficulty and the smallest amount of controversy. More than anything else, more even than the "Metaphysic," they are responsible for the idea of 'authority' which attached itself to the name of Aristotle throughout the Middle Age. This edition makes it possible for the English reader to understand how the philosopher Immanuel Kant could cite logic as the example of a science which had emerged complete and perfect from its first formulation, and take it as the model of the work he himself proposed to do for metaphysics.

Physikalisch-chemische Mineralogie und Petrologie: die Fortschritte in den letzten zehn Jahren. Von Prof. Dr. Wilhelm Eitel. (Wissenschaftliche Forschungsberichte: Naturwissenschaftliche Reihe, Band 13.) Pp. viii+174. (Dresden und Leipzig: Theodor Steinkopff, 1925.) 8 gold marks.

THIS is a welcome addition to the series of which it forms part. Within the limits of its scope, it is an invaluable guide to the results of recent investigations on the physics and chemistry of minerals and rocks. It is not intended to supersede larger works such as that of Boeke; but to constitute a supplement by which the student of the subject may bring his knowledge up-to-date. Similar publications are to follow on kindred subjects. It will be noticed that the author speaks of "Petrologie," not "Petrographie," as he is concerned with the evolution, not the mere discription, of rocks.

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.*]

Spirals and Waves in Wool.

ALL the Merino wool imported from Australia and South Africa is characterised by a conspicuous waviness throughout the individual lock or staple (Fig. 1). When drawn out, each separate fibre exhibits a regular series of convexities and concavities, and it is the adjustment of these to one another which gives the waviness to the complete lock. They are permanent structural features, returning after the elastic fibre has been stretched. The degree of the waviness, whether close or open, shallow or deep, varies in individual fleeces, and affords a ready means by which the farmer and manufacturer estimate the fineness or

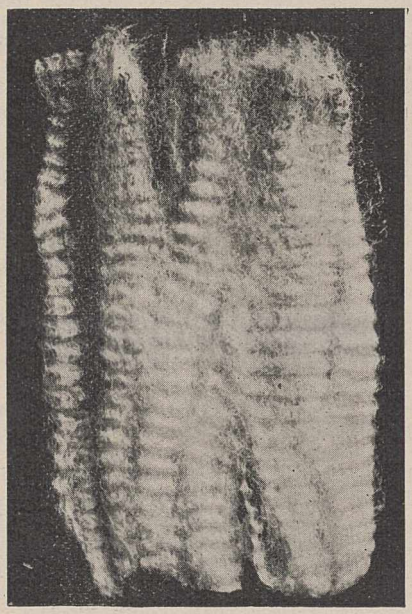

FIG. 1.—Staple of coarse Merino wool showing waves or crimps.

coarseness of the wool, from which the 'spinning count' is largely determined.

Much discussion has taken place recently as to the manner of formation of this waviness, whether determined by unequal lateral growth of the fibre within the follicle or superimposed later by the mechanical conditions in the fleece. A comparison of the fine, compact, short Merino wool with the coarse, open, long wool of many of the British breeds is found to afford a satisfactory solution of the problem. In the first instance, examination has been made of the natal coat of a large series of Merino, Karakul, and British breeds of sheep, and these show a remarkable degree of similarity, despite the conspicuous differences which the adult fleeces display. In all instances the coat of lambs at, and shortly after, birth is constituted of short spiral tufts, curls or ringlets of wool, usually intermingled with larger, coarser, medullated fibres known as kemp, and representing the outer coat of primitive sheep (Fig. 2). The spirals reach their most regular and compact form in the natal coat of the Karakul, and it is this which gives the attractiveness of the so-called Astrakhan fur. They are well shown as close, distinct spirals in the Merino and Southdown, and as loose and more open in the curl in the coarse, straight wool of the Scotch blackface, but all intermediate stages can be obtained by comparing different breeds, or even from within a single breed. It is significant of the common origin of all the varieties

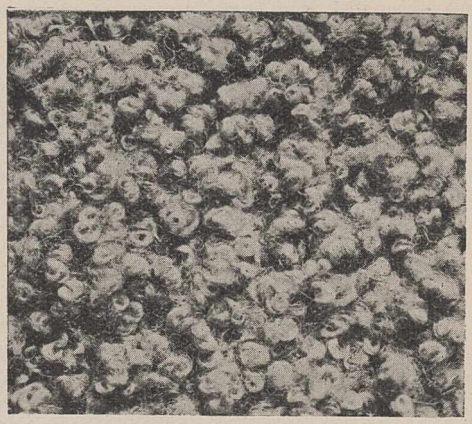

FIG. 2.—Natal fleece of Southdown with spiral tufts or ringlets under an outer coat of kemp fibres.

of sheep that at this early stage of their ontogeny their woolly coats should bear such a close resemblance.

Enclosed as the unborn lamb is within the fœtal membranes, and surrounded by the amniotic fluid, it is clear that the individual fibres, however close or scattered, can have little or no mechanical influence upon one another, and each one is free to assume the form impressed upon it by its structure. Therefore the spiral form they assume in the natal coat may be deemed to be that given them from their growth within the follicle, and to represent, as it were, the natural form of the fibre.

With the continuance of fibre growth after birth, new factors are introduced which modify the natural spiral form. If the staples are sufficiently free from one another as to be unimpeded in their growth, each

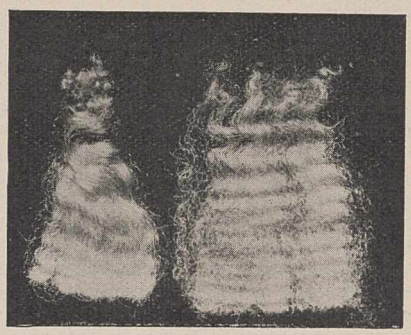

FIG. 3.—Staples of lamb's wool with spiral tufts (mother hair) at tip and wavy wool below.

continues the natal spiral form, and we get the well-known ringlets of the Leicester, Lincoln, and Wensleydale, as well as of the Angora goat. If, however, the fibres are so closely arranged that the staples press upon one another and form a compact fleece, then each lock is mechanically unable to assume the independent spiral form and the wavy structure is produced. The change can be best illustrated by compressing a rather open spiral of wire, the spire when flattened assuming a wave-like form, altogether resembling the waviness in the wool fibre. All

degrees of transformation of the spiral lock into the flattened wave can be traced in such fleeces as the Border Leicester, according as the staples are free throughout their length (' locky ') or compact below for a greater or lesser part of their length.

The change from spiral to wave is also recognisable in the first coat of sheep having a short compact fleece, as in the Merino and Southdown. At birth, as already remarked, the coat consists of independent spirals, maybe with an outer coat of kemp. The spirals grow upwards as the tip of the corresponding lock or staple and retain their form, while the wool below is in waves or crimps (Fig. 3). The spiral tips, known to the farmer as ' mother hair,' enable the woolman to determine wool of the first from later shearings.

J. E. DUERDEN.

Animal Breeding Research Department,
University of Edinburgh,
June 17.

The Reduction of Carbon Monoxide.

F. FISCHER (*Brennstoff Chem.*, 7, 97, 1926), in describing the formation at atmospheric pressure of solid, liquid and gaseous hydrocarbons by passing a mixture of carbon monoxide and hydrogen over a variety of catalysts, has advanced the theory that hydrocarbon formation depends on the transient formation of high carbon carbides which, by the action of hydrogen, give rise to products similar to petroleum. He states that no acids or other oxygenated substances are formed.

We have confirmed the formation of liquid hydrocarbons by passing an artificial water gas over a catalyst consisting of reduced manganese, cobalt and copper oxides (*Fuel*, 5, 263, 1926). Further experiments have shown the possibility of synthesising oxygenated compounds from this gas mixture, at ordinary pressure, although the literature available on the subject seems to indicate that pressure is essential for the production of such compounds. From thermodynamic considerations (Matignon), the reaction $CO + 2H_2 \rightarrow CH_3OH$ is scarcely possible at atmospheric pressure and $CO + H_2 \rightarrow HCHO$ cannot be carried out at all. The following reactions are perhaps possible :

$$2CO + 4H_2 \rightarrow C_2H_5OH + H_2O.$$
$$3CO + 5H_2 \rightarrow CH_3COCH_3 + 2H_2O.$$
$$2CO + 2H_2 \rightarrow CH_3COOH.$$

In an experiment where a gas mixture (composition 53·9 per cent. carbon monoxide and 44·6 per cent. hydrogen) was passed at atmospheric pressure over a contact mass consisting of the reduced oxides of manganese, cobalt and copper, impregnated with 0·5 per cent. lithium carbonate at 302° C., we obtained evidence of the formation of products apparently similar to those obtained in the now well-known high-pressure reactions between these gases over certain catalysts.

In this experiment 1·2 c.m. of the gas mixture gave 1·4 gm. of a yellow oil not miscible with water, and water-soluble acids equivalent to 0·33 gm. of potassium hydroxide. The steam distillate from this solution of potassium salts of the acids, on distillation through a column, gave about 0·5 c.c. of a pleasant smelling liquid with a boiling range of 74-80° C. This liquid possessed a ketonic odour and gave the iodoform reaction in the cold, but did not readily reduce ammoniacal silver nitrate. Reducing substances were present in the aqueous part of the fractionated liquid. There was also formed 0·5 gm. of solid which blackened on exposure to light and air.

The theory of the intermediate formation of carbides advanced by Fischer does not suffice to explain the formation of oxygenated compounds.

It is possible that the hydrocarbons he obtains are formed by the dehydration of alcohols followed possibly by hydrogenation, but again this does not explain the absence of acids and ketones from the products obtained by him at atmospheric pressure.

If the view is accepted that catalysis is an acceleration of reactions already taking place, then the formation of organic substances, other than methane and carbon dioxide, must depend on the preferential acceleration of the definite reactions which give rise to them. In the case considered here the question is complicated by the probability that not only does hydrogenation take place, but also oxidation, dehydration, and possibly polymerisation.

The reaction stages, if any, which lead to methane from carbon monoxide and hydrogen are possibly

$$CO + 3H_2 \rightarrow CH_2O + 2H_2O \rightarrow CH_3OH + H_2$$
$$\rightarrow CH_4 + H_2O$$

and $$CO + H_2O \rightarrow CO_2 + H_2.$$

Up to the present, however, the formation of formaldehyde and methyl alcohol has not apparently been established at ordinary pressure without the intervention of extraneous sources of energy such as ultra-violet light, X-rays, etc.

The formation of oxygenated compounds and hydrocarbons may also be regarded as being preceded by the hypothetical formation of methyl alcohol, which is converted, according to the catalyst and the experimental conditions, into methane or into other substances. Thus the reaction may proceed in consecutive stages or the catalyst may accelerate one or more of the thermodynamically possible reactions from carbon monoxide and hydrogen. No doubt, where a mixed product of aldehydes, ketones, acids and hydrocarbons is obtained, both of these courses may be followed.

Manganous oxide, cobalt and copper are not generally considered to have dehydrating powers as catalysts, but Medsforth (*J. Chem. Soc.*, 123, 1452, 1923) has explained the action of nickel in methane formation as being partly of a dehydrating nature, while the addition of oxide with dehydrating properties leaves the nickel more free to accelerate the hydrogenation stage of reaction. Nevertheless, we are of the opinion that the majority of the products obtained, in which acids, alcohols, ketones, aldehydes and hydrocarbons are all probably present, are formed simultaneously rather than consecutively. Carbon dioxide, water and methane would have to be considered in formulating chemical equations for the reactions involved.

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A. W. NASH.

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The Spark Spectrum of Lithium.

IT has been shown by Schüler and the present author that the first spark spectrum of lithium (the Li II spectrum) is of the same type as the arc spectrum of helium and consists of two spectral systems. In a letter published in NATURE of October 17, 1925, a scheme of those terms of the lithium spark spectrum was given, which must be considered as analogous to the terms of the ordinary ' doublet ' spectrum of helium (the orthohelium spectrum). In this note the results of further research on the lithium spark spectrum will be given. A number of new spark lines has been found which makes it possible to establish a series scheme of the terms of the lithium spark spectrum which are analogous to the terms of

the singulet spectrum of helium (the parhelium spectrum).

To distinguish between the two spectral systems it is proposed to denote the system, which by analogy with the parhelium spectrum must include the normal state of the spectrum, the *p*-system of the lithium spark spectrum (abbreviated the Li II *p*-spectrum), while the other by analogy with the orthohelium spectrum will be denoted as the *o*-system of the lithium spark spectrum (the Li II *o*-spectrum). As observed first by Schüler (*Ann. d. Phys.*, **76**, 292, 1925), and confirmed by recent observations by the author, the Li II *o*-spectrum is not a doublet spectrum, but seems to be a triplet spectrum of a type different from the ordinary triplet spectra.

Table I. gives the wave-lengths of the lines belonging to the Li II *p*-spectrum, and their series notation. The numbers in brackets are the estimated intensities of the lines, relatively to the lines of the *o*-spectrum given in my former letter (*l.c.*). It will be seen that the *p*-spectrum as a whole is considerably weaker than the *o*-spectrum. A similar behaviour is observed in helium under the same conditions of discharge, the parhelium spectrum being weaker than the orthohelium spectrum. Table II. gives the terms derived from the lines in Table I., with the effective quantum numbers (n^*) added in brackets.

TABLE I.

5037·8	(1)	$3P$-$4S$	
4788·8	(1·5)	$3P$-$4D$	
4677·7	(2)	$3D$-$4F$	
4156·3	(0·5)	$3S$-$4P$	
3305·2	(0·5)	$3P$-$5S$	
3249·8	(1)	$3P$-$5D$	
3199·4	(1·5)	$3D$-$5F$	
2952·7	(0·5)	$3S$-$5P$	
2767·0	(1)	$3P$-$6D$	
2730·7	(0·5)	$3D$-$6F$	
2508·9	(0·3)	$3D$-$7F$	
1681·8	(2)	$2P$-$3D$	
1755·4	(3)	$2P$-$3S$	

TABLE II.

$3S$ =	51300	(n^* = 2·925)	
$4S$ =	28484	(n^* = 3·926)	
$5S$ =	18080	(n^* = 4·927)	
$2P$ =	108264	(n^* = 2·014)	
$3P$ =	48328	(n^* = 3·014)	
$4P$ =	27244	(n^* = 4·014)	
$5P$ =	17440	(n^* = 5·017)	
$3D$ =	48803	(n^* = 2·999)	
$4D$ =	27448	(n^* = 3·999)	
$5D$ =	17464	(n^* = 4·999)	
$6D$ =	12200	(n^* = 5·999)	
$4F$ =	27434	(n^* = 4·000)	
$5F$ =	17556	(n^* = 5·000)	
$6F$ =	12193	(n^* = 6·000)	
$7F$ =	8957	(n^* = 7·000)	

The value of the term $2S$ has not been found. An extrapolated value of this term ($2S$ = 120000) shows that the line $2S$-$2P$ is in the infra-red at about λ8500 Å.U., and for $2S$-$3P$ (λ about 1400 Å.U.) no line has been observed which with certainty could be ascribed to this transition. It is not possible to give the value of the $1S$-term corresponding to the normal state. The excitation potential of the $2s$-$2p$ line seems to be about 60 volts, and from this the ionisation potential for the Li^+ ion can be estimated to be about 70 volts, which gives the value 550000 for the $1S$-term and for n^* a value between 0·85 and 0·90.

The scheme given in Table II. is in good agreement with the theoretical expectations. For the theory of the spectrum of an atom with two electrons, the reader is referred to a paper by W. Heisenberg, soon to appear, and a paper by I. Waller.

A remarkable feature is that the two strong lines 2934 Å.U. first reported by Mohler, and the line 3715 Å.U. first reported by Schüler, seem, contrary to what was previously assumed, not to belong to the series of the ordinary lithium spark spectrum. From a kind communication from Dr. Paul Foote, the author learns that Dr. Schüler has arrived at the same conclusion.[1] The excitation voltage of these lines is nearly the same as that of the strong green Li II– line ($2s$-$2p$). In addition to these two lines, two rather strong lines at 4607·4 Å.U. and 2337·0 Å.U. have been observed, which seem to be of the same character.

SVEN WERNER.
Universitetets Institut for teoretisk Fysik,
Copenhagen, June 16.

[1] *Note added in the proof.*—Since the above was written a short paper by Schüler (*Z. f. Phys.*, **37**, 568, 1926) has appeared, containing the results of his recent measurements in the Li II *p*-spectrum. The results given in his paper and in the present note confirm and supplement each other.—S. W.

The Distribution of Red Algæ in Relation to Illumination.

WE have recently been engaged in photo-electric measurements of submarine illumination, as a result of which certain conditions governing the distribution of algæ have become evident.

The illumination in the water is reduced in amount and altered in spectral character, and these effects are composite. First, there is the absorption due to the water, as such, which results in the longer wave-lengths being reduced in far greater proportion than are the blue and violet. Grein has shown how surprisingly large the ultra-violet transmission may be in very clear water. Secondly, there is the non-selective absorption due to gross particles in suspension; this merely reduces the illumination and might be more correctly termed scattering or reflection than absorption; but as it can only be measured by the absorption coefficient of the water as a whole, the term absorption is used. Thirdly, there is the selective absorption or scattering due to very small particles, which have most effect upon the ultra-violet, violet, and blue. Fourthly, there is the selective absorption due to any tint in the water occasioned by substances in solution, as in the clear amber water of bog pools.

Determinations of the coefficient of absorption were made under various conditions by means of a photo-electric cell sensitive mainly to the blue. Values of μ were obtained as follows: near shore, with water obviously sandy, $\mu = 0{\cdot}81$; same spot in calm weather, $\mu = 0{\cdot}165$; about 20 miles from land in calm weather, $\mu = 0{\cdot}110$. Consider now the illumination at 10 metres depth, taking that immediately below the surface as unity; with sandy water the illumination at 10 m. was only 0·033 per cent., on the calm day it was 19·2 per cent. and 20 miles out 33·5 per cent. In pure water 37 per cent. of blue light of 4750 Å.U. is transmitted to about 50 m., and the same percentage of light of 4490 Å.U.—the most sensitive region for the cell used by us—to about 82 m.; on the other hand, only 19 per cent. of red light 6000 Å.U. is transmitted by pure sea water to 10 metres, a depth at which we found 33·5 per cent. of blue light for actual sea water 20 miles off shore.

It is thus obvious that the selective absorption of the water, as such, is most noticeable in clear water in which there is absolutely no tint and the grosser particles are much reduced in number save for the plankton organisms themselves. The red end of the spectrum being cut out, the light remaining is largely blue in clear water, so red algæ—which appear black to the eyes of a diver—are obviously efficient absorbers of light; they flourish, therefore, in clear water, where their red pigment is an adaptation that enables them to utilise to advantage the blue light present in reduced amount. In fresh water, however, such clear conditions are rarely encountered, and algæ with red pigment are conspicuous by their absence.

It is true that Paschen has recorded that in Alpine lakes flagellates and Cyanophyceæ with red spotted olive green and, finally, deep red are found at about 10 metres and downward, but there is no general development of algæ with red pigment in fresh water,

simply because at the depth at which the water, as such, would have left light preponderatingly blue, the gross particles would have reduced the illumination to less than that at which plants could survive. The presence of a selectively absorbing tint and of finer particles also reduces the blue light.

Evidence as to the relatively great turbidity of fresh-water lakes is afforded by measurements with the Secchi disc. Southern and Gardiner found that in Lake Atorick, which is supplied by drainage from bogs, the maximum depth for visibility was 3 m., for Lake Derg, 10 miles from the entry of the River Shannon, 4·8 m., for a very clear lake, Loughrea, 10·3 m. Values for certain lowland European lakes range from 0·2 to 7·25 m., according to Thomasson. In the sea, however, off Plymouth, Russell has found 13 m. in April to more than 20 m. in June, and values up to 50 m. are not uncommon in the open sea. Moreover, most of the fresh waters are subjected to periodical floods, with increase in turbidity. Only rarely, therefore, would the possession of a red pigment be of any service to fresh-water plants.

W. R. G. ATKINS.
H. H. POOLE.

Marine Biological Laboratory, Plymouth,
and Royal Dublin Society,
July 8.

The Caryophyllene Alcohols and their Occurrence in Nature.

IT is a well-known fact that most hydrocarbons of the terpene and higher terpene classes are associated in Nature with corresponding alcohols from which the hydrocarbons themselves can be derived by removal of the elements of water. It is very probable, indeed, that these unsaturated hydrocarbons are actually produced in the plant by this method. Now, with the exception of cadinene, caryophyllene is probably the most widely distributed sesquiterpene in Nature, and it has therefore long been a matter of surprise that caryophyllene alcohol (which may readily be prepared from caryophyllene by Wallach's hydration method) does not occur naturally. The author knows of no recorded discovery of this alcohol in essential oils.

A study of the chemistry of caryophyllene, however, and in particular some work carried out recently in this laboratory (Henderson and Robertson, *Jour. Chem. Soc.*, 1926, 62-70), throws considerable light on this problem. Briefly, it has been established that Wallach's hydration method effects ring closure in the caryophyllene molecule with the production of a tricyclic structure. The reaction is not reversible, and the dicyclic caryophyllene structure cannot again be derived from the alcohol and its derivatives. The alcohol and its esters, therefore, possess a different configuration from that of caryophyllene, and hence could not be expected to occur as parent compounds of this hydrocarbon.

This may be said to explain the non-occurrence of caryophyllene alcohol in Nature. Another interesting result of this work, however, has recently been brought to my notice. In the paper referred to above, a new caryophyllene alcohol, called caryophyllol, was synthesised directly from the hydrocarbon, and was shown to retain the dicyclic caryophyllene structure. Caryophyllol, therefore, and not Wallach's hydrate, we would expect to find occurring in plants as the natural parent of caryophyllene, and this surmise appears to be justified by some work of Semmler on an oil drawn from clove stems (*Ber.*, 1912, 45, 1392). In the higher boiling fractions he discovered a bicyclic sesquiterpene alcohol the properties of which are practically identical with those of the synthetic caryophyllol, as the following figures show:

	b.p.	$d_4^{17-20°}$	$n_D^{17-20°}$	$[R_L]_D$
Semmler's alcohol from clove stems	138-148° at 8 mm.	0·9681	1·5010	68·18
Synthetic caryophyllol	142-150° at 10 mm.	0·9632	1·5015	68·03

The agreement is the more striking in that the boiling-point and density of these compounds are both lower than is usual with alcohols of this class, and are therefore the more characteristic.

It is hoped that further work will establish the chemical identity of these two alcohols, although the experiments may be complicated owing to the theoretical possibility of four closely related isomers. In the meantime it may with some safety be predicted that caryophyllol will be found to occur in the higher boiling portions of other essential oils which contain caryophyllene.

J. MONTEATH ROBERTSON.

The Chemistry Department,
University of Glasgow,
July 5.

The Reversal of the Hydrogen Series in the Extreme Ultra-Violet.

IN the course of the presentation of a paper on the spectrum of neon at the spring meeting of the American Physical Society a year ago, I mentioned that I had been able to obtain the first three members of the hydrogen series in the extreme ultra-violet reversed. Recently I have repeated the experiment with the purpose of improving the technique and confirming the results.

In the first place, it is necessary to produce a continuous spectrum in the region in question; I have already described briefly how this may be accomplished (*Astrophysical Journal*, vol. 60, July 1924, p. 2). The procedure consists in charging a condenser of about 0·5 micro-farad capacity with a direct current and then discharging it through a vacuum tube of the internal capillary type arranged in series with a half-centimetre spark gap. The best results are obtained with a discharge tube of common glass. It is important that the capillary be not too large: I have found a diameter of about a millimetre satisfactory. The material of the electrodes is not important: I have employed tungsten.

The continuous spectrum seems to owe its existence to the disintegration products of the glass set free by the erosive action of the discharge; its strength depends scarcely at all on the nature of the gas in the discharge tube. The experiment is not without mechanical difficulties, for the slit of the spectroscope frequently becomes plugged up by glass dust, the removal of which involves a troublesome process.

Once the conditions for producing the continuous background have been secured, the best results were obtained by admitting hydrogen into the discharge tube at a pressure of about one millimetre. Upon applying the explosive condenser discharge, the first four members of the series—1215·6, 1025·8, 972·5, and 949·7—appear on the photographic plate sharply reversed. It is not necessary to employ pure hydrogen, however; the first two members of the series have been obtained with helium containing a trace of hydrogen. The nature of the apparatus is such (*Astrophysical Journal*, vol. 60, p. 8, 1924) that a distance of about one centimetre separates the end of the capillary from the slit of the spectroscope, while the gas which fills the discharge tube is removed from the light path by a pump the inlet of which lies two

centimetres on the grating side of the slit. The path length available for absorption is thus of the order of three centimetres. It seems certain that a very small quantity of hydrogen is sufficient to produce the reversal of the lines. THEODORE LYMAN.

Jefferson Laboratory,
Harvard University,
June 29.

Plastic Deformation of Single Metallic Crystals.

IN a letter to NATURE (May 22, 1926, p. 720), Messrs. W. E. Millington and F. C. Thompson have proposed a formula for the angle of a uniform wedge formed by the fracture of a single metallic crystal, which purports to be more general than that given by the writer in connexion with the fracture of tungsten single crystals (*Phil. Mag.*, Aug. and Nov. 1924). By the use of this formula they consider it "possible to extract from the experimental results obtained on these single crystals of tungsten information with regard to the distance through which the atoms move and the number of planes involved which has hitherto remained unrealised."

The writer would like to point out that the use of their formula presupposes a type of slip which is inconsistent with experimental fact and that consequently it is inapplicable as a theory of wedge formation.

They have assumed that slip takes place on two sets of planes equally inclined to the specimen axis, and that the wedge angle depends only on the extent of slip per plane and the distance apart of the slipping planes. It has been shown, however, that a minimum extension of the crystal is required in such a case if fracture is to take place (*Phil. Mag.*, pp. 234-235, Aug. 1924), from which it follows that a definite wedge angle (39° approx.) must result if the two halves of the divided crystal are symmetrical; and further, that if a wedge were formed in one half of the crystal with an angle greater than 39°, a wedge having an angle less than 39° must be formed in the other half. Such unlike wedges are not found by experiment; either the wedge angles were both 39° or both were greater than 50°.

The explanation of the 39° wedges is based on a purely geometrical argument and tells us nothing about the extent of slip per plane or the distance apart of the slipping planes other than that on the average they give the theoretical wedge form. The explanation of the large wedge angles given by the writer, although it may not be entirely satisfactory, was at least based on the experimental fact that they were always associated with crystals asymmetrically inclined to the specimen axis—a case which Messrs. Millington and Thompson did not consider.

F. S. GOUCHER.

New York City, June 30.

Use of Pith Dust in Kundt's Tubes.

DURING the summer of 1924, while experimenting at Indiana University with a Kundt's tube, I discovered that the striæ could be most readily observed by using pith dust in the tube. I obtained the pith dust by grinding dry pith from sunflower on a fine-grained emery wheel. By the use of this dust I was able to obtain discs that extended completely across the tube and having the same diameter as the inside of the tube.

These striæ were obtained by the ordinary method used with a Kundt's tube, but for demonstration purposes I found the following to be an excellent way to produce them: Some pith dust was placed in a glass tube of any convenient length and diameter. In one end of the tube a stopper was placed and the open end of the tube was inserted in the open end of a sounding organ pipe. When the tube was inserted the proper distance the striæ formed at regularly spaced intervals and showed the nodes and loops in an excellent way. Discs apparently but one particle in thickness were formed, and when the tube was carefully adjusted with regard to the distance to which it was inserted into the organ pipe, the separate particles remained almost motionless. Often they wove themselves into thin sheets, and when the air was turned off they fell over, maintaining the sheet form.

ROLLA V. COOK.

Bethany College,
W. Va., U.S.A.

The Ancestral Third Claw of a Spider: *Clubiona interjecta.*

THE accompanying photomicrograph (Fig. 1) shows a leg of a young spider of the species *Clubiona interjecta* Koch, before its escape from the egg-cocoon. Adults of the family Clubionidæ possess two tarsal claws, but on the tarsi of the spiderling the median, third, claw is present, demonstrating the fact that the possession of three claws is the ancestral condition. All web-spinning spiders have retained the third claw, while many hunting spiders lose it when very young.

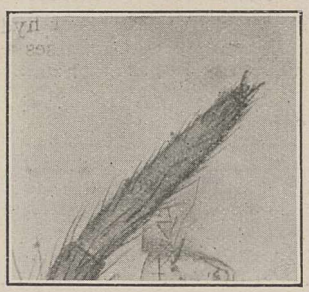

FIG. 1.—Leg of young spider, *Clubiona interjecta* Koch.

I have referred to this fact in a recent paper on "Evolution in Spiders" (*Science Progress*, Jan. 1926, pp. 475-480), but I believe that this photomicrograph is the only published illustration in support of my statement. For the photography, I am indebted to my friend and colleague, Mr. R. W. Barney.

THEODORE H. SAVORY.

The Biological Laboratory,
Malvern College.

Egyptian History.

HISTORICAL truth compels me to remark that it is inexact to say that the dating by the Egyptians is only "*modern* calculations" (NATURE, June 5, p. 788). All three ancient versions of the lists of kings named by Manetho also state the totals of each of the three great periods; excepting the last, which is not in dispute, only named in one version. These totals count up to Alexander. Where these lists can be checked by external sources they show that overlapping periods of rule were eliminated. It is quite impossible to discuss the details here, but at least the facts justify my statement of the Egyptian reckoning. FLINDERS PETRIE.

The Bose Research Institute, Calcutta.

IN view of the lively interest that has been aroused by the lectures that have been delivered recently by Sir J. C. Bose in London and elsewhere, on the methods and results of his investigations on the physiology of plants, it will no doubt be agreeable to many readers of NATURE to have some general information concerning him and his work, and about the Research Institute which he has founded in Calcutta.

Already a B.A. of the University of Calcutta, possessing a fair knowledge of physics and chemistry, Sir Jagadis Bose came to England in 1880 for the purpose of studying medicine, and entered University College, London, where he made his first acquaintance with biology in the course of instruction given by Sir E. Ray Lankester. However, he soon found that his health, then somewhat precarious, could not stand the strains peculiar to medical study, and decided to go to Cambridge in order to devote himself to natural science. Accordingly he presented himself as a candidate for an open scholarship at Christ's College, to which he was duly elected, and went into residence there in January 1881. At Cambridge he pursued the general course of work for the Natural Sciences Tripos: he studied chemistry, and especially spectroscopy, under Liveing; physics under Lord Rayleigh in the then newly erected Cavendish Laboratory; physiology under Michael Foster; embryology under Francis Balfour; botany under Vines, who was also his college tutor. He took his B.A. degree in 1883: in the meantime he had taken his B.Sc. at the University of London, and ten years later the D.Sc. degree was conferred upon him. He thus acquired a good all-round scientific education, with a special knowledge of physics.

On returning to India in 1884, Sir Jagadis was appointed officiating professor of physics in the Presidency College, Calcutta, on the recommendation of Lord Ripon, the then Viceroy. As the value of his work came to be appreciated, he was soon raised to full professorial rank. This office he continued to hold until 1915, when he retired with the distinction of emeritus professor.

Whilst adequately discharging the onerous duties of his office, Sir Jagadis carried on research as actively as circumstances permitted. He produced a series of papers on electrical subjects which were communicated to the Royal Society by the late Lord Rayleigh, his former teacher, and made his first appearance as a lecturer in England with a discourse on "Electric Waves" at the Royal Institution in 1896, which he soon afterwards repeated in Paris and in Berlin.

At this point came the widening of Sir Jagadis' horizon to include living as well as non-living matter. He incidentally observed, in the course of his researches, that the metallic receivers of the electric waves showed 'fatigue' after prolonged service, and regained their activity after a period of rest; and conversely, that they became inert after too long a rest, but could be revived by an electric shock. He was so struck by the close resemblance of these phenomena to those presented by living muscle and nerve under similar conditions, that he proceeded to make a series of comparative experiments, the results of which were embodied in his book, "Response in the Living and Non-Living" (1902). It is there established beyond doubt that metals (but apparently no other form of non-living matter) possess to a certain degree the 'irritability' which had hitherto been regarded as peculiar to living protoplasm. When a nerve is stimulated, whether electrically, mechanically, or thermally, it gives an electrical response of negative variation. The amplitude of the response can be made to vary by changes in the conditions; it is increased, within limits, by a stronger stimulus, by a rise of temperature, or by treatment with stimulant substances; it is decreased by weakening the stimulus, by lowering the temperature, or by treatment with depressant substances; it can be altogether arrested, either temporarily or permanently, by excessive heat or cold, or by treatment with poisons. All these reactions Sir J. C. Bose obtained with strips of metal. This leads to the remarkable conclusions that 'irritability' is not exclusively the property of living matter; that the 'negative variation' response to stimulation is not a sign of 'life.' Irritability would appear to indicate a certain unstable molecular constitution common to metals and to protoplasm: the negative electric variation, to be the expression of molecular disturbance due to stimulation.

In the book to which reference has been made, the first evidence was given that not only the 'sensitive' plants, as was already known, give this electric response, but also that all plants, and all parts of plants, do so. It was made clear that all plants are sensitive, though only the so-called 'sensitives' are conspicuously motile. The novelty of the idea led Sir Jagadis to devote himself more to the biological than to the physical side in his further investigations; and rather to plants than to animals, because the physiology of animals had advanced much further than that of plants. Progress in the study of the physiology of plants had been hindered by the too mechanical conception of it that had prevailed: it seemed to have been forgotten that both animals and plants consist essentially of protoplasm, and that they must therefore present essentially the same reactions, though modified by special adaptations.

Inspired by this principle, Sir Jagadis proceeded to investigate the irritability and movements of plants by applying the methods that had yielded such fruitful results when applied to animals, and devised apparatus of special sensitiveness for the detection and automatic record of their less vigorous response. His results and conclusions have been published in a series of books, in a number of papers in the *Proceedings*, and in the *Transactions of the Royal Society*, of which he was elected a fellow in 1920; and in the *Transactions of the Bose Research Institute*, of which four volumes have appeared (1918–21).

Without going into too much detail, a few of Sir Jagadis' most striking researches and discoveries may be mentioned. For example, his book "The Physiology of Photosynthesis" (1924) gives the most satisfactory extant account of a process which is of cosmic importance. In his "Physiology of the Ascent of Sap" (1923), he brings forward convincing experimental

evidence that the sap is raised in the tree-trunk by the active contraction of special propulsive cells, the position of which he was able to localise by the electric probe, which he originally devised for the detection of the geo-perceptive layer of cells in stems and roots, a conclusion which is still strongly contested by the adherents of the traditional physical explanation of the process. His most recent book, "The Nervous Mechanism of Plants" (1926), brings together all the evidence scattered throughout previous works that the conduction or transmission of excitatory impulse in plants is a physiological process and is limited to a particular tissue, certain elongated tubular cells of the bast in the vascular bundle, which may justly be termed 'nerve,' in opposition to the current view that the process is purely mechanical and that the tissue concerned is the wood. The conducting tissue in the stem and leaf was located by the electric probe, which again did good service, and the physiological nature of conduction is established by the observation that, in the plant as in the animal nerve, conduction is affected by changes of temperature, by blocking and by stimulating agents, which could not have any such effect upon it were it merely mechanical. A special account is given of the nervous arrangements in the motile leaf of the sensitive *Mimosa pudica*, in which reflex action is demonstrated.

Taking together this book and that on the ascent of sap, it may be generally stated that Sir J. C. Bose's researches have established the existence in the vascular plants, at least, of a circulatory and of a nervous system, using the terms in a loose general way. The 'circulatory system' includes neither heart nor veins, consisting entirely of strands of propulsive cells distributed throughout the plant, representing a contractile arterial system: similarly, in the 'nervous system' there are no central organs, such as brain, spinal cord, or even ganglia, only nerves, of which some have been shown to be sensory, others to be motor. No doubt there remains much yet to be discovered along these various lines of research.

The Research Institute at Calcutta (Fig. 1) was founded and built by Sir J. C. Bose as a place where he and his students and their successors might continue to carry on the researches of which some account has been given above. It was publicly inaugurated on November 30, 1917, and has been in active operation ever since. It is a beautiful and commodious building, standing in its own spacious grounds, with all the details of its construction and arrangements carefully thought out to ensure its perfect adaptation to its purposes. There is a large auditorium capable of accommodating 1500 persons, a library, and rooms and laboratories for work of various kinds. No elementary teaching is undertaken: the only object in view is post-graduate research. The carefully selected scholars, of whom there are at present about sixteen, are admitted on the condition that they devote themselves wholly to the prosecution of research, not as a means of livelihood or for the satisfaction of personal ambition, but, in the words of the founder, "in order to realise an inner call to devote one's whole life to the infinite struggle to win knowledge for its own sake and to see Truth face to face." They receive a modest allowance for their maintenance so that they may be free from distracting cares. The line of research pursued is essentially physiological in its direction, and includes both animal and plant in its scope, though so far the plant has received more

FIG. 1.—The Bose Research Institute, Calcutta.

attention than the animal. But it is physiological in the widest sense, encroaching, as occasion arises, on physics, on bio-chemistry, on botany and zoology, and on histology. At the present time there are no workers at the Institute other than the staff and the scholars, but it is the hope and desire of the founder that it may be frequented by students from all parts of the world, who are assured beforehand of a hearty welcome and of a hospitable reception.

The foundation of the Research Institute in Calcutta, as well as of the branch, Mayapuri, situated at Darjiling at 7000 ft. elevation, in an altogether different climate, was due, in the first instance, to the munificence of Sir J. C. Bose; since then, considerable sums have been contributed by Indian princes and others for extensions and for endowment. The Imperial Government of India has recognised the value of the services rendered by the Institute to the advancement of science by making an annual grant out of public funds for its upkeep. The Institute has continued from the beginning to expand both materially and intellectually. It has shown what important results can be obtained by the combination of the logic and the scientific methods of the West with the imagination and the idealism of the East. Even now it is still only at the beginning of its career, a career, let us hope, of ever-increasing usefulness and brilliance, which ought to be assured by the principles of self-abnegation upon which its constitution is based, more than fulfilling the most sanguine expectations of its founder and reviving the ancient reputation of India as a home of learning.

The Lewis Evans Collection at Oxford.

RECENT ADDITIONS.

WHEN the oldest of British museums was reopened for the scientific treasures presented to the University of Oxford by Dr. Lewis Evans, it was foreseen that that fine collection must act as a lodestone and attract cognate objects to itself. This expectation has been realised in a remarkable measure by gifts and loans of apparatus, and by the discovery and reconstruction of long-forgotten instruments. The first fruits of the reversion of a part of the Old Ashmolean building to its original use as a Science Museum are now on exhibition.

Several colleges have contributed apparatus that is second to none for illustrating the early history of many scientific inventions. Both Merton and Oriel Colleges have proved themselves faithful custodians of the quadrants and astrolabes of their astronomer-fellows of the fourteenth century. No other educational institution can boast continuous possession of scientific appliances for so many centuries. Contemporary manuscripts written about these very instruments, describing their use, collected when the instruments to which they refer were three centuries old, were given by Ashmole to be "preserved in the presses" of his Science Museum, that his good name might endure "for all time." There they remained for yet another two hundred years, while the instruments, to the use of which they supplied the key, languished in college chests and cupboards. To-day the instruments are on exhibition in Ashmole's building, while Ashmole's own books about them have been put away out of sight in hidden recesses in buildings other than those named in his will. If both books and instruments were once again placed side by side, we should have visible proof of the scientific pre-eminence of the Merton School in the fourteenth century.

To a distinguished fellow of Merton we owe the beginning of our technical scientific literature. Richard, the son of a blacksmith at Wallingford, received a practical education that enabled him in 1326 to compose in terms as clear as those of a proposition of Euclid, a model treatise, the first of its kind known to have been written by an Englishman, upon "How to Make" a scientific instrument. He prescribed the exact dimensions of the metal parts, both in the rough and in the finished state; and he illustrated the shaping and fitting by working diagrams, so that it is possible to interpret his meaning after six hundred years. His distinction as a man of science led to ecclesiastical preferment. Richard, the maker of our first recorded astronomical clock, became abbot of St. Albans. His 'rectangulus,' figured in NATURE for January 12, 1924, has been partly reconstructed this very year in honour of the sixth centenary of his original invention.

Two centuries later the needs of Elizabethan navigators and gunners advanced the skill of the instrument maker to higher levels, both of execution and of invention. By the generosity of the University Court of St. Andrews, there is on view the finest astrolabe known to have been made by an English craftsman. It is 2 feet in diameter, and 33 pounds in weight. It is inscribed with the name of its maker, Humphrey Cole of London, and is dated with the day of the month, May 21, 1575, the very year when he was getting ready the instrumental outfit for Martin Frobisher's first expedition in search of the North-west Passage to Cathay, an enterprise in which Elizabeth herself was financially interested to the extent of 1000*l*. By the finding of Cole's great astrolabe we have proof for the first time that there were in London craftsmen capable of executing work equal in quality to that of the instrumental equipment of the best-endowed observatory in the world, the astronomical observatory of Tycho Brahe at Uraniborg. Nor was this Cole's only claim to a place in our memory. He was the first Englishman to engrave a copperplate map for the illustration of a book, the Bishops' Bible of 1572. The advent of the Lewis Evans collection has also led to the discovery of one of Cole's early theodolites in the Library of St. John's College. This discovery proves him to have been the maker and improver, if not the original designer, of our premier surveying instrument, an invention usually associated with the name of Leonard Digges of University College.

A century later and we come to the epoch of the great experimenters, too soon to be followed by the epoch of the great destroyers. The Royal Society, finely equipped in the days of Daniel Colwall and Grew

with a repository of scientific apparatus that would now have the utmost historical value, has neglected and scattered the instruments of its great alumni, Boyle, Wren, Hooke. A fashion has been set of undervaluing scientific treasures left in trust, the latest examples being the dispersal of the Crisp collection of Microscopes, of the Howard Library (by the Royal Society), and of a part of the Library of Sir Isaac Newton.

The Lewis Evans collection has afforded an opportunity of trying to stem the current of our losses, and by the construction of models illustrating certain aspects of the work of the first Oxford fellows of the Royal Society. Models of Wren's perspectograph and level recall his method of dealing with problems presented by the devastated areas in the Metropolis after the Great Fire of 1666. A model of Hooke's microscope recalls what was perhaps the greatest achievement of that universally inventive genius, the first discovery of cell structure in living beings. In another case is an exhibit illustrating the first discovery of oxygen in 1668 by John Mayow of Wadham College. A model of Boyle's first airpump reminds us that it was the High Street in Oxford that produced the first English engine to demonstrate the possibility of harnessing the force exerted by atmospheric pressure, the "spring of the air," as Boyle called it. Other models show how the dwellers in an inland town have been able to teach and assist navigators; Hooke's reflecting instrument, Gunter's cross-staff and sector, the magnetic compasses of 1269 of Peter Peregrinus, and of 1750 of Gowin Knight of Magdalen College being notable examples, paralleled in our own time by the instruments invented for seamen by Lord Kelvin.

Space will not permit us to rehearse all the exhibits in our small Museum, but in truth we may define it as a school of gratitude to the great men who have increased the knowledge and the power of the human race. The most recent of the reconstructions is a beautifully made astrolabe designed by Prof. Frewen Jenkin, for making known the virtues and uses of that 'mathematical jewel' to a wider public than the favoured few who possess original examples. In this regenerated form, the astrolabe again becomes an instrument of great educational value.

The enterprise of museum founding has not been without its disappointments. First and foremost was the dispersal of the collection formed by Sir Frank Crisp to illustrate the evolution of the microscope. Through the kindness of Sir John Findlay, one of the masterpieces of that collection, a superb silver instrument by Adams, is on view in Oxford for the meeting of the British Association. But the general disappearance of much good apparatus in Oxford itself is deplorable. Only a few months ago there were in existence things of great scientific interest which have vanished. A model with which Bradley illustrated his discovery of the aberration of light is not now forthcoming. Antique microscopes, barometers, the paraphernalia of the educational methods of a century of preparation for the great scientific advances of to-day, have gone to the scrap heap—destroyed in many cases by the urgent needs of research in hand. In the modern laboratory there is no place in which to store the apparatus of bygone experimenters, even if there were a desire to keep it intact, rather than to make use of its parts.

It is our plea that scientific instruments that are of value, either for beauty of design, for achievement in the laboratory or lecture-room, or for some other good cause, should at least be treated with the respect that is accorded to early editions of printed books in a library, or to pictures in a gallery of art. The destruction of a copy of an old book that has been printed in hundreds and reprinted in tens of thousands, inflicts no great harm on the world of letters, but the loss of a unique instrument obscures the whole meaning of early work. Only by contemporary scientific appliances can we hope to show to future generations the ever-varying fashions and phases of our natural philosophy: and few objects are better worth the effort, for in our northern civilisation, natural science has become of greater consequence than art. To traverse the long galleries of the museums of arts and crafts, and to study their masterpieces, is a dispiriting pilgrimage, for it brings home to one how slight is the influence that such exhibitions exercise in elevating the art of a modern people. Scientific instruments, too, show regression in respect of their art; but they show continuous advance in respect of their science.

All work of preservation is of the utmost value in that it helps to check a tendency to destroy evidences of our own early civilisation, and to remind us that with our now diminished resources, instead of spending large sums on the conservation of relics of antiquity abroad, it may pay better to honour the prophets of our own country. R. T. G.

The Oxford Meeting of the British Association.

MEMBERS of the British Association visiting Oxford during the forthcoming meeting will find themselves in the midst of a south-midland district which is, from the naturalist's point of view, possessed of great and varied interest. Opportunities will be given by means of sectional excursions for gaining such acquaintance as may be possible with the geology of the surrounding country, and with noteworthy features of its characteristic fauna and flora. It is obvious that no extended study of the district can be undertaken in the short time at the disposal of those attending the meeting, but the "Handbook" which will be distributed to all visiting members of the Association will provide them with a summary, under various heads, of what the neighbourhood of Oxford can show in the way of natural features of interest.

This handbook, the work of several authors, each of them a first-rate authority on the subject with which he deals, is being produced under the editorship of Commander J. J. Walker, R.N., and will no doubt take rank as a volume of permanent value. It begins with an account by Mr. H. O. Beckit, director of the School of Geography, of the physiography of the Oxford region, including a definition of its boundaries, and describing its land forms and physical history. Sections are added by Mr. W. G. Kendrew on its climate, by

Mr. E. T. Leeds on its early and by Mr. H. O. Beckit on its modern settlement. The geology of the area is dealt with by Prof. W. J. Sollas, who devotes his attention mainly to the parts of the great Jurassic system which lie within easy reach of Oxford. Dr. K. S. Sandford contributes an account of superficial deposits, and Mr. A. J. Arkell an appendix on the Corallian Period. Articles follow on the botany, ornithology and entomology of the Oxford country; these have been treated with great thoroughness by Dr. G. Claridge Druce, the Rev. F. C. R. Jourdain, and Commander J. J. Walker respectively; the latter having as collaborators Messrs. W. J. Lucas, A. H. Hamm, E. G. R. Waters, and J. Collins. The spiders have been attended to by Mr. A. W. Pickard-Cambridge, and the land and fresh-water mollusca by the Rev. L. W. Grensted. Among the institutions for which Oxford is famous there are three of special importance for the members of the British Association. The first of these, the great entomological department, which takes its name from the late F. W. Hope, is described by Prof. E. B. Poulton; the Pitt-Rivers Museum of Ethnology is treated of by its curator, Mr. Henry Balfour; and the whole series of these valuable memoirs is wound up by Dr. R. T. Gunther's account of the Old Ashmolean Museum and the Lewis Evans collection of scientific instruments therein housed under his curatorship.

The general excursions to Swindon, Stratford-on-Avon, Warwick and Kenilworth, Burford, Fairford and the Cotswolds, Blenheim Palace, and the expeditions by river to Day's Lock, to Abington and to Reading, all have their own objects of interest; but for the special purposes of the naturalist the sectional visits to Fawler, Hanborough and Stonesfield; Kirtlington; Culham, Abingdon and Radley; Aylesbury and Wheatley; Swindon, Faringdon, etc.; Boar's Hill; Shotover and Headington (geology); Tring (zoology); and Swinford Bridge; the Berkshire Downs; Lord Parmoor's beechwoods; Bagley Wood (botany and forestry), will provide the best opportunities for studying the natural features of the district.

Apart from the excursions and exhibits which appeal more directly to the geologist and biologist, there is much in Oxford to engage the attention of visiting members. A special selection of rare and interesting works will be on view in the Bodleian Library, by the courtesy of the librarian; and a similar courtesy will be shown by the authorities of the Radcliffe Library now housed at the Museum. Special visits to colleges have been arranged, each under the direction of a guide competent to explain the historical and architectural interest of these institutions, which are such distinctive constituents of the older Universities. The Lewis Evans collection of historic scientific instruments will be shown and discoursed on by the curator; the Pitt-Rivers ethnological collection will be open to inspection, and a visit will be undertaken to the printing works of the famous Clarendon Press. Not the least popular amongst other attractions will be a demonstration on Port Meadow by the Royal Air Force. Machines of several types, with instruments and other apparatus of special interest, will be parked for inspection; a flying display will take place, and the machines will be seen to leave park and take off by flight for return to their home aerodromes.

Much interest will naturally centre round the University Museum, the early history of which structure has been graphically related by Dr. and Mrs. Vernon in an excellent little book published soon after the jubilee celebration held on October 8, 1908. To those whose recollections go back to the days when Acland and Ruskin were prominent figures in the University, the main building of the Museum is eloquent of the generous ideals of those distinguished enthusiasts. Nor should it be forgotten that without the support of Pusey and his Tractarian friends the scheme for giving the natural sciences a worthy home in the University might have been indefinitely delayed. It is true that the ideal proposed to himself by Acland, that of ensuring that every one leaving Oxford with a degree should at least have had given to him "a general view of the planet on which he lives, of its constituent parts, and of the relations which it occupies as a world among worlds," has never been realised; the growing necessity for specialisation, together with other reasons, forbade its accomplishment. But the tree planted with so much hope by Acland, Daubeny and Buckland has borne good fruit, though of a kind scarcely contemplated by its original cultivators. Of late years opposition to the growth of the Museum and its departments has usually taken the form of protest against encroachments on the open space of the University park. But a delimitation of frontier has at last been established by general agreement, and the question may now be taken as settled for very many years to come. On the present occasion the Sections of Mathematics and Physics, Geology, Zoology and Engineering, will be housed in the Museum and its annexes, while Botany will find an appropriate home in the neighbourhood of the venerable "Physic Garden." F. A. D.

Distinguished Guests from Abroad.

Usually a number of eminent scientific workers from countries outside the British Empire are invited to be guests of the Association at its annual meeting. We print below some particulars of those who have accepted invitations for the Oxford meeting.

Prof. George David Birkoff, who has occupied the chair of mathematics in Harvard University since 1919, was born at Overisal, Michigan, in 1884. He early engaged in teaching mathematics in the University of Wisconsin; next at Princeton, until 1912, when he became an assistant professor at Harvard, taking up later the major post. President, in 1925, of the American Mathematical Society, he has been editor of its *Transactions* since 1920. He is a member of the National Academy of Sciences, Washington. In 1918 Prof. Birkhoff was awarded the Querini-Stampalia prize of the Royal Institute of Science and Arts, Venice, for researches in dynamics. He is the author of "Relativity and Modern Physics" (1923).

Dr. Max Born, professor of theoretical physics in the University of Göttingen, is one of the chief exponents of the conceptions of modern physics. A recent work of his, "Vorlesungen über Atommechanik" (1925), has received wide attention and appreciation, and an English translation is in course of preparation.

The Abbé Breuil, D.Litt. (Cambridge), is chief pro-

fessor at the Institute of Human Palæontology, Paris, the foundation of the late Prince Albert of Monaco. He is the foremost authority on the art and technique of the palæolithic epoch. Prof. Breuil has collaborated in many important works on prehistoric art, and in general archæology, with MM. Capitan and Peyrony. One of the most illuminating and suggestive of his memoirs (1905) is "La Dégénérescence de Figures d'Animaux en Motifs Ornementaux à l'Époque du Renne." Prof. Breuil made lately a tour through Central Europe, Poland, and Hungary, accounts of which have appeared in *L'Anthropologie*.

Prof. DOUGLAS HOUGHTON CAMPBELL, botanist, was born at Detroit, U.S.A., in 1859. He is a foreign member of the Linnean Society, and a member of the National Academy of Sciences, Washington. Professor of botany in the University of Indiana from 1888 until 1891, he has since then occupied a similar chair in the Leland Stanford University, California. Prof. Campbell is the author of several botanical text-books.

Prof. CONSTANTIN CARATHÉODORY, University of Munich, mathematician, was born in 1873. Originally professor of mathematics in the Technical Institute, Hanover, next at Breslau, he afterwards successively occupied professorial chairs in the Universities of Göttingen, Berlin, Smyrna, and Athens. He is Ph.D. Göttingen.

M. MAURICE CAULLERY, who was born in 1868, has been professor of zoology at the Sorbonne, Paris, since 1909; formerly he occupied a similar chair in the University of Marseilles. He is director at the Sorbonne of the Laboratoire d'Évolution des êtres organisés et embryologie générale. A publicist of note, he has written on the universities of the United States, and connected scientific life. Prof. Caullery is a foreign member of the Linnean Society of London.

Prof. FRANK WIGGLESWORTH CLARKE, chemist, was born at Boston, U.S.A., in 1847. He was professor of chemistry in Harvard University, 1873–74; afterwards, down to 1883, he held the chair of chemistry and physics in the University of Cincinnati. From that date Prof. Clarke has been Chief Chemist to the United States Geological Survey, and Honorary Curator of Minerals, United States National Museum. A Chevalier of the Legion of Honour, he is a foreign member of the Geological Society of London, LL.D. Aberdeen, and D.Sc. Manchester. In 1903 the Literary and Philosophical Society of Manchester awarded him its Wilde medal. Prof. Clarke is the author of many papers on geo-chemistry in the U.S. Geological Survey's publications.

Prof. EDWIN GRANT CONKLIN, biologist, was born at Waldo, Ohio, in 1863. He graduated at Ohio Wesleyan University, and was (1891–94) professor of biology there. Since 1908 he has occupied the chair of zoology in the University of Princeton. He is a member of the National Academy of Sciences, Washington. Prof. Conklin is the author of "Heredity and Environment," "Biology and Democracy," and other works.

M. PIERRE DANGEARD is professor of botany at the Sorbonne, Paris, and director of the Botanical Laboratory there. He is a member of the Academy of Sciences, Paris, and an Officer of the Legion of Honour. Prof. Dangeard has been responsible, during many years, for an ever-constant series of memoirs and observations in general botany.

Dr. WALTHER VON DYCK, rector of the Bayerische Technische Hochschule, Munich, is also professor of mathematics in the Institute. He is the author of numerous papers on analysis, differential equations, and the theory of functions, and has interested himself in the work of the German Museum at Munich.

Prof. PAUL EHRENFEST, born in 1880 at Vienna, has been, since 1912, professor of theoretical physics in the University of Leyden. He holds a high position in the ranks of mathematical physicists, and has published many valuable memoirs, particularly ou spectra in relation to atomic structure. He is Ph.D. Vienna.

Prof. JAMES FRANCK, occupant of the chair of physics in the University of Göttingen, and director of the Physical Laboratory there, is the author of many memoirs of distinction on the atomic theory and its issues. He has collaborated with Dr. Max Born in some of these contributions in the *Zeitschrift für Physik*.

Prof. OTTO JAEKAL, Ph.D. Munich, occupant of the chair of geology and palæontology in the University of Greifswald, was born in 1863. He is well known in English geological circles, and recently was elected a Foreign Associate of the Geological Society of London. Formerly on the teaching staff of the University of Strassburg, he was afterwards curator of the Geological and Palæontological Museum, Berlin. Prof. Jaekal long rendered signal service as editor of the *Palaeontologische Zeitschrift*.

Prof. ARTHUR EDWIN KENNELLY, who has occupied the chair of electrical engineering in Harvard University since 1902, was born at Bombay in 1861. Educated at University College School, London, he early trained for service with the Eastern Telegraph Company and was engaged on cable-repairing work in many seas; also at one time he was engineer in charge of submarine cable laying for the Mexican Government. Prof. Kennelly was principal electrical assistant to Mr. T. A. Edison from 1887 until 1892. He is a Chevalier of the Legion of Honour, an honorary member of the Institution of Electrical Engineers, London, and a member of the National Academy of Sciences, Washington.

Prof. HENRY FAIRFIELD OSBORN, president of the American Museum of Natural History, was born at Fairfield, Connecticut, in 1857. He graduated at Princeton University, U.S.A. Early in his career he studied at Cambridge under F. M. Balfour, and for some time under Huxley, at the Royal School of Mines, London. Prof. Osborn was this year awarded the Wollaston medal of the Geological Society, when reference was made to his long record of researches on the palæontology of vertebrates. Important publications of his include "The Age of Mammals in Europe, Asia, and North America," and "Men of the Old Stone Age." Prof. Osborn is a foreign member of the Royal Society of London, and a Darwin medallist.

Prof. CARL RUNGE, of Göttingen, was born in 1856. Originally one of the professors at the Technical Institute, Hanover, he was appointed (1904) to the chair of applied mathematics in the University of Göttingen. He is eminent for his classical researches in spectroscopy. In 1909–10, Prof. Runge was at Columbia University, New York, as interchange lecturer.

Prof. G. MANNE SIEGBAHN, who has held the chair of physics in the University of Upsala since 1923, was born in 1886. Formerly he was a professor in the University of Lund. Nobel laureate in physics for 1924, an experimentalist of great refinement of method, his chief researches have been in the field of X-ray spectroscopy. He has made a special study of the soft radiations which lie between the ultra-violet and the ordinary X-ray region. Prof. Siegbahn is the author of "The Spectroscopy of X-rays" (Oxford Press, 1925). Published originally (1923) at Berlin, it was translated by Mr. George A. Lindsay, assistant professor of physics in the University of Michigan.

Prof. FRANK LINCOLN STEVENS, botanist, was born at Syracuse, N.Y., in 1871. He studied at Ohio State University and the University of Chicago. He occupied the chair of botany and vegetable pathology in North Carolina College of Agriculture and Mechanical Arts from 1902 until 1912, and shortly afterwards was elected professor of plant pathology in the University of Illinois, a post he still fills. He has been for many years head of the department of plant diseases and biologist in North Carolina Agricultural Experimental Station. Prof. Stevens is the author of a standard work, "Plant Disease Fungi."

Dr. JOHANNES WALTHER, who was born in 1860, occupies the chair of geology in the University of Halle-Wittenberg, Halle. Formerly he held a similar chair in the University of Jena. Dr. Walther is a foreign member of the Geological Society of London.

Prof. HENRY BALDWIN WARD, zoologist, was born at Troy, N.Y., in 1865. He is a graduate of Williams College, U.S.A., and he was a post-graduate student at the Universities of Göttingen, Freiburg, and Leipzig. He was professor of zoology in the University of Michigan from 1899 until 1909, and has since that date occupied the chair of zoology in the University of Illinois. He has long been in charge of the biological work of the Michigan Fish Commission on Lake Michigan, and has rendered good service to the United States Fish Commission. Prof. Ward is the author of "Freshwater Biology" (1917), and of many monographs and papers, especially in regard to animal parasites and the relations of animals to disease.

Geheimrat WILHELM WIEN, the distinguished physicist, rector of the University of Munich, was born in 1864. Formerly he was professor of physics in the University of Würzburg, having succeeded Röntgen in 1900. Whilst working there, Prof. Wien was awarded the Nobel prize for physics (1911); in that year Madame Curie was given the Nobel prize for chemistry. Prof. Wien accepted the chair of experimental physics at Munich, on leaving Würzburg. It may be recalled that at the meeting of the Association held in Cambridge in 1904, Prof. Wien attended and read a paper entitled "Experiments to decide whether the Ether moves with the Earth."

Prof. PIETER ZEEMAN, of Amsterdam, was born in 1865. He is a foreign member of the Royal Society of London, and in 1922 was awarded the Rumford medal for his researches in optics. Earlier (1902) Prof. Zeeman was Nobel laureate in physics, jointly with Prof. H. A. Lorentz.

Limitations of space do not allow extension of the above brief notices, but we may add that other prominent European men of science attending the meeting include M. von Frey, professor of psychology, University of Würzburg, Dr. D. Nys A. Michotte, professor of psychology in the University of Louvain, Prof. E. Rignano, Milan, Prof. H. Kniep, occupant of the chair of botany in the University of Berlin, Dr. Bosch Gimpera, University of Barcelona, the leading archæologist of northern Spain, M. Champy, professor of histology in the University of Paris, Dr. J. A. Christiansen, professor of chemistry in the University of Copenhagen, and Prof. H. ter Meulen, of Delft.

Obituary.

SIR PETER SCOTT LANG.

WE learn with regret that Sir Peter Redford Scott Lang died on July 5 at his residence at Mansefield, St. Andrews. Owing to failing health, in 1921 he had retired from the chair of Regius professor of mathematics in the United College at the University of St. Andrews, being given the title of emeritus professor, while he ever continued to show an alert and sympathetic interest in the town and college which he loved and served.

Born in Edinburgh on October 8, 1850, Sir Peter received his early education at the Institution and then studied at the University there, where he performed brilliantly in spite of the interruptions to his college work caused by the need to spend considerable time in an office. As a student so circumstanced and yet so successfully overcoming the difficulties of his twofold task, he won first the notice and later the esteem and lasting friendship of the late Prof. P. G. Tait, who appointed him in 1872 to be his assistant in natural philosophy at the University of Edinburgh.

In those days the graduate in arts was seldom proficient or even interested in the sciences; and it was notable how this youthful assistant soon acquired a wide and accurate knowledge of these fields, inspired as he was by the example of Prof. Tait. These two friends co-operated both in classroom and in the work of the Royal Society of Edinburgh, where under this guidance the younger man received much useful experience, and where in 1878 he was made a fellow.

The next year Sir Peter was called to the chair of mathematics in St. Andrews, which had just been vacated by Chrystal, who was migrating to Edinburgh. From 1879 until 1921 Scott Lang held this post with marked distinction. He devoted himself both to his teaching and also to the wider interests of college life. In this venerable University, affiliated indeed to Bologna, the oldest of medieval universities, new life was wanting. Chrystal had scarcely spent long enough time there to make his influence felt; but during the service of his successor a regeneration took place. He sought to regain that spirit of comradeship among the students which was lacking, and, thanks very largely to his unsparing energies, St. Andrews regained much of the charm and distinction which are the incidental gifts that one of the older universities bestows on its

students. He earned the honours which King and College gave to him at the close of his active career.

MISS GERTRUDE LOWTHIAN BELL.

ARCHÆOLOGICAL studies in the Near East have suffered a great, indeed an almost irreparable, loss by the death of Miss Gertrude Lowthian Bell, which took place at Baghdad on July 11, at the age of fifty-seven years. The eldest daughter of Sir Hugh Bell, she was educated at Queen's College, London, and at the University of Oxford, where she took a first class in the History Schools. She then went to Teheran and later began her travels in Arab countries, travels in which—a remarkable achievement for a woman—she crossed the deserts of Arabia, thereby winning for herself the gold medal of the Royal Geographical Society, and visited the Shammar stronghold at Hayil, to which no European had penetrated for twenty years. Here a detention, virtually as a prisoner, gave her a remarkable insight into Arab customs, the Arab temperament, and an acquaintance with Ibn Saud, which were to prove later of the greatest value to Great Britain. It was very largely this knowledge of Arab character which was responsible for her successful achievement as a political officer at Baghdad during the War in the Political Department of the Government of India, which was then in charge of Mesopotamian affairs.

Miss Bell was not interested in geographical exploration alone; her knowledge of eastern archæology was both wide and deep. She was particularly interested in the study of early Christian and Islamic architecture, and in 1905 and 1907 she was associated with Sir William Ramsay in an examination of the churches of Lycaonia. The results were published in "The Thousand and One Churches," of which she wrote the greater part. Perhaps her greatest service to archæology was after the War, when she had taken up her residence as a member of the Government service in Baghdad. It was largely through her efforts that excavations were so promptly resumed after the War by the British Museum at Ur and the University of Oxford at Kish, and she founded and organised the Museum of Antiquities at Iraq, in which she worked hard as a labour of love until the time of her death.

Miss Bell's knowledge of the Arab and Arab politics played a large part in the settlement of Iraq after the War. How great this knowledge was, and the qualities upon which it was based, may perhaps best be gathered by those who did not know her personally from her books. In "The Desert and the Sown" (1906) and "Amurath to Amurath" (1910) she revealed the indomitable courage, backed as it was by an iron constitution, which had enabled her to endure the hardships of the desert; but she also showed what were her most striking qualities—penetration, sympathy, and a wide knowledge of Eastern human nature, permeated with a humorous and tolerant appreciation of its foibles.

MR. F. HARRISON GLEW, M.B.E.

WE regret to record the death of Mr. F. H. Glew, M.B.E., which took place on July 10, at the age of sixty-eight years. Mr. Glew was educated at Wakefield Grammar School and entered engineering works in that town, but soon changed over to pharmaceutical studies and, in due course, became a member of the Pharmaceutical Society. Soon after the discovery of X-rays he became one of the pioneers of their use in medical work in England, and, for many years, he did the X-ray work for the Lambeth Infirmary, for the Belgrave Hospital for Children, and for medical men in that district.

As a pharmacist, Mr. Glew's interest was aroused by the medical uses of radium, and he occupied an important position in the radium world for many years, where his manipulative skill and chemical knowledge were put to very severe tests. During the War he was chief adviser on radium technique to the Ministry of (Optical) Munitions, his services being rewarded by an M.B.E. When the War was over, a large quantity of radium was put at the disposal of the Medical Research Council for medical investigations, and here again the services of Mr. Glew were requisitioned to deal with the technical problems involved in its use.

Mr. Glew was one of the original members of the Röntgen Society, and contributed several papers to its proceedings, but he wrote little beyond these articles and parts of the section on radiology and radium in the "Extra Pharmacopœia." He was also a fellow of the Institute of Physics and member of the Physical Society, and he served on the Board of Visitors of the Royal Institution, at all of which he gave not infrequent demonstrations. By these demonstrations, always exhibiting something novel in an ingenious way, Mr. Glew became known to a very wide scientific public; he had indeed made for himself a unique place in scientific work. His loss will be felt very much, especially by those who had learnt to look upon him with something akin to affection. S. RUSS.

WE regret to announce the following deaths:

Mr. E. T. Cresson, founder of the Entomological Society of Philadelphia, later the American Entomological Society, and an authority on North American Hymenoptera, on April 19, aged eighty-seven years.

Mr. G. A. Keartland, for more than forty years a member and in 1907 president of the Field Naturalists' Club of Victoria, who took part as naturalist in several expeditions to Central Australia, notably the Horn Expedition of 1894, and was known for his interest in bird-life.

Prof. Geo. D. Shepardson, professor of electrical engineering in the University of Minnesota since 1892, distinguished for his work on problems of electric lighting and telephone disturbances, on May 26, aged sixty-one years.

Prof. J. C. Smock, assistant in charge of the New York State Museum and afterwards (1890–1900) State geologist of New Jersey, on April 21, aged eighty-three years.

Dr. Henry M. Whelpley, dean of the St. Louis College of Pharmacy, secretary of the United States Pharmacopœial Convention and formerly president of the American Pharmaceutical Association, on June 26, aged sixty-five years.

News and Views.

IN his speech at the opening of the exhibition of British chemical plant, held last week at the Central Hall, Westminster, in connexion with the Society of Chemical Industry's Congress of Chemists, Sir Max Muspratt referred to the ever-changing nature of the chemical industry and to the great part which chemical engineering plays in the changes. The life of the Le Blanc soda process, now extinct, was greatly prolonged by engineering, and it is that branch of the industry to which we must look to keep us abreast of the times, and more particularly in regard to the artificial fibre industry and to what is known as 'high-pressure' chemistry. As an illustration of the radical changes now taking place, Sir Max referred to a large sulphuric acid works, using the lead-chamber process, which is producing 1000-1200 tons of acid per week solely by electric power. We must learn to dispense with coal, he said. British chemical industry was built upon cheap coal and the German industry upon dear coal; now the positions are reversed, and all our old problems must be attacked from this new point of view.

THE exhibition, which was organised by the British Chemical Plant Manufacturers' Association, may be described as small but good. Owing to the restricted dimensions of the hall, it was impossible to show any large plant, but the exhibits of plant parts, constructional materials, and accessories, were so numerous and so well selected, that they presented a convincing picture of the resourcefulness and constructive ability of British plant manufacturers. From careful inquiries we have made, we can endorse the claim that at the present time practically all the requirements of British chemical manufacturers can be met at home; in a few respects, such as plant for high-pressure work, it may be necessary to go abroad, but we are gradually accumulating our own experiences in this direction and can look forward to complete independence of foreign makers within a comparatively short time.

AMONG the novelties exhibited was the Webb colloid mill, which consists of a spherical shell with three arms or beaters, circular in section and revolving at different speeds. The emulsified material is withdrawn in such a way that only the extremely finely divided material is removed. Another exhibit of a similar kind was a copper-lined machine for breaking down cotton linters in the manufacture of acetyl-cellulose silk. Excellent centrifugal machines, such as are used in the home beet-sugar industry, were shown, together with a clutch-pulley which enables the cage-motor to start against full-load torque. The Ruths steam-accumular was too large to be shown *en bloc*, but illustrations and plant parts testified to the value of this type of plant for eliminating the peak-load on boiler-plants, especially in works where large quantities of low-pressure steam are required in process work; the boiler can be worked for the average demand, and the pressure, as well as the temperature, of the steam can be maintained at uniform levels. A 300-gallon aluminium still formed an attractive exhibit, and other interesting exhibits included heat-exchangers, crushing machines, compressors of various types, mixers, electrolytic cells, filters, evaporators, film-dryers, scrubbers, and excellent enamelled cast-iron ware. Constructional materials were shown in abundance, non-corroding metals and alloys being particularly conspicuous. Acid-resisting, long-fibred asbestos from the Transvaal, silica-ware, and 'Prodorite,' the new pitch-cement, were among the more noticeable non-metallic resistant materials. No fewer than forty firms were represented at the exhibition, which left a most favourable impression of the quality and diversity of British chemical plant.

ALL interested in technology from whatever point of view will welcome the news that Italy has fallen into line with others of the leading countries of the world, and has commenced the printing *in extenso* and in separate numbers of the specifications of patented inventions. All patents granted after October 1 of last year are, we understand, to come under the new regulation, but it may be hoped that perhaps some day the earlier period will be similarly dealt with so that the record may be complete. The gap is not so large. The old Kingdom of Sardinia printed the specifications and drawings of patents granted under the basic law of 1855 in a publication entitled *Descrizione delle macchine*, which appeared in semi-annual volumes until 1864, when it was replaced by the *Bollettino Industriale del Regno d' Italia*, which continued except for a short period until 1896. Since the latter year, however, those concerned have had to be content with classified lists of inventions from which only the meagre information supplied by the bare titles is obtainable. The new regime is to be congratulated on the revival of the original practice in the more modern style adopted by so many patent offices. Belgium, Spain, and Portugal are the chief European countries that still have to take this step.

AN unofficial committee of twelve members of various points of view, and no doubt of divergent opinions, on economic problems, has drawn up a report which, under the title of "The Facts of Industry," has been published by Messrs. Macmillan and Co. Ltd., (price 1s.). The committee included among others Lord Astor, Prof. Bowley, Mr. W. L. Hichens, Mr. W. T. Layton, Mr. Kenneth Lee, Mr. B. Seebohm Rowntree, Mr. F. Hodges, Mr. A. Pugh, Mr. J. T. Brownlie, and Mr. J. J. Mallon. In other words, it represented employers, employees, professional economists, and trade union officials. The purpose of the committee was to investigate the possibilities of increased statistical publicity, and to ascertain what statistical information is required and how it can be obtained. The committee, agreeing that it is impossible to formulate a wise policy in industrial problems without knowing the facts of the case, has drawn up a series of recommendations, not with the aim of introducing changes in industrial relations, but in the hope of obtaining an adequate basis of facts

on which to discuss any problem that may arise. In problems of industrial relations, information additional to that which is already available should be collected on total production, cost of material and cost of labour. For the study of industrial fluctuations, figures should be provided by each industry as regards stocks, deliveries, and orders on hand. From the point of view of the investor a number of recommendations are also made. The pamphlet indicates reforms which are outside the scope of political controversy, many that have already been put into effect in the United States and none that could fail to throw light on the difficult problems of the day.

DURING the last twenty years the electric pressures used for testing the material and apparatus used by electricians have been steadily rising. Owing to the much wider areas over which power is transmitted, and the greatly increased demand for it, economical considerations make it necessary to increase the pressure. The pressure required in the test room has to be at least double the working pressure. This necessitates the use of very large transformers which need to be housed in special laboratories. A paper on high voltage laboratories by Mr. A. P. M. Fleming, which has appeared in *World Power* for July, is therefore a timely one. Mr. Fleming points out that in order to keep ahead of developments it is necessary that facilities for producing a million volts should be provided. Several million-volt transformers are in daily use in the United States and on the Continent. At the National Physical Laboratory the high-pressure laboratory has been built but the apparatus has not yet been constructed. The Soviet Government at Moscow has similar plant under consideration. With these high-pressure transformers, it is very difficult to avoid producing brush discharges and this renders the measurement of the applied pressure very difficult. Mr. Fleming points out that the sphere-gap method of measurement is the one that is almost universally used. In our opinion the radiations from brush discharges must seriously affect the pressure at which the disruptive discharge ensues and so must make the readings very uncertain. It is scarcely fair to say that the method is dependent on purely empirical data. One of the data is the value of the maximum potential gradient between the spherical electrodes and the other is purely experimental. The first is computed by advanced theory, the second is got from concordant experimental results obtained in almost every laboratory in the world. For many tests, high voltage direct current is necessary. This is readily obtained by rectifying high voltage alternating current by a thermionic valve rectifier.

THE First Report of the commission appointed to further the study of solar and terrestrial relationships (Étienne Chiron: Paris, 1926), has recently been circulated by the International Research Council, setting out the statements and recommendations made by the committee which met in Brussels last July. Statements are given (1) of the principal terrestrial phenomena definitely known to be affected by intrinsic changes in the state of the sun or by the sun's rotation, such as (*a*) the magnetic state of the earth and earth currents; (*b*) auroræ; (*c*) meteorological and climatic changes; (2) terrestrial phenomena not improbably affected by solar changes but requiring further investigation to establish a definite relationship, such as (*d*) atmospheric electricity (potential gradient and general ionisation of the atmosphere); (*e*) radio-telegraphic transmission; and (3) terrestrial phenomena likely to be affected by solar changes and therefore requiring investigation from this point of view, such as (*f*) the amount of ozone in the upper air; (*g*) the extra-polar auroral light; (*h*) high-level atmospheric absorption; (*i*) penetrating radiation in the atmosphere; (*j*) the light of the night sky. The recommendations of the committee are then given, indicating clearly the particular matters requiring research and co-operation in observation. Memoranda contributed by members of the committee (C. G. Abbot, G. Abetti, S. Chapman, C. Chree, H. Deslandres, G. Ferrié, G. C. Simpson, C. E. St. John, and C. Størmer) and by a few other investigators make an admirable commentary on the foregoing recommendations. The report concludes with a comprehensive summary of literature up to 1924 dealing with the relations of solar and meteorological phenomena. A French version of the complete report is appended.

ABOUT eighteen years ago, Lippmann indicated the possibility of the preparation of a photographic plate that should contain in itself the image-forming elements, and by a single exposure, etc., give a result that would show a picture of the original in stereoscopic relief, adopting the principle of an insect's multiple eye, and Dr. E. Estanave shortly afterwards deposited a sealed communication with the Paris Academy. Dr. Estanave has only recently been able to demonstrate experimentally the possibility of the process, and he describes his method in *La Nature* of June 26, p. 409. The attempt to make it commercially practical by moulding the glass plate so that it shall have one side covered with small, regularly placed, spherically curved projections the principal focal points of which lie on the other surface, which is coated with a fine-grain gelatine emulsion, appears to have failed because the small lenses so obtained were not good enough. The demonstration that the principle is correct was done by making a block of closely packed Stanhope lenses of about 6 mm. focal length each with a square base of about 2 mm. × 2 mm. A photographic plate was placed with its film side in contact with the surface made by the bases of these small lenses, the exposure made and developed, etc., and the plate then attached to the block of lenses exactly in its original position. The composite plate is viewed by looking through it (as a transparency) with the lens surface towards the eyes. The picture of the original object is then seen in stereoscopic relief.

A REPORT issued by the Smithsonian Institution states that news has been received from Dr. Matthew

W. Sterling that the expedition to New Guinea of which he is the leader has started up the Memberamo River. This expedition, which is a joint undertaking of the United States and the Dutch East India Government, is very completely equipped, and has with it an aeroplane for scouting, exploration and cartography. Including carriers and Indonesian troops, the expedition numbers nearly four hundred individuals. Its purpose is the exploration and mapping of the country which lies between the coast line and the range of mountains which forms the backbone of Dutch New Guinea. The members of the expedition are Dr. Sterling, leader and anthropologist, R. H. Peck, photographer, Hans R. Hoyte, chief pilot, A. E. Hamer, assistant photographer and mechanic, S. A. Hadberg, historian of the expedition. Dr. Van Leeuwen, botanist, and M. Leroux, cartographer and surveyor. It is hoped to secure an extensive collection of bird skins in addition to the scientific data for which provision is made in the personnel of the expedition. A special effort will be made to obtain information concerning the pygmy people of the forests on the mountain slopes, of whom comparatively little is known. It is possible that unknown peoples may be discovered in the interior, of whom the existence is at present only suspected.

BEFORE the War the wood-distillation industry in what is now the eastern part of Czechoslovakia was in a very flourishing condition on account of the abundant supplies of beech-wood. But the industry has received a severe set-back on account of the rapid development of improved industrial processes for producing both acetic acid and methyl alcohol synthetically. Acetic acid is now manufactured from acetylene by oxidation with oxygen in the presence of vanadium pentoxide and mercuric sulphate as catalysts. More recently methyl alcohol has been made from water-gas, and it is stated in the *Chemiker Zeitung* that the new process may ultimately lead to the abandonment of the older process, although the synthetic product is much less suitable than wood-spirit for the denaturation of fermented spirit. The success of the method depends upon the careful control of external conditions, namely, temperature, pressure, nature of the catalyst, and the relative masses of the reacting gases, since methane, carbon dioxide, and water may be obtained as by-products if conditions are not well adjusted. The water-gas needs to be carefully freed from certain impurities, particularly from sulphur compounds.

UNDER the rather curious title of *The Cancer Review*, the British Empire Cancer Campaign has begun to issue a journal of abstracts of the voluminous literature of cancer in its various aspects. The mass of matter printed on the subject of malignant disease is so great and its quality so varied that some such critical collation is most desirable, and we do not doubt that the present journal will be useful. We hope, however, that it will be possible to arrange and group the material more effectively and to supplement the arid abstracts with the critical surveys which may more properly be called 'reviews,' and in these connexions we would commend the admirable *Tropical Diseases Bulletin* to the consideration of Dr. Francis Cavers and his editorial committee. The form is not so good as the substance: it is printed on heavy art paper (illustrations may be contemplated, but there are none in this first issue), and the line is too long (4⅝ inches) for convenient rapid reading—a point on which publishers and physiologists might collaborate with advantage.

A MEETING of the Society for Experimental Biology was held at Edinburgh University on July 17-19. A variety of papers was presented, including one on the growth of fish by Mr. J. Gray, the anterior pituitary and metamorphosis by Mr. E. A. Spaul, the fertilisation membrane of Echinus by Mr. A. D. Hobson, the kinetics of hæmolytic and bacteriolytic reactions by Dr. Ponder, and a demonstration of new methods for studying early stages of cell injury by Dr. Rettie. At a session held in the Botanical Gardens, Dr. K. Blackburn discussed the relation of plant chromosomes to sex, Dr. Philip Smith the effect of acidity on regeneration in Coleus, while Prof. Priestley considered the conceptions of stimulus-transmission and hormones in plants. One session was devoted to a visit to Dr. Crew's laboratory, where breeding experiments with many domestic animals were demonstrated and discussed. This was followed by a dinner which was well attended. The next conference will be held in London in December.

THE Report of the Director-General of Public Health, New South Wales, for the year 1924, recently received, contains details of the public health administration of the State and of investigations carried out for the Board of Health. In industrial hygiene an investigation has been made of the sandstone dust hazard among miners, quarrymen, and stonemasons. It is recommended that a standard of not more than 200 dust particles per c.c. of air, as determined by the Owens' dust counter, should be adopted for the air of the workings, a figure which can easily be attained by proper methods and ventilation. No cases of plague occurred among human beings or rats. Of the latter, 16,351 were examined, and the species and number of fleas upon the rodents are recorded. Interesting details are given of cases of snake-bite and of paralysis following the bite of ticks.

A NUMBER of scientific expeditions to Arctic Russia and Siberia are announced in the *Weekly News Bulletin* of the U.S.S.R. Society of Cultural Relations, No. 22, vol. 3. The Hydrographical Board has begun the exploration of Maligena Strait which separates Byeli Island from the north of the Yamal peninsula, on the northern sea route to Siberia. Another expedition has left Perm to study the flora and fauna of the Kara Sea, the Ob estuary and the Gulf of Taz. A third expedition, based on Muzhinskoe on the River Ob, is to study the northern Urals, particularly the valleys of the Sosva and Lyapin. Lastly, a geological examination of the coal and oil deposits of northern Sakhalien is promised.

THE Library of the Chemical Society will be closed for stocktaking from Monday, August 2, until Saturday, August 14, inclusive, and will close each evening at 5 o'clock from August 16 until September 11.

THE following have been elected officers of the Institution of Electrical Engineers for the year 1926–1927: *President*, Dr. W. H. Eccles; *Vice-President*, Colonel T. F. Purves; *Hon. Treasurer*, Lieut.-Col. F. A. Cortez Leigh.

APPLICATIONS are invited by the Dorset Field Club for the Cecil medal and prize of 10*l*. for the best essay on "The Wireless Transmission of Power, its Position and Prospects." The competition is open to persons between the ages of seventeen and thirty-five on May 31, 1927, and either born in Dorset or resident in the county not less than one year between May 1, 1925, and May 1, 1927. Particulars may be obtained from Mr. F. H. Haines, Appleslade, Ringwood, Hants.

AT a meeting of the Council of the Royal Society of Arts held last week at Clarence House, H.R.H. the Duke of Connaught, President of the Society, presented the Society's Albert Medal for 1926 to Prof. Paul Sabatier, "in recognition of his distinguished work in science and of the eminent services to industry rendered by his renowned researches in physics and chemistry, which laid the foundation of important industrial processes."

NOTICES have been issued of a class in marine biology to be held at the Millport Marine Biological Station during the fortnight August 17-31. Facilities will be provided for collecting and the examination of living specimens, and those attending will be encouraged to investigate some particular problem. Lectures will be given by the Station staff and others on special subjects. Improved facilities for research workers are now available at Millport Laboratory, following the recent installation of electric plant.

THE following are among the recipients of Civil List pensions recently announced: Mrs. Marian Dibdin (125*l*.), in recognition of the scientific work of her husband, the late Mr. W. J. Dibdin; Lady Dorothea Hosie (100*l*.), in recognition of the public, literary, and scientific services rendered by her husband, the late Sir Alexander Hosie; Mrs. Elizabeth Japp (100*l*.), in recognition of the services rendered by her husband, the late Prof. F. R. Japp, to the advancement of organic chemistry and chemical education.

IN our issue of July 24, p. 126, we referred to the retirement of Prof. J. A. Fleming from the chair of electrical engineering in the University of London (University College), which he has occupied with distinction since 1885. In recognition of his services to electrical science it has been decided, by a committee presided over by Mr. A. A. Campbell Swinton, to invite subscriptions for a portrait to be placed in University College, and a replica for Prof. Fleming himself, who wishes to offer it to the Institution of Electrical Engineers. Subscriptions should be sent to Prof. W. C. Clinton, University College, Gower Street, London, W.C.1.

WE have received a copy of Circular 279 of the U.S. Bureau of Standards on the relations between the temperatures, pressures, and densities of gases, prepared by S. F. Pickering of the Bureau. It is the purpose of the circular to explain simple methods of making calculations and solving problems involving the properties of gases. Detailed explanations of the gas laws and equations of state are presented together with a large number of charts, tables of data for various gases, and an extensive bibliography.

Natural History, the journal of the American Museum of Natural History, does much to popularise zoology and keep the public informed of discoveries in natural history as they are revealed by study and by exploration in various lands. Its issue for March-April 1926 (vol. 26, No. 2) is devoted to insects and contains a number of general articles admirably illustrated by coloured and half-tone figures. Among the contributors to this issue are Dr. L. O. Howard, who discusses the great economic waste occasioned by insects; Dr. J. Bequaert, who writes on insects and man in tropical America; and Dr. V. L. Kellogg, who describes the structure and functions of the wing-scales of butterflies.

THE British Museum (Natural History), South Kensington, London, S.W.7, has recently issued a fourth edition of the "Guide to the Exhibited Series of Insects" (price 1*s*.). It is a reprint of the previous edition except that a few slight alterations and corrections in the text have been made. Some idea of the magnitude of the main collection of insects that is contained in the Museum may be gathered from the fact that it is now estimated at 3,500,000 specimens comprised in about 250,000 named species. Only a very small representative series of these is exhibited in the public galleries, but the exhibit is sufficiently complete to give the public a general idea of the classification, forms, and habits of all the chief groups of these animals. The present guide serves as a useful brochure on the subject, and should be used by all who wish to make intelligent use of the specimens that are displayed for their benefit in the galleries. It is fully illustrated, and can be obtained either at the Museum or through booksellers.

THE latest catalogue (No. 484) of Mr. F. Edwards, 83A High Street, Marylebone, W.1, will be interesting to those on the look-out for books relating to the Far East, seeing that it gives particulars of many works on China, Formosa, the Indian Archipelago, Japan, Korea, and the Philippines.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A small live-stock instructress and an assistant for general agricultural instruction and dairying under the Surrey Agricultural Committee—C. R. Harding, County

Agricultural Officer and Secretary to the Agricultural Committee, County Hall Annexe, Kingston-on-Thames (August 4). Inspectors under the Ministry of Agriculture and Fisheries for the purposes of the Diseases of Animals Acts 1894–1925—The Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, S.W.1 (August 9). A lecturer in agriculture at the Agricultural Institute, Plumpton—The Director of Agriculture, County Hall, Lewes (August 10). A lecturer in pathology at the Welsh National School of Medicine—The Secretary, University College, Cardiff (August 21). A senior metallurgist under the British Cast Iron Research Association—The Director, 75 New Street, Birmingham (August 27). A reader in physics at King's College, Strand—The Academic Registrar, University of London, South Kensington, S.W.7 (September 17). A male junior assistant under the directorate of explosives research of the Research Department, Woolwich—The Chief Superintendent, Research Department, Woolwich, S.E.18. A taxidermist for Public Museum—Prof. Carr, University College, Nottingham. A physics mistress at the Cowley Girls' School, St. Helens—The Secretary to the Governors, 17 Cotham Street, St. Helens.

Our Astronomical Column.

JULY METEORS.—Mr. W. F. Denning writes: "A few observations were made at Bristol between July 12 and 22, but meteors seemed somewhat scarce. The coming Perseid shower gave evidence of its presence on July 13 and 16, and several rather bright meteors were seen, presumably from radiants near α and ζ in Cygnus. These are well-known showers at about $314° + 48°$ and $317° + 31°$ and appear to be pretty regular in their annual returns. On July 16 and 20, meteors were recorded from a shower directed from a point near α Capricorni ($304° - 12°$). A rather fine object, belonging probably to this stream, appeared on July 20, $2^h\ 25^m$ G.M.T., moving along a path of about 45° approximately between Jupiter and Mars and towards Mars. This meteor was seen by an assistant, who pointed out the position, but no other observations have as yet come to hand. This shower of Capricornids is one of considerable activity and seems possibly connected with comet 1881V. Its meteors were numerous in 1908 and 1916, but their chief abundance seems to occur a fortnight before the earth's nearest approach to the comet's orbit."

CHANGES IN THE EARTH'S RATE OF ROTATION.—Prof. Newcomb was the first to suggest that the unexplained oscillations in the moon's position might really be changes in the earth's rotation. Support was given to the suggestion by Glauert, Innes, and others, the test being that other rapidly moving bodies should show similar oscillations, agreeing in phase but differing in amplitude proportionally to their motion.

Prof. E. W. Brown contributes a paper to the *Proc. Nat. Acad. of Sciences*, U.S.A. (June 1926), on the subject. He strongly supports the hypothesis, finding, *inter alia*, confirmation from the observations of the sun: there has been a marked deviation from the tables since 1900, which now amounts to 1″. He considers that an oscillation in the earth's radius appears to be the only way of producing such changes in the rotation. Such oscillations were already postulated by Joly ("The Surface of the Earth"), but these are of much longer period than those required for the present research. The chief unexplained lunar term has a period of some $2\frac{1}{2}$ centuries, found by Prof. Turner to be about the same as a period indicated by Chinese earthquakes. The amount of oscillation in the radius required by Brown lies between 5 inches and 12 feet according to the depth of the source, which he estimates to be at least 80 kilometres.

MUTUAL ECLIPSES OF JUPITER'S SATELLITES.—Once in six years the orbit planes of Jupiter's satellites are turned edgewise to the sun, and mutual eclipses of one satellite by another occur. These phenomena have very seldom been observed, for they last so short a time that, unless notice is given beforehand, they are likely to escape detection. The Computing Section of the British Astronomical Association has now undertaken the computation of these phenomena, and gives lists of them for June, July, and August in the March and April issues of its journal. Unfortunately, after July 6, none is visible in England until Aug. 4, when III. is eclipsed by II. at $21^h\ 28^m$. Mr. B. M. Peek described at the June meeting of the Association his observations of three of these phenomena. On June 17, I. was partially eclipsed by II.; at mid eclipse their magnitude was equal, I. having been $\frac{1}{4}$ mag. brighter before eclipse. On June 23, III. was eclipsed by II., the loss of light being very appreciable, so that III. became equal to II. On June 28 there was an annular eclipse of II. by I., of very brief duration, since the motion of the satellites was in opposite directions. Fading began at $23^h\ 46^m\ 15^s$, centrality occurred $23^h\ 46^m\ 45^s$, and II. suddenly brightened at $23^h\ 47^m\ 10^s$.

THE REFLECTION EFFECT IN ECLIPSING VARIABLES.—In some cases of eclipsing binaries the light is not constant during the period between two eclipses, owing to reflection of the brighter star's light by the secondary. The hemispheres of the fainter stars facing and remote from the primary are of unequal luminosity and produce a well-recognised effect on the light curve of the system. The theory of this reflection effect is discussed by Eddington in the *Monthly Notices, Roy. Ast. Soc.*, vol. 86, p. 320 (March 1926). He considers primarily the case of the reflection of heat energy, which is greatly simplified by the fact that the 'heat albedo' = 1 (*i.e.* a star re-emits completely the radiation falling on it). The phenomenon considered in the theoretical case is not strictly one of reflection, but of absorption and re-emission of radiation, and the conclusions obtained are translated into terms of light reflection by means of simple assumptions. It is shown that the 'reflection' coefficient for heat will not be greater than that for light, and calculated theoretical values are compared with observed values of the reflection effect, in the case of systems of known orbits. Good agreement is shown between the calculated heat reflection and the observed light reflection in seven systems out of twelve, and (contrary to expectation) in only one case is the light reflection the greater of the two. The assumption that the incident radiation is re-emitted in amalgamation with the natural radiation of the fainter star as black body radiation would imply a large increase of the luminous efficiency of this star. The absence of this effect in observed systems suggests that the incident light retains its original quality after 'reflection.'

Research Items.

SANATORIUM TREATMENT OF PULMONARY TUBERCULOSIS.—"Although it was at one time believed that sanatoria were effective in curing phthisis, and at the present time it is tacitly assumed that they are at least effective in favourably influencing the progress of the disease, it has never been satisfactorily proved that such is really the case." With the assistance of M. Noel Karn, Dr. Percy Stocks has made an elaborate study of the first 2794 consecutive cases of undoubted pulmonary tuberculosis brought under the survey of the Belfast Tuberculosis Dispensaries from 1914 onwards. His results, published in *Annals of Eugenics*, vol. 1, parts 3 and 4, show that the average ultimate progress, as estimated over a period of six years unless the patient had been previously lost to view, was undoubtedly worse in the case of the sanatorium-treated than in the case of patients otherwise treated, for cases first seen in the incipient stage, but was not significantly different for patients first seen in advanced stages. Judged by the proportion in whom the disease became arrested or apparently cured, sanatorium treatment showed a temporary superiority during the first two or three years which was lost in subsequent years. While length of stay at a sanatorium was not found to be correlated with ultimate progress, there was an appreciable relation between regularity of dispensary treatment and progress. No consistent evidence was found that bad housing conditions, as judged by rent, class of house, state or cleanliness of rooms, or overcrowding, had any influence on ultimate progress or rate of recovery. The authors suggest that sanatorium treatment should be reserved for patients diagnosed *very early*, those so ill as to require hospital treatment, or those whose circumstances demand their removal from home.

LOUISIANA MOUND BUILDERS.—Dr. J. Walter Fewkes, Bureau of American Ethnology, has been engaged during last winter in excavating on the Red River mounds near Marchville, Louisiana, which are, it would appear, of an origin entirely obscure. Breastworks two-thirds of a mile long and 20 mounds, of which the largest, flat on top, is 12 feet high and covers 3 acres of ground, suggest a population of some considerable size. Yet the archæological evidence which has been obtained by excavation suggests a culture of low standard precariously existing in an unfavourable environment. The structure of the mounds varies considerably from that of the Mississippi tribes, Natchez, Choctaw, and others east of the river, or of the Caddo, to the west. The mounds appear to be older than those of the Mississippi Valley, and contain no evidence of contact with the white man. They are very poor in artefacts, and it is clear that the living afforded by the area was precarious and meagre. The larger of the mounds contains remains of many skeletons. There are 8 lodge-sights, circular excavations supported by a low embankment. When settlers first visited the country the site of the mounds was occupied by a small tribe of Avoyelle Indians.

LUMINESCENCE IN EARTHWORMS.—G. E. Gates (*Records Indian Mus.*, vol. 27, part 6) has observed that four species of earthworms which occur in Rangoon eject from the dorsal pores, after mechanical or chemical stimulation (*e.g.* weak ammonia solution), a mucoid substance which is luminous in various degrees according to the species of worm from which it has issued. The light is not immediately forthcoming on the discharge of the mucus, but appears after a short interval and gradually increases to a maximum. The earthworms are respectively three species of Eutyphœus and one species of Megascolex; no species of either genus has hitherto been reported as luminous.

THE PREVENTION OF DAMAGE BY TERMITES.—Termites or 'white ants' are among the most destructive pests in tropical and subtropical countries. They are well known in these lands to cause serious injuries to woodwork and foundations of buildings, and to furniture and other manufactured articles, as well as injuring trees, crops, and other vegetation. At one time it was believed that the life of a termite colony was dependent upon the presence of the greatly enlarged queen individual, and if she were destroyed, the community would be quickly exterminated. We now know that in the event of her destruction, the life and reproduction of the colony is maintained by other types of queens which, although showing little increase in size, make up in fecundity by their numbers. In *Farmers' Bulletin*, No. 1472 of the U.S. Department of Agriculture, Dr. T. E. Snyder has provided a useful brochure dealing with combating these insects. He recommends that the foundation of buildings should be made of stone, brick, or concrete, including stone or metal columns in the basement to support the floor above. Walls and flooring in basements or cellars should be of concrete, and in no case should untreated timbers be sunk into the ground. Where timber is the only practicable material, it should be first impregnated with coal-tar creosote. Complete dryness of foundations of basement flooring is an important means for rendering buildings safe from attack. Many details referring to termite attacks under various conditions will be found in this bulletin, together with recommendations concerning their elimination from cultivated lands.

GENETICS OF THE SWEET PEA.—The sweet pea, *Lathyrus odoratus*, was one of the earliest objects of genetical study in the beginning of the neo-Mendelian period. The first case of what is now known as linkage and crossing-over was described in this material. As the genetical work with this plant proceeds, the number of linkage groups of characters is still, in the work of Punnett, fluctuating about the haploid number (7) of chromosomes. Partial studies of the pollen development have been made, but the first thorough cytological investigation has recently been published by Miss J. Latter (*Annals of Botany*, April 1926). Several discoveries of much interest are recorded; no more critical paper has appeared in cytology for several years. During the thread stages of meiosis in the pollen mother cell, a definite dark-staining body is discovered in the nucleolus, and it is shown to be invariably connected with a loop of the spireme. It grows in size and apparently serves to pass elaborated material from the nucleolus on to the thread. There is some evidence that it is derived from a crystalline body which is constantly present in the nucleolus at an earlier stage. The spireme thread shows a telosynaptic history, which is traced with great accuracy. Finally, seven loops are formed radiating from the centre of the nucleus. This is the stage which Gates has called brochonema. During this stage the two arms of each loop, representing a pair of chromosomes, are frequently twisted about each other, thus providing a possible basis for

genetical crossing over. Hitherto such crossing over has only been considered to occur in connexion with parasynapsis or side-by-side pairing of the chromosome threads.

RAINFALL AND VEGETATION IN NIGERIA.—"The Physiography of Southern Nigeria and its effect on the Forest Flora of the Country," by Mr. J. R. Ainslie, is the title of No. 5 of the Oxford Forestry Memoirs (Oxford: Clarendon Press; London: Oxford University Press, 1926. Price 4*s.* net). After a summary of the main physical features of the country, Mr. Ainslie shows that three physiographical regions can be distinguished—the littoral, the plain, and the upland. The distribution of rainfall decreases from the littoral region, where it is more than 100 in., to the uplands, with less than 50 in. These three physical divisions closely correspond with the forest types. The littoral region, apart from mangrove swamps, is characterised by tropical rain forests of a more or less hygrophilous type with much undergrowth. Beyond this most of the plains were originally covered with deciduous forest of large trees with a good deal of evergreen undergrowth. In the small areas of upland that occur this gives way to savannah forest opening out to the grasslands of the north. Apart from these climatic formations Mr. Ainslie recognises certain edaphic formations due to ground water. As a rule these follow rivers and entail the invasion of the drier by the wetter formations. Contrary to the general rule in Nigeria of a decrease of moistures with increasing distance from the coast, in one area the loss of rainfall is partly counterbalanced by frequent mists, with the result that in the north of Ondo a neck of rain forest projects into Northern Nigeria. The paper is well illustrated.

COLD WEATHER RAINS IN INDIA.—A discussion on "Rainfall Types in India in the Cold Weather Period, December 1 to March 15," by Sir Gilbert T. Walker and Dr. J. C. Kamesvara Rav is given in *Memoirs of the Indian Meteorological Department*, vol. 24, Part 11. It is agreed as essential for progress in weather forecasting that existing knowledge should be kept on record so that time should not be wasted in discovering facts familiar to predecessors. For the present inquiry, the occurrence of appreciable rainfall of more than 2 inches at stations in the Daily Weather Report is the only meteorological effect considered, and that is collated for the twenty-one winter seasons, December 1900-March 1921. The bursts of rainfall are classed according as they are associated with a late monsoon or with a western disturbance. The rainfall types are classified in different tables and subdivided where distinction is possible. From the analysis, such facts as the following are obtainable: "A fall of pressure at a northern station occurred 67 times and was succeeded by a northern track 55 times and a southern track 5 times, while 7 were neutral; after 25 falls of pressure at southern stations there are 12 northern tracks and 6 southern."

THE NEW ATOMIC THEORY.—In his address to the Scandinavian Mathematical Association last August, Prof. Niels Bohr intimated (NATURE, December 5, 1925, p. 845) that the atomic theory of the moment required re-editing as a branch of the mathematical theory of quadratic or bilinear forms. How far this process has been effected during the year may be judged from a summary of it by Prof. Leon Brillouin in the May issue of the *Journal de Physique*. He shows that the representation of the quantities which specify the atom as bordered matrices leads directly without further hypotheses to the same results as the older quantum theory with its special hypotheses known as the principles of 'selection' and of 'correspondence,' and he anticipates great advances in our knowledge of the atom from this method of attack. A shorter article dealing with the same subject, but entitled "The New Quantum Theory," by Dr. H. T. Flint, is to be found in the July issue of *Science Progress*. The author adopts a vector notation as being more familiar to physicists than the notation of matrices. He points out that the new theory gets rid of the anomalous half quantum which it has been necessary to introduce into the old quantum theory to explain band spectra.

THE COUPLING BETWEEN ELEMENTARY RADIATION PROCESSES.—In a communication from the Reichsanstalt, published in the *Zeitschrift für Physik*, June 16, Dr. W. Bothe describes a series of experiments in which a piece of thin copper or iron foil placed in a narrow space between the front surfaces of two Geiger counters was caused to fluoresce by means of a beam of molybdenum $K\alpha$ radiation. The K fluorescence radiation from the foil passed through two thin aluminium windows into the counters, L radiation and photoelectrons given off from the foil being kept back by the aluminium. The interior of the counters was filled with argon, which greatly increased the number of photoelectrons recorded by the counters. Air does not absorb the K-radiations of copper and iron very much, and when it is used the deflexions are mainly due to electrons from the walls of the counters. The sensitiveness of the apparatus was such that according to the absorption statistical theory of Bohr, Kramers, and Slater, a considerable number of coincidences between the deflexions in the two counters should have been observed. In the first set of experiments such coincidences were seen, but it was shown that they were due to radioactivity of the brass of which the counters were made and not to the K-radiation from the foil. When the counters were reconstructed using zinc of low radioactivity, the number of coincidences was no greater than was to be expected with a haphazard distribution of the deflexions. The results indicate that quanta given out by the foil travel in one direction only and are absorbed in a single elementary act.

THE DISCOVERY OF OXYGEN.—In his presidential address to the Indian Chemical Society, printed in the Society's journal (vol. 3, No. 1), Sir P. C. Rây gives an account of the parts played in the discovery of oxygen by Priestley and Lavoisier. He emphasises the great service rendered to chemistry by Lavoisier, who alone of contemporary chemists was able to see the real meaning of Priestley's work, and by his own experiments and reasoning to lay the foundations of chemistry as it exists to-day. The services of Lavoisier have never seriously been called into question, but his claim to the discovery of oxygen can scarcely be entertained. Nothing which Sir P. C. Rây brings forward in the slightest degree alters the position, which has been most exhaustively studied by former historians of chemistry. That Lavoisier had any claim to be an independent discoverer of oxygen cannot be maintained on the evidence available and the important services of the great French man of science neither require nor justify any such claim. It is not clear from his paper whether Sir P. C. Rây wishes to reassert this claim, but his concluding sentence seems to indicate that he does not. "It is not necessary to belittle the one in order to magnify the other. Each was great in his own way and has extended the boundaries of our science."

Society of Chemical Industry: Annual Meeting and Congress of Chemists.

SINCE its foundation in 1881, the Society of Chemical Industry has held its annual meeting in one or other of the many geographical centres where its sections are located. This year's meeting—the forty-fifth—was held in London on July 19–23, and differed from all previous meetings in taking the form of a congress of chemists, no fewer than seventeen chemical organisations taking part in it. For this reason, everything was done on an unusually large scale, and save for the physical weariness which inevitably follows from such an orgy of conferences, dinners, excursions, and social functions, the week must have been one of unmitigated profit and enjoyment to the very large number of chemists and their friends who attended.

The United States was well represented by Drs. F. G. Cottrell and E. Hendrick, Mr. T. H. Norton, and Profs. J. Kendall, H. R. Moody, and R. Stevenson; Profs. P. Sabatier and E. Fourneau came from France, Dr. J. P. Arend from Luxembourg, Prof. L. F. Goodwin from Canada, and Prof. K. Matsubara from far Japan. The Hotel Great Central made an excellent headquarters, its spacious rooms and lounges providing all the accommodation required, whilst the exhibitions of chemical plant and of chemical apparatus were shown at the Central Hall, Westminster, and at the Institute of Chemistry, respectively, and club facilities were generously provided by the Chemical Industry Club in Whitehall Court. Nothing but praise is due to those who were responsible for the general organisation, and the president, Mr. W. J. U. Woolcock, the chairman of the London Section and the Chemical Engineering Group, Mr. C. S. Garland, and the general secretary, Dr. J. P. Longstaff, must have been gratified at the undoubted success which attended their efforts.

For the first time in the history of the Society, an organised attempt was made, through the agency of a publicity committee, to interest the lay as well as the technical press, and although competition for 'space' was severe owing to the vagaries of the franc, the meeting of the British Medical Association at Nottingham, and innumerable sporting events, the results obtained were very encouraging. The presence of H.R.H. the Duke of York, the Earl of Balfour, and the Lord Mayor on the opening day made an excellent *lever du rideau*, whilst the speeches of Sir Alfred Mond at the conference on hormones and at the Society's annual dinner, the address of Sir Josiah Stamp, who spoke on "The Economics of Monopolies, with particular reference to America," and that of Sir Max Muspratt at the opening of the exhibition of chemical plant, provided the press with favourable opportunities to direct attention to the importance of chemistry through the mouths of well-known public men.

The increasing growth of the chemical industry proper is a fact that was emphasised by several speakers, but of even more significance is the manner in which chemistry has penetrated into a large number of industries which are not specifically chemical. No body is more suited to advance the welfare of chemistry in industry than the Society of Chemical Industry. In recent times many smaller societies, essentially chemical in nature, have been formed to serve the needs of branches of applied chemistry, but this Society is in a sense the mother of all, and although it has suffered from the competition of these smaller communities, and is still feeling the full blast of financial stringency, there yet remains to it a most important sphere of influence in co-ordinating the activities of all societies devoted to the advancement of applied chemistry. Substantial progress has been made in this direction during the past two years: joint conferences and joint social functions have become the order of the day, and a valuable step forward has been made in the formation of a Fuel Section of the Society.

This centripetal tendency within the industry and profession of chemistry is well shown in the project to establish a central home for chemistry in London, which was taken up by the Federal Council for Pure and Applied Chemistry some six years ago, but, unfortunately, has been held up for financial reasons. The subject was discussed at a special meeting of the Congress, but no solution was found. One group favours a policy of 'masterful inactivity' until the industry is in a position to subscribe a sum of the order of 250,000*l.* for acquiring a home large enough to house the offices of existing societies, and to provide accommodation for large meetings, a library, and a club. The other group is weary of waiting and would embark upon a much smaller scheme involving the expenditure of 35,000*l.*-40,000*l.* If such a sum could be raised, the latter scheme would appear preferable, provided that it were carried out in such a way as not to exclude the ultimate realisation of the more ambitious project.

Concurrently with a conference on hormones (see p. 174 of this issue), a symposium on corrosion was held under the auspices of four societies. Mr. U. R. Evans led off with an able summary of the main facts and hypotheses connected with the corrosion of metals by air and by chemical agents. He was followed by Dr. W. H. Hatfield with a paper on resistant steels for chemical engineering, in which were described the action of various chemicals on chromium steels (12-14 per cent. chromium) and on a nickel-chromium steel (18 per cent. chromium, 8 per cent. nickel); the latter steel is now used extensively in chemical manufacture. A similar subject was treated by Messrs. T. G. Elliot and G. B. Willey, who outlined the properties of certain Hadfield steels that are remarkably resistant at very high and very low temperatures. Two papers by Mr. P. Parrish completed the series, the first dealing with the corrosion and erosion of plant used in the manufacture of ammonium sulphate at gas and coke-oven works, and the second with the corrosion and erosion of chemical sheet-lead.

Among the most interesting and best-delivered contributions were those by Dr. W. R. Ormandy in connexion with power alcohol. In the first he described the development of a process for making glucose from waste wood, by which the cellulose of dried sawdust is treated with concentrated hydrochloric acid and converted into hexose sugars (92 per cent.) and pentose sugars (8 per cent.) Very many technical difficulties impeded the elaboration of the process, not the least of which was to find a material capable of withstanding the action of the acid. The material now successfully used ('Prodorite') is a high-melting pitch mixed with mineral matter of carefully graded particle-sizes; it shows no tendency to 'creep,' behaving like a solid up to 125° C. About 250,000*l.* has been expended in elaborating the process, which is now a technical success, and it is hoped to produce large quantities of high-grade glucose together with inferior sugar suitable for conversion into alcohol. As about 20 per cent. of all timber hewn is lost as waste wood, it is obvious that there is great scope for this process in such countries as Canada and Scandinavia.

In their paper on "Experiences with Alcohol Motor

Fuels," Dr. Ormandy and Mr. D. Ross dealt with the use of alcohol as a motor fuel when mixed with petrol or benzol. Alcohol has the great advantage that it allows the use of a much higher compression ratio in the engine than petrol or any constituent of petrol, thereby obviating premature detonation (' pinking '). Commercial (95 per cent. vol.) alcohol does not mix well with petrol, but now that alcohol can be easily and economically dehydrated by distilling azeotropic mixtures, this difficulty has disappeared. Road tests carried out by the London General Omnibus Co. using petrol with a small proportion of 99 per cent. alcohol, and a mixture of 65 per cent. denatured alcohol, 30 per cent. benzol, and 5 per cent. ether gave quite satisfactory results and showed that, owing to its anti-detonating action, alcohol can advantageously be added to low-grade petrols to improve their value.

The great importance of the size of particles of pigment and compounding powders used in the paint and rubber industries, was discussed at a conference presided over by Sir William Bragg. After Dr. D. F. Twiss and Mr. C. A. Klein had outlined the main problems, specialised papers were read by Dr. S. S. Pickles, Dr. P. Schidrowitz, Mr. T. R. Dawson, Mr. Nöel Heaton, Mr. E. A. Murphy, Mr. H. Green (U.S.A.), and by Messrs. G. Gallie and B. D. Porritt. At the concluding sessions Mr. L. J. Simon and Prof. J. W. Hinchley contributed a paper on fat-extraction by solvents, in which they described a new large-scale process for extracting fat from seeds which involves a very short period of extraction, economy in the consumption of solvent, and low capital cost; and Dr. E. W. Smith presented a very useful summary of recent discussions concerning solid smokeless fuel. Low-temperature processes, said the author, are at present both technically and economically unproven and the immediate problem consists in improving high-temperature coke for industrial and domestic uses. Such coke must be dry, and contain as low an ash-content as is compatible with economic production. It must be suitably graded, and the grades standardised.

The attendance at all the conferences was very good, and the papers were of a high standard, although there were so many of them that little time was left for discussion. Considered as a whole, the meeting was remarkable not only for its magnitude, but also for the diversity and interest of the subjects discussed.

The Commercial Production of Hormones.

AT a joint meeting of the Biochemical Society and the London Section of the Society of Chemical Industry on July 20, a series of papers on "The Scientific and Industrial Problems presented by the Hormones—the Natural Drugs of the Body," was read. The chair was taken by Sir Alfred Mond, who, in the course of his introductory remarks, referred to the work done by the British school on this subject and to the success which has followed the co-operation of the biochemist, the manufacturer and the physiologist, especially in the commercial production of insulin. The financier, though doubtless an essential member of the team, should occupy a subsidiary position to the research worker. Dr. H. H. Dale followed with a paper on the experimental study and use of hormones; Dr. H. W. Dudley described the chemistry of the pituitary gland and of insulin, and Mr. F. H. Carr the commercial production of hormones; Dr. H. A. D. Jowett gave an account of the history of adrenaline, and Prof. G. Barger discussed the recent progress in the chemistry of thyroxine. Dr. J. W. Trevan's paper on the biological assay of hormones was not read, but in the following account of the main parts brought out by the various speakers, use has been made of an abstract with which we have been furnished.

Only one of the hormones has, so far, been synthesised in the laboratory. Although the presence of a pressor principle in the suprarenal gland was first shown by Oliver and Schafer in 1894, it was not until 1901 that it was obtained in the crystalline state by Takamine, who, with greater courage than was shown by previous investigators, added strong ammonia in excess to the purified aqueous extract of the gland and so precipitated the base. In the same year Aldrich assigned it the formula $C_9H_{13}O_3N$, and this was afterwards confirmed: its structure was definitely proved by Jowett in 1904, who, by exhaustive methylation and subsequent oxidation, obtained veratric acid and trimethylamine, and about the same time the compound was also synthesised by Stolz. The synthetic product was of course the racemic form: in 1908 Flacher separated the dextro- from the lævo- variety, by treating the bitartrate with methyl alcohol, which dissolves the former and leaves the latter behind. The pressor effect of the lævo- naturally occurring form is fifteen times greater than that of its isomer.

Although the chemist may have finished with adrenaline, to the biochemist and physiologist it is still the central figure in many unsolved problems. How does the body make it? What is its function under ordinary conditions of life? To the first question there is as yet no answer: to the second a tentative reply may be given, but it is a curious fact that, although adrenaline has so simple a chemical constitution, and such a powerful physiological action when injected, yet its presence in the body under ordinary conditions, except in the suprarenal glands themselves, has been extremely difficult to demonstrate satisfactorily: in fact it has even been denied that it has any function in ordinary circumstances. It is probable, however, that it plays a part in the maintenance of the tone of the small blood-vessels, and also is secreted into the blood stream in larger quantities under conditions of emotional and physical stress.

It is interesting to contrast with the history of adrenaline that of thyroxine. The administration of thyroid gland in myxœdema was the first example of a successful substitution therapy: it is still the main example of this type of treatment, and, excepting possibly the oxytocic principle of the pituitary gland, the only example of a successful result being obtained by administration by the mouth. It is stated to have been used in China for this purpose more than a thousand years ago. But the active principle was not isolated until a few years since, when Kendall was successful in preparing it. Within the last year Harington has been able to synthesise desiodo-thyroxine, the compound formed when the iodine is removed from the molecule of thyroxine. An account of Harington's work has been recently given in these columns (July 10, p. 65), so that it will not be further discussed here: it may be assumed that the final synthesis is now only a matter of time.

The commercial production of other hormones, of which the chemical constitution is unknown, requires the supervision of skilled chemists in the process of manufacture, and the co-operation of the research biochemist in the improvement of existing processes

or the discovery of new ones; the physiologist is also required, since the detection of the presence of the hormone and its quantitative estimation require the use of animal tests in the absence of satisfactory chemical reactions. The usefulness of this co-operation has never been more successfully shown than in the commercial production of insulin. At the present time firms in Great Britain satisfy all home requirements, and have a large balance available for export, whilst the price is low enough to bring the remedy within the means of the poorest diabetic. Of the hormones of, at present, unknown chemical constitution, insulin and those of the posterior lobe of the pituitary gland are the best known. Secretin, the hormone which arouses the secretion of pancreatic juice at the inflow of the partially digested food from the stomach into the duodenum, from the mucous membrane of which it is absorbed into the blood stream, has been recently obtained in a very pure form by J. Mellanby. The active principle of the parathyroid glands and the œstrus-producing hormone of the ovary have been extracted and partially purified, and methods of biological assay, which are probably roughly quantitative, worked out. Of the active principles of the testes, the cortex of the suprarenal glands and the anterior lobe of the pituitary, almost nothing is known; but our ignorance is not due to their non-essentiality, since both the suprarenal cortex and the anterior pituitary are essential to life, whilst an inkling of their functions has been obtained from human and experimental pathology.

An insight into the manufacturing problems is given by a knowledge of the properties of these hormones: insulin and the pituitary hormones may serve as a basis for the following short description. It is probable that the active principles exist in the glands in a combined form, from which they are set free by appropriate treatment; this is certainly the case with thyroxine and probably also with adrenaline. Under certain conditions the hormones will even stand boiling, but, apart from this, their main characteristic is their exceeding sensitiveness to even quite mild reagents. They are rapidly destroyed by autolysis after the death of the animal, being attacked by proteolytic enzymes, though to varying degrees.

This is also probably the reason why the majority are inactive when taken by the mouth, except in relatively enormous doses. They are extremely sensitive to alkalies, but are stable in the presence of weak acids. They appear to be either themselves simple proteins such as an albumose or polypeptide or are closely associated with them. They adhere tenaciously to precipitates formed in their aqueous solutions. Thus Dudley obtained a crystalline picrate from a concentrated aqueous solution of the pituitary hormones, which retained in full its physiological activity when re-crystallised from water: but on re-crystallisation from dilute alcohol, the activity remained behind in the mother liquor, whilst the crystals were identified as potassium creatinine picrate. Abel has recently announced the isolation of a crystalline insulin, the activity of which is two to four times greater than that of ordinary commercial insulin; the crystals bear a remarkable resemblance to cystine. Now it is known that if edestin is allowed to crystallise in a solution of insulin a great part of the activity adheres to the crystals, so that, until further evidence is forthcoming, caution should be exercised in accepting Abel's conclusion.

The principles to be followed in the production of hormones on the large scale must therefore be the inhibition of enzyme action, and the avoidance of the use of destructive reagents or the production of precipitates which remove the activity, except where the latter can be used as a method of purification with recovery of the active principles from the precipitate. The prevention of autolytic changes is best ensured by the freezing of the glands immediately after removal from the animal. The material can then be worked up at leisure and in convenient quantities, though slow changes occur in time in the frozen state, leading to lowered yields. In working up the glands, every means should be taken to prevent enzyme action: thus in the case of the pancreas, the frozen glands are minced, the acid and alcohol incorporated at a temperature of 0° C., and the whole thoroughly ground; filtration and clarification follow to remove, so far as possible, traces of adhering enzymes, and the subsequent concentration is carried out at a low pressure and temperature. In the case of the pituitary gland, dehydration with acetone at a low temperature destroys the autolytic enzymes, leaving a stable powder from which the activity can be extracted by water or dilute acid. The acidity of the solution is of great importance in the case of both insulin and the pituitary hormones. Moreover, use is made of the fact that insulin is insoluble at *p*H of about 5·0 in the later stages of the purification, so that it is essential that those working on the insulin plant should be able to determine the hydrogen ion concentration of the solutions with which they are dealing: a colorimetric method is easy to learn and gives sufficiently accurate information. In the final stages of the preparation of insulin, use is made of Dudley's method, precipitation with picric acid followed by addition of alcoholic hydrochloric acid, by which treatment the insulin hydrochloride is formed and can be precipitated with acetone as a uniform white powder.

In conclusion, reference may be made to one further point in which the co-operation of the manufacturer, the biochemist, and the physiologist may lead to important results. To obtain further insight into the chemical nature of these unknown active principles requires the provision of a moderately large quantity of relatively pure material as the starting point for further analysis. The posterior lobe of the pituitary gland of the ox weighs about 0·5 gm., of which 0·1 gm. is solid matter. Probably less than 0·1 per cent. of this represents the active principles: in other words, to obtain 100 gm. of 'pure' hormone would require the working up of glands from 1,000,000 oxen, with the probability that this material would still be a mixture of active principles and contaminating substances. Large scale working, over a course of years probably, seems the only way to accumulate sufficient material on which the biochemist can commence his research, and until the principles have been isolated in a pure condition, identified and synthesised.

The co-operation of the physiologist will be essential in tracing the course of the hormone through the necessary chemical manipulations. Moreover, until our chemical knowledge of these hormones is complete, quantitative estimation of them can only be carried out by the aid of animal tests. By the use of suitable preparations or a sufficiently large number of animals, the errors in this method of assay can be reduced within reasonable limits: thus for pituitary standardisation (on the virgin guinea-pig's uterus), the error of a single test is ±20 per cent., and for insulin assay ±5-10 per cent. Such differences as these would scarcely be detected in clinical medicine, so that the method of biological assay sufficiently safeguards both the physician and the patient.

University and Educational Intelligence.

CAMBRIDGE.—Mr. T. C. Hodson has been appointed reader in ethnology in succession to Dr. A. C. Haddon.

EDINBURGH.—At the graduation ceremonial on July 20, the following, among others, were presented for the honorary degree of Doctor of Laws: The Earl of Crawford and Balcarres, Chancellor of the University of Manchester, a trustee of the British Museum, and president in 1916 of the Board of Agriculture and Fisheries; emeritus Prof. J. S. Nicholson, formerly professor of political economy in the University of Edinburgh; Lord Salvesen, formerly president of the Zoological Society of Scotland and of the Royal Scottish Geographical Society.

The degree of Doctor of Science was conferred on Dr. D. A. W. Fairweather for a thesis on "Electrosynthesis"; Dr. S. R. Khastgir for a thesis on "Studies in the *J*-transformation of Scattered X-radiation"; Dr. J. Muir for a thesis on "The Flora of Riversdale, South Africa"; Mr. J. D. M'B. Ross for a thesis on "A Relationship between the Associating Power of Optical Isomers, and the Formation of Racemic Compounds"; Dr. G. Shearer for a thesis on "The Application of the Method of X-ray Analysis to the Study of the Organic Aliphatic Series."

At the medical graduation ceremonial on July 23, intimation was made of the award of the Cameron Prize in practical therapeutics to Dr. H. H. Dale, head of the Department of Biochemistry and Pharmacology under the Medical Research Council, for important investigations on the pharmacological and therapeutic action of a series of substances which have effects on the functional activity of nerve, muscle, ductless glands, and other tissues.

LEEDS.—Mr. A. E. Ingham, Fellow of Trinity College, Cambridge, has been appointed reader in mathematical analysis in succession to Dr. W. E. H. Berwick. Mr. Leonard R. Johnson has been appointed assistant lecturer in agricultural zoology.

LONDON.—Mr. E. B. Verney has been appointed as from August 1 to the University chair of pharmacology tenable at University College. Mr. Verney was educated at Tonbridge School, and at Downing College, Cambridge. He was assistant in the Department of Physiology at University College from 1921 until 1924, and since 1924 has been assistant in the Medical Unit at University College Hospital. In July 1922 he was awarded a Beit Memorial Fellowship and was re-elected for a 4th year in 1925.

Mr. S. J. Davies has been appointed as from August 1 to the University readership in mechanical engineering tenable at King's College. He was educated at H.M. Dockyard School and the Technical College, Portsmouth. Since 1920, Mr. Davies has been senior lecturer in engineering at Armstrong College, Newcastle-upon-Tyne; he has also lectured at the Technische Hochschule in Charlottenburg and in Düsseldorf and Essen.

The title of emeritus professor of electrical engineering in the University has been conferred on Prof. J. A. Fleming, on his retirement from the University chair of electrical engineering at University College.

THE honorary degree of D.Sc. of the University of Wales has been conferred on Sir T. W. Edgworth David, professor of geology in the University of Sydney, for distinction as a geologist and his eminent position in the university life of Australia; and on Dr. A. H. Church, University lecturer in botany, Oxford, for his distinguished contributions to botanical science.

NOTICE is given by the Huddersfield Technical College of the forthcoming award of the two following research scholarships, each of which is of the yearly value of 100*l.*, with remission of fees: The Joseph Blamires' (for research in colour chemistry), and the Drapers' Company's (tenable in the dyeing department). Particulars of the scholarships are obtainable from the principal of the college.

THE College Research Committee of Armstrong College, Newcastle-upon-Tyne, has recently initiated a new scheme under the title of Senior Research Fellowship. A member of the staff elected to a fellowship is released from teaching duties for one year, the Research Committee providing the salary of a temporary lecturer from the funds at its disposal. A first appointment has been made of Dr. G. R. Goldsbrough, lecturer in applied mathematics.

THE Trustees of the Beit Fellowships for Scientific Research at their annual meeting extended the fellowship awarded a year ago to Mr. Rudolf Kingslake for mathematical and experimental researches on the properties of optical instruments. Three new fellows were elected: Mr. J. Topping for research on the calculation of the equilibrium configuration and energy of crystals from the mutual electrostatic and repulsive forces, in particular Al_2O_3 and Fe_2O_3; further extension of the research upon which he is at present engaged and the calculation of the repulsive forces for the nitrate crystals and further comparisons of calcite and aragonite; Mr. J. W. Maccoll for research in aerodynamics; and Mr. G. H. Mitchell for research on the Borrowdale volcanic rocks of the eastern part of the Lake District, more especially in the Kentmere and Troutbeck areas, in continuance of research now being pursued. For the first time in the history of the Trust, the appointments are for the definite period of two years instead of for one year as hitherto.

THE Education Committee of the London County Council, on the advice of its Consultative Committee on Engineering, has awarded Robert Blair Fellowships to Mr. Malcolm D. Bone and Mr. Eric W. Fell. These fellowships, which are of the value of 450*l.*, are awarded to young engineers of high promise to enable them to undertake research overseas. Mr. Malcolm Bone, who is a student-assistant with the Consett Iron Co., is the son of Prof. W. A. Bone, of the Imperial College of Science and Technology, South Kensington. He was educated at St. Albans Grammar School, Mill Hill School, the Friends' School, Sidcot, and the Imperial College. He will now study iron and steel manufacture in continental works, mainly in Germany. Mr. Eric Fell is a research student in the University of Birmingham who was previously educated at St. Aubyns School and Haileybury. Like Mr. Bone, he also proposes to study in Germany and to undertake research in the metallurgy of steel at the Technische Hochschule, Aachen. Four Robert Blair Fellowships have already been awarded for research in the United States, Canada, and in Germany. The first research report written as the result of these awards has recently been received from Mr. George Bird, who gained a fellowship two years ago. This report has been forwarded to the Institution of Mechanical Engineers, with the result that Mr. Bird has now been invited to write a paper, dealing with some particular phase of his investigations, for publication in the proceedings of the Institution.

Contemporary Birthdays.

July 28, 1864. Prof. Charles Herbert Lees, F.R.S.
July 30, 1856. Viscount Haldane, K.T., O.M., F.R.S.
Aug. 2, 1876. Prof. James Wesley Jobling.
Aug. 5, 1878. Prof. Louis C. Karpinski.
Aug. 7, 1864. Mr. Oswald H. Latter.
Aug. 8, 1845. Mr. William Barlow, F.R.S.
Aug. 8, 1859. Sir Alfred G. Bourne, K.C.I.E., F.R.S.
Aug. 8, 1857. Prof. Henry Fairfield Osborn, For. Mem. R.S. (see page 163).
Aug. 8, 1858. Sir Francis G. Ogilvie.

Prof. LEES, who occupies the chair of physics in the University of London (East London College), was born at Glodwick, Oldham. He was educated privately, then at Owens College, Manchester, and at the University of Strasbourg. Before engaging in professorial work in London he was lecturer in physics in the University of Manchester.

Lord HALDANE, Chancellor of the University of Bristol since 1909, was educated at Edinburgh Academy, the University of Edinburgh (of which he was rector, 1905-8), and at Göttingen. He is Hon. D.C.L. (Oxon). Among many critical expositions, he is the author of "The Philosophy of Humanism" (1922). Lord Haldane is president of the British Institute of Adult Education.

Prof. J. WESLEY JOBLING was born in Ohio. Originally on the teaching staff of Columbia University, he was professor of pathology from 1914 until 1918 in the medical department of Vanderbilt University, Nashville (Tennessee), returning then to Columbia to occupy the chair of pathology there.

Prof. LOUIS C. KARPINSKI, mathematician, was born at Rochester, N.Y. He was educated at the State Normal and Training School, Oswego, N.Y., and the University of Strasbourg. Since 1919 he has been professor of mathematics in the University of Michigan. He is joint author with H. Y. Benedict and J. W. Calhoun of "Unified Mathematics" (1918).

Mr. OSWALD LATTER, who has been for many years science master at Charterhouse School, was born at Fulham. From Charterhouse he went to Keble College, Oxford. Sometime Berkeley fellow of Owens College, Manchester, he was also a tutor of Keble before returning to his old school to take up science teaching.

Mr. WILLIAM BARLOW is a Londoner. He is specially identified with researches on crystal structure and related problems. Mr. Barlow is a past president of the Mineralogical Society.

Sir ALFRED BOURNE, a native of Lowestoft, was educated at University College School, London. His services to the Indian Empire have been varied and distinctive. Successively he has been registrar of the University of Madras, botanist to the Madras Government, and professor of biology in the Presidency College, Madras.

Sir FRANCIS OGILVIE, an Aberdonian, graduated at the University of Aberdeen, and, early in his career, was on its teaching staff. In Edinburgh he had, later, various important interests. He was principal of the Heriot-Watt College there from 1886 until 1900, thereafter, for three years, director of the Edinburgh Museum of Science and Art. Transferred to London, he was Secretary of the Board of Education for the Science Museum and Geological Survey from 1910 until 1920, holding also the directorship of the Science Museum. Sir Francis was principal assistant-secretary, Department of Scientific and Industrial Research, 1920–22. He is Hon. LL.D., Edinburgh.

Societies and Academies.

DUBLIN.

Royal Irish Academy, June 28.—H. Ryan, J. Keane, and B. O'Donoghue: Some derivatives of γ-piperonylidene-methylethylketone. The present communication describes the results of experiments carried out with this substance and some aromatic aldehydes. The starting substance, $CH_3 . CO . C(CH_3) = CH . C_6H_3 . O_2CH_2$, was prepared by the condensation of piperonal and methylethylketone in the presence of hydrochloric acid. By the action of piperonal on γ-piperonylidene-methylethylketone in the presence of alkali, a compound having the formula $C_{20}H_{16}O_5$ was obtained. This dicondensation derivative did not react with a further quantity of piperonal in the presence of alkali, and it was regarded as being 1-methyl-4·5-dipiperonyl-cyclopenten (3)-one (2). On treating this compound with alcoholic hydrochloric acid, it was converted into the isomeric 1-methyl-4·5-dipiperonyl-cyclopenten (4)-one (2). This substance reacted with piperonal in the presence of alkali to form a tricondensation compound $C_{28}H_{20}O_7$. By the action of piperonal on γ-piperonylidene-methylethylketone or on the $C_{20}H_{16}O_5$ body in the presence of hydrochloric acid, the same tricondensation compound $C_{28}H_{20}O_7$ was obtained. This derivative is regarded as being 3-piperonylidene 1-methyl-4·5-dipiperonyl-cyclopenten (4)-one (2). The results obtained in this research are similar to those found by Ryan and Lennon in their investigation on the condensations of aldehydes with methylethylketone.—H. Ryan, J. Keane, and B. O'Donoghue: Some derivatives of α-piperonylidene-methylethylketone. The results of the interaction of α-piperonylidene-methylethylketone and some aromatic aldehydes are described. By the action of piperonal on the starting substance, a compound having the formula $C_{20}H_{16}O_5$ was obtained. This dicondensation derivative of methylethylketone and piperonal was not identical with either of compounds having the same molecular formula obtained by the action of piperonal on γ-piperonylidene-methylethylketone. The last-mentioned derivatives are regarded as isomeric cyclopentenones. The $C_{20}H_{16}O_5$ body prepared by the action of piperonal on α-piperonylidene-methylethylketone formed a tetrabromide and did not react with a further quantity of piperonal. It is regarded as α-γ-dipiperonylidene-methylethylketone. By the action of piperonal on α-piperonylidene-methylethylketone in the presence of hydrochloric acid, a tricondensation compound $C_{28}H_{20}O_7$ was obtained. This body was also prepared by the action of piperonal on γ-piperonylidene-methylethylketone and was proved to be 3-piperonylidene-1-methyl 4·5-dipiperonyl-cyclopenten (4)-one (2).—R. K. Boylan: Atmospheric dust and condensation nuclei. As a result of observations made in Dublin between October 1925 and June 1926, using Owens' jet dust counter and Aitken's apparatus, the following average values were obtained: dust particles per c.c. 1580, nuclei per c.c. 23,800. The correlation coefficient between the concentrations of the two bodies was 0·73±0·056. It was found, in confirmation of the results of Wigand, that dust particles would not act as centres for cloudy condensation even in the absence of the ordinary nuclei.

EDINBURGH.

Royal Society, July 5.—J. Tait: Experiments and observations on Crustacea (Pt. vii.). Some structural and physiological features of the valviferous isopod Chiridotea. This isopod is found along the eastern shores of America. It is peculiar among its kind in that it combines the activity of swimming, walking,

and tunnelling in sand, and the position and arrangement of its limbs may be interpreted in relation to each of these purposes as well as in relation to its habits of feeding.—Norman **Maclaren**: Development of Cavia. Implantation. The theory put forward by Graf von Spee, that in the guinea-pig the ovum is implanted in the uterine mucosa after the manner of a parasite in virtue of the destructive action of its surface cells, has been generally accepted. An alternative theory for the primary phases of implantation here discussed brings the process in Cavia more into line with what is known to occur in other mammals. Instead of eating its own way through the epithelium, the egg becomes lodged in one of the crypts which normally occur at the antemesometral end of the uterine lumen. This crypt becomes closed by the overgrowth of its lips, while the epithelium which originally formed its floor disappears. With the disappearance of the epithelium, destructive changes supervene in which the whole antemesometral part of the lumen is involved. The primary implantation cavity is thus a part of the uterine lumen, and the process does not, in principle, differ from that which occurs in certain other rodents such as the mouse and rat.—W. L. **Ferrar**: On the cardinal function of interpolation theory. Interpolation over a set of equi-distant points by cardinal function formula is 'consistent,' *i.e.* a function which is given accurately by the interpolation formula applied to the values of the function at points $0, \pm w, \ldots$ is also given accurately if w be replaced by any smaller w'. The formula consists of an infinite series; its relation with a corresponding infinite integral is considered.—E. L. **Ince**: Researches into the characteristic numbers of the Mathieu equation. (Second paper.)

SHEFFIELD.

Society of Glass Technology, June 1 and 2.—Sir W. Flinders **Petrie**: Glass in early ages. No glass was made in Egypt prior to about 1500 B.C., all earlier specimens being imported, probably from the Syrians. Examples of glass had been found in Syria, in the Euphrates region, which can definitely be dated back to 2500 B.C. Only fifty years or so elapsed between a time when glass was a comparatively rare commodity in Egypt and a time when it was possibly the commonest commodity of all. Glass vases and glass beads rapidly came into everyday use. At first it was not a liquid glass which was produced, but a glass paste which could be moulded in the plastic state. No blown glass was found in Egypt until one came to an examination of the products of the Christian period. The whole of the earliest glasswares discovered in Egypt were coloured. It was not until about 1200 B.C. that the Egyptians began to make glass by pressing it into moulds, and from thence onwards, until the seventh century B.C., the colour of their glasswares got worse and worse, although the patterns became more and more composite. From the year 350 A.D. the Egyptian glass-makers resorted to the moulding of glass in the production of standard weights for gold coins, a practice which was later copied by the Arabs. The glazing of stones began in Egypt about the twelfth century B.C. Some of the tiles covering the walls of early Egyptian chambers are magnificent examples of colouring; not only single colours were achieved, but also polychromes.—J. W. **Ryde**: Opal glass. A number of commercial and experimental glasses have been examined by the X-ray method in order to determine the nature of the opacifying material which separated out. Sodium fluoride and calcium fluoride had separated out from the glasses examined. The rates of cooling were controlled, and varied so that the effect of the rate of cooling on the depth of opal produced could be investigated. With slow cooling the size of particles which separated out increased until a certain limiting size was reached. In bulbs made of opals in which the opacifying particles are relatively large, very little light is scattered back to traverse the bulb again.—F. F. S. **Bryson**: The electrical conductivity of glasses at high temperatures. The electrical conductivity of several series of glasses was determined at temperatures between the softening point and 1150° C. The glass was heated in a small cylindrical crucible in a platinum wound electric furnace. The temperature-resistance curves for several glasses bear a close relationship to the temperature-viscosity curves for similar glasses, and suggest the possibility of using conductivity measurements as a method of determining changes in the viscosity of a glass immediately before being worked.—Edith M. **Firth**, F. W. **Hodkin**, M. **Parkin** and W. E. S. **Turner**: The influence of moisture on the rate of melting and on the properties of soda-lime glasses. Moisture was present in amounts ranging from 0·25 to 15 per cent. in different batches. In general, when present to the extent of not more than 1-2 per cent. in soda ash batches and not more than 3-4 per cent. in batches containing both soda ash and saltcake, moisture has a beneficial effect on the rate of melting. The glasses which were made from batches containing saltcake, were refined more easily, and were freer from waviness than those prepared from batches containing soda ash only. Glasses prepared from batches containing more than 5-6 per cent. of moisture were more viscous and had a shorter working range than those prepared from ordinary dry batches.

PARIS.

Academy of Sciences, June 21.—A. **Lacroix**: Preliminary note on an aerolith discovered in the Department of the Côte-d'Or and remarks on the classification and nomenclature of the chondrites.—Charles **Richet** and P. **Lassablière**: The protective effects of preliminary saline injections on chloroform anæsthesia. Experiments on dogs have proved that the injection of a solution of common salt into the veins before administering chloroform increases the resisting power of the heart. The amount of chloroform can be increased to six times the normal without collapse.—Gabriel **Bertrand** and M. **Mâchebœuf**: The influence of nickel and cobalt on the action produced by insulin in the rabbit. It has been shown previously that the pancreas is one of the organs containing the largest proportions of nickel and cobalt, and preparations of insulin are even richer in these two metals. This suggested the study of the effect of adding nickel or cobalt or both to preparations of insulin and examining the physiological effect. The effects, which are marked, are shown in a series of graphs.—E. **Bataillon**: The membranogen process and the regular development provoked in virgin eggs of Echinus by hypertonic treatment alone.—Pierre **Weiss** was elected a non-resident member in succession to the late G. Gouy.—A. **Buhl**: The integration of Maurer's equations by series of homogeneous functions.—Armand **Cahen**: Differential equations of the first order linear with respect to the function and the variable.—Renato **Caccioppoli**: Linear functionals.—A. **Tychonoff**: Abstract spaces.—N. **Lusin**: An arithmetical example of a function not forming part of the classification of M. René Baire.—Henri **Bénard**: The inexactitude, for real liquids, of the theoretical laws of Kármán relating to the stability of alternate vortices.—**Garsaux**: The provision of aeroplanes with oxygen. A device is described in which a specially constructed Dewar vessel containing liquid oxygen replaces the usual

cylinder of compressed oxygen: the weight of the apparatus is reduced to one-tenth of that when an oxygen cylinder is carried.—**Dumanois**: The retarded inflammation effect produced by antidetonants. The effect of the addition of such substances as lead tetraethyl to petrol is to retard ignition.—L. **Cagniard**: The use of the quadrant electrometer in high-frequency measurements of precision.—R. **Forrer**: The structure of the atomic magnet. The deformation of the multiplet by the field. The triplet in iron.—F. **Wolfers**: Interferences by diffusion.—R. de **Mallemann**: The dispersion of electrical double refraction of camphor. The specific double refraction of active camphor and of inactive camphor are sensibly identical. The dispersion is normal.—H. **Jedrzejowski**: The method of preparation of sources of RaB + RaC.—Pierre **Achalme** and Jacques **Achalme**: The influence of the viscosity on the specific rotatory power of certain active bodies. Two series of experiments are described, one in which the concentration was kept constant and the viscosity varied by the addition of solution of citric acid, the other in which the viscosity was kept constant and the concentration varied. In the first case the calculated specific rotatory power varied from 13·6 to 6·2; with concentration variable from 3·75 per cent. to 60 per cent. tartaric acid, viscosity constant, the calculated specific rotatory power was practically constant, 8·3 to 8·5. It is pointed out that this new fact of the effect of viscosity is of importance as affecting deductions on the molecular structure of active bodies.—Edmond **Bauer**: The electric structure of the molecules, particularly mesomorph bodies (anisotropic fluids).—P. **Surun**: The adsorption of some organic acids by two activated carbons of different origin. The data given are not in accord with the conclusions of Fromageot and Wurmser, which were based on experiments with Urbain carbon.—F. **Bourion** and E. **Rouyer**: Discussion of the results obtained in the quantitative study of the association of mercuric chloride. Reviewing the work of Linhart, Beckmann, together with the results of their own experiments, the authors conclude that there is equilibrium between simple and double molecules of mercuric chloride at 25° to 40° C. for concentrations not greater than 0·37 mol. There is equilibrium between simple and triple molecules at 100° C. and for concentrations higher than 0·5 mol.—E. **Sterkers** and R. **Bredeau**: Contribution to the study of reactions between solid bodies reduced to the colloidal state. Details of the preparation of calcium resinate in a colloidal mill. Zinc oleate and magnesium stearate can be prepared in a similar manner.—Ch. **Maurain**: The relations between terrestrial magnetic disturbances and solar activity.—Alb. **Frey**: The pigments of *Sterigmatocystis nigra*.—Ph. **Joyet-Lavergne**: The heterogamy of the spores of the horsetail and the characters of sexualisation of the cytoplasm.—R. **Combes** and R. **Echevin**: The variations in the organic matter, mineral matter, and especially calcium, in the leaves of trees during the autumnal yellowing.—H. **Prophète**: Contribution to the study of the waxes of flowers: rose wax. The results of a detailed chemical examination are given.—E. **Chemin**: The development of the spores of *Colaconema Bonnemaisoniæ*.—Mme. L. **Randoine** and R. **Lecoq**: Do the water-soluble vitamins (B) contained in beer yeast exist beforehand in the culture medium? It has been shown in an earlier communication that beer yeast and extracts of beer yeast, so far as concerns the water-soluble vitamins, have a higher value than that of other Saccharomyces or of other yeast extracts of different origin. It is now shown that the source of these vitamins is the malt extract used as the culture medium.—Jules **Amar**: Cellular pigments and physico-chemical actions.—Maurice **Piettre**: Some physical and chemical influences in hæmolysis by hæmolytic immunoserums.—J. **Benoit**: Differentiations, spontaneous and provoked, in the genital glands of the Gallinaceæ.—René **Fabre**: A spectrophotometric method for the study of hæmolysis.—L. **Mercier** and Raymond **Poisson**: Parasitic microsporidia of Mysis.—Edm. **Plantureux**: An antirabies vaccine containing formaldehyde.

CAPE TOWN.

Royal Society of South Africa, April 21.—C. von **Bonde**: The chorology of the S. African Heterosomata with some relative problems. The zoogeographical distribution of the S. African flat-fishes is dealt with. Part I. deals with ecology or environment of the species, and Part II. with chorology or their distribution in space. A comparison of the distribution of the Heterosomata with that of other marine faunas shows a remarkable agreement in the ratio of their occurrence in deep sea or in shallow water, the number of endemic species and the preponderance of east coast species.—A. **Ogg**: The structure of the sulphates.—W. A. **Humphrey**: (1) An occurrence of diamonds near Port Nolloth. This occurrence is the first to be discovered on the coastal belt south of the Orange River. The gravel is disposed in alternating layers of loose gravel and thin partings of hard conglomerate in which the constituents of the gravel are cemented together by a calcareous cement. This points to a seasonal deposition of gravel by a stream which was intermittent in its flow. The gravel shows signs of long-continued transport and the diamonds also show slight traces of wear. The source of the diamonds is probably somewhere within the basin of the Kammas River, with which the watercourse containing the gravel was once connected. The diamonds are very brilliant, white and well crystallised. (2) The changed conditions of Namaqualand. The river valleys of Little Bushmanland immediately south of the Orange River have been formed by the action of streams of considerable volume, which cut their way through masses of mountains during some far-distant pluvial period. The upper courses of the shorter tributaries of the Orange in this neighbourhood have been gradually filled up with drift sand which has encroached from the north and obliterated the stream valleys altogether; in some cases mountain ranges are in the process of being buried. The climate has changed from one with a comparatively heavy rainfall to its present semi-arid character. Similarly the Kammas River now no longer carries water to the sea, but is in course of filling up its own bed by its summer floods, which now spread the detritus from the Klipfontein Mountains in wide alluvial flats. This portion of Namaqualand represents an exceedingly old land surface in which valleys are gradually being filled up owing to a decrease in the humidity of the climate.—R. C. **McGaffin** and E. **Newbery**: Single potential of the copper electrode. Very varied results have been obtained by different workers for the single potential of copper in solutions of its salts. One, at least, of the main factors producing this variation is the formation of an insoluble film of basic salt by the action of the electrolyte upon the metallic copper. Attempts have been made to obtain concordant and trustworthy values (*a*) by careful cleaning of the electrode and measurement of the potential immediately after immersion, and (*b*) by retarding or if possible, preventing the formation of the film either by rapid rotation of the electrode or by violent stirring of the electrolyte.

Official Publications Received.

Journal of the College of Agriculture, Hokkaido Imperial University, Sapporo, Japan. Vol. 16, Part 1: (i) Über die qualitativen Methoden zur Methylpentosanbestimmung, von Kintaro Oshima und Kinsuke Kondo; (ii) Über die quantitative Bestimmung von Pentosan und Methylpentosan, von Kintaro Oshima und Kinsuke Kondo. Pp. 71. Vol. 17, Part 1: Studies in Plasmopara Halstedii, II. By Prof. Makoto Nishimura. Pp. 61+5 plates. Vol. 18, Part 1: On the Five Species of Dendrolimus injurious to Conifers in Japan, with their Parasitic and Predaceous Insects. By Prof. S. Matsumuia. Pp. 42+5 plates. (Tokyo: Maruzen Co., Ltd.)

Proceedings of the Geologists' Association. Edited by A. K. Wells. Vol. 37, Part 2, June 25th. Pp. 117-250. (London: Edward Stanford, Ltd.) 5s.

Royal College of Surgeons of England. Annual Report on the Museum, by the Conservator, June 17th, 1926. Pp. 24. (London.)

Canada. Department of Mines: Mines Branch. Investigations of Mineral Resources and the Mining Industry, 1924. (No. 642.) Pp. ii +118+5 plates. Investigations in Ore Dressing and Metallurgy (Testing and Research Laboratories), 1924. (No. 643.) Pp. 115. Investigations of Fuels and Fuel Testing (Testing and Research Laboratories), 1924. (No. 644.) Pp. ii+81+4 plates. (Ottawa: F. A. Acland.)

Union of South Africa: Department of Agriculture. Science Bulletin No. 47: Physical and Chemical Analyses of Papers employed for Wrapping Fruit. By Dr. Francois J. de Villiers. Pp. 19. (Pretoria: Government Printing and Stationery Office.)

Bulletin International de l'Académie Polonaise des Sciences et des Lettres: Classe des Sciences mathématiques et naturelles. Série B: Sciences naturelles. No. 3-4B, Mars-Avril, 1925. Pp. 277-508+planches 15-23. 4·50 zł. No. 5-6B, Mai-Juin, 1925. Pp. 509-622+planches 24-32. No. 7B, Juillet, 1925. Pp. 623-727+planches 33 36. No. 8B, Octobre, 1925. Pp.729-800+planches 37-48. Série A: Sciences mathématiques. No. 8-10A, Octobre-Décembre, 1925. Pp. 259-375+planches 3-9. No. 1-2A, Janvier-Février, 1926. Pp. 101. No. 3-4A, Mars-Avril, 1926. Pp. 103-132. (Cracovie: Gebethner et Wolff.)

The Institute of Chemistry of Great Britain and Ireland. Register of Fellows, Associates and Students, corrected to 31st March 1926. Pp. 352. (London.)

Bishop's Stortford College. Report of the Proceedings of the Natural History Society, 1925. Pp. 21. (Bishop's Stortford.)

Results of Meteorological Observations made at the Radcliffe Observatory, Oxford, in the Five Years 1921-1925. Vol. 54. Pp. xvi+101. (London: Oxford University Press.)

Koninklijk Magnetisch en Meteorologisch Observatorium te Batavia. Jaarverslag 1925. Pp. 24. (Weltevreden: Landsdrukkerij.)

Memoirs of the Department of Agriculture in India. Botanical Series, Vol. 14, No. 2: Studies in Gujarat Cottons, Part 3. The Wagad Cotton of Upper Gujarat, Kathiawad and Kutch. By Maganlal L. Patel and D. P. Mankad. Pp. iv+59-112+3 plates. (Calcutta: Government of India Central Publication Branch.) 1.4 rupees; 2s. 3d.

The Kent Incorporated Society for Promoting Experiments in Horticulture. Annual Report (Thirteenth Year). 1: General, East Malling Research Station, 1st January 1925 to 31st December 1925. Pp. 100. (East Malling.) 2s. 3d.

Board of Education. Syllabus of the Science Scholarships Examination, 1927. Pp. 24. (London: H.M. Stationery Office.) 4d. net.

Subject Index of the *Transactions of the Optical Society*, Vols. 1-25. By Prof. A. F. C. Pollard. Pp. iv+89. (London: Optical Society, Imperial College of Science.)

The Decimal Bibliographical Classification of the Institut International de Bibliographie. Partly translated for the Formation and Use of a Universal Bibliographical Repertory concerning Optics, Light and cognate Subjects. By Prof. A. F. C. Pollard. Pp. viii+109. (London: Optical Society, Imperial College of Science.)

The Midland Agricultural and Dairy College, Sutton Bonington, Loughborough. Bulletin No. 9: County and Inter-County Clean Milk Competitions, organised by the College and the County Agricultural Education Authorities; Report on the Inter-County Competition, 1925-26. Pp. 12. (Loughborough.)

Philosophical Transactions of the Royal Society of London. Series A, Vol. 226: The Behaviour of Single Crystals of Aluminium under Static and Repeated Stresses. By H. J. Gough, Dr. D. Hanson and S. J. Wright. Pp. 30+3 plates. (London: Harrison and Sons, Ltd.)

Zoologica: Scientific Contributions of the New York Zoological Society. Vol. 6, No. 1: Studies of a Tropical Jungle, One Quarter of a Square Mile of Jungle at Kartabo, British Guiana. By William Beebe. (Department of Tropical Research, Contribution No. 190.) Pp. 193. (New York.) 1 dollar.

Scientific Papers of the Institute of Physical and Chemical Research. Nos. 57-58: On the Plasticity of Metals, Part 1, by Hikoroku Shōji; On the Plasticity of Metals at High Temperatures, Part 2, by Hikoroku Shōji and Yoshio Mashiyama. Pp. 189-206. 25 sen. No. 59: Über die Konstitution der durch Hydrolyse von Rohoryzanin entstehenden β-Säure (Dioxychinolin-Carbonsäure). Von Yoshikazu Sahashi. Pp. 207-234. 30 sen. No. 60: The Influence of Cholesterol upon the Reproductive Potency of White Rats. By Umetaro Suzuki and Nabetaro Hashimoto. Pp. 235-256. 25 sen. No. 61: About the Transference of Active States and the Mechanism of Catalytic Action. By Susumu Miyamoto. Pp. 257-262. 15 sen. No. 62: Analysis of the Alkali Group. By Sunao Ato and Isaburo Wada. Pp. 263-294. 35 sen. (Tokyo.)

New York Zoological Society. Report of the Director of the Aquarium. (Reprinted from the Thirtieth Annual Report of the New York Zoological Society.) Pp. 14. (New York City.)

Department of Commerce: Bureau of Standards. Scientific Papers of the Bureau of Standards. No. 523: Wind Pressures on Structures. Part 1: General Discussion on Wind Pressure Data; Part 2: Distribution of Pressure over a Model of a Tall Building. By Hugh L. Dryden and George C. Hill. Pp. 697-732. 20 cents. No. 524: Measurements on the Thermal Expansion of Fused Silica. By Wilmer Souder and Peter Hidnert. Pp. 23. 10 cents. No. 526: Transmission and Absorption of Sound by some Building Materials. By E. A. Eckhardt and V. L. Chrisler. Pp. 37-63. 15 cents. (Washington, D.C.: Government Printing Office.)

Annals of the Natal Museum. Edited by Dr. Ernest Warren. Vol. 5, Part 3, May. Pp. 235-448+plates 15-25. (London: Adlard and Son and West Newman, Ltd.) 17s. 6d. net.

Edinburgh and East of Scotland College of Agriculture. New Series, No. 1: A Pure Milk Supply. By A. Cunningham and T. Gibson. Pp. 24. (Edinburgh.)

Proceedings of the United States National Museum. Vol. 68, Art. 25: Amphipods of the Family *Bateidae* in the Collection of the United States National Museum. By Clarence R. Shoemaker. (No. 2626.) Pp. 26. Vol. 69, Art. 1: A new Species of Fluke, *Parametorchis noveboracensis*, from the Cat in the United States. By See-Lü Hung. Pp. 2. (Washington, D.C.: Government Printing Office.)

The Physical Society of London. Proceedings, Vol. 38, Part 4, June 15. Pp. 277-336. (London: Fleetway Press, Ltd.) 6s. net.

Memoirs of the Department of Agriculture in India. Chemical Series, Vol. 8, No. 9: Nutrients required for Milk Production with Indian Foodstuffs. By F. J. Worth, Asst.-Prof. Labh Singh and S. M. Husain. Pp. 153-187. (Calcutta: Government of India Central Publication Branch.) 14 annas; 1s. 6d.

Government of Madras: Local Self-Government Department (Public Health). Report of the Chemical Examiner's Department for the Year 1925. Pp. 13. (Madras: Government Press.)

Report of the Department of Industries, Madras, for the Year ended 31st March 1925. Pp. v+102. (Madras: Government Press.) 6 annas.

Meddelanden från Statens Skogsförsöksanstalt. Häfte 22, Nr. 3: Till Kottklängningens teori och praxis (Zur Theorie und Praxis des Klengprozesses). Av Lars-Gunnar Romell. Pp. 125-144. Häfte 22, Nr. 4: Tillväxtprocentens Beräknande (The Calculation of the Increment percent with the Method of Compound Interest). Av Sven Petrini. Pp. 145-168. Häfte 22, Nr. 5: Studier över Barrskogens Humustäcke, dess Egenskaper och Beroende av Skogsvården (Studien über die Humusdecke des Nadelwaldes, ihre Eigenschaften und deren Abhändigkeit vom Waldbau). Av Henrik Hesselman. Pp. 169-552. Häfte 22, Nr. 6: Om Uppskattningen på Försöksparkerna, av Sven Petrini; Redogörelse för Verksamheten vid Statens Skogsförsöksanstalt under år 1925. Pp. 553-590. (Stockholm: Centraltryckeriet.)

Diary of Societies.

AUGUST 4 TO 11.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (at Oxford).

Wednesday, August 4 (in Sheldonian Theatre), at 8.30 P.M.—H.R.H. The Prince of Wales: Presidential Address.

Thursday, August 5.—At 10 A.M.—Addresses by Sectional Presidents: B.—Prof. J. F. Thorpe, F.R.S.: The Scope of Organic Chemistry.—C.—Prof. S. H. Reynolds: Progress in the Study of the Lower Carboniferous (Avonian) Rocks of England and Wales.—F.—Sir Josiah Stamp: Inheritance as an Economic Factor.—K.—Prof. F. O. Bower: 1860-1894-1926.

At 11 A.M.—Addresses by Sectional Presidents: E.—Hon. W. Ormsby-Gore: The Economic Development of Africa and its effect on the Native Population.—I.—Prof. J. B. Leathes: Function and Design.—Discussion (Section M): Cultivation Methods.

At 2.—Conference of Delegates of Corresponding Societies.—Sir John Russell: Regional Survey (Presidential Address).

At 2.15.—Dr. F. A. Dixey: Recent Criticisms of the Theory of Mimicry (Lecture).

At 2.30.—Discussion (Sections E, H): The Effect on African Native Races of Contact with European Civilisation.—Discussion (Section M): Soil Classification.

At 5.—Discussion: (Sections L, M): Educational Training for Overseas Life.

Friday, August 6.—At 10 A.M.—Addresses by Sectional Presidents: G.—Sir John Snell: The Present and Future Development of Electricity Supply—L.—Sir Thomas Holland. Discussion (Section C): Problems of the Thames Gravels.—Discussion (Section M): Agricultural Education.

At 11 A.M.—Discussion (Section L): Scholarships.

At 11.30 A.M.—Addresses by Sectional Presidents: D.—Prof. J. Graham Kerr: Biology and the Training of the Citizen.—J.—Dr. J. Drever: Psychological Aspects of our Penal System.—Discussion (Section K): Sex Determination in Plants.

At 2.30.—Discussion (Section I): The Relationship of Vitamin B to Bios.—Discussion (Section L): The Cinema in Education.

At 3-15.—Discussion (Section I): The Meaning of the Symptoms of Beri-beri.

At 3-30.—Discussion (Section L): Wireless in Education.

At 8.—Prof. A. S. Eddington: Stars and Atoms (Evening Discourse).

Monday, August 9.—At 10 A.M.—Addresses by Sectional Presidents: A.—Prof. A. Fowler: The Analysis of Spectra.—H.—Prof. H. J. Fleure: The Regional Balance of Racial Evolution.—M.—Sir Daniel Hall: The Limits of Agricultural Expansion.—Discussion (Section B): Tautomerism.—Discussion (Section L): Recent Advances in Educational Science.

At 11 A.M.—Discussion (Section K): Vegetative Propagation.—Discussion (Section D): The Training of a Zoologist.

At 2.—Discussion (Sections D, H, J): Heredity in its Physical and Mental Aspects.

At 8.—Prof. H. F. Osborn: Discoveries in the Gobi Desert by the American Museum Expeditions (Evening Discourse).

Tuesday, August 10.—At 10 A.M.—Prof. J. S. Huxley: The Study of Growth and its bearings upon Morphology (Lecture).—Discussion (Section L): The Public School System.

At 11 A.M.—Discussion (Sections C, D, K): The Conception of a Species.

At 11.30 A.M.—Discussion (Section M): The Feeding of the Dairy Cow.

At 12 noon.—(Section I) by Dr. J. S. Haldane: Acclimatisation to High Altitudes (Lecture).

At 2.—Conference of Delegates of Corresponding Societies.

At 2.30.—(Section J) by Miss W. Spielman: Recent Progress in Vocational Selection (Lecture).

At 5.—Sir F. Keeble: The Nervous System of Plants (Lecture).

Wednesday, August 11.—At 11 A.M.—Discussion (Section E): Regional Work in Geography.

At 12 noon.—Concluding General Meeting.