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## The Centenary of the University of London

**D**URING the week June 29–July 3 will be celebrated the centenary of the University of London. The granting of its first Charter in 1836 by H.M. William IV was an important landmark not only in the history of education but also in the history of science itself. It must be remembered that, in the early nineteenth century, England had only the two Universities of Oxford and Cambridge, and these “kept the noiseless tenour of their way”, steeped in the traditional policy of medieval times and paying little attention to the new sciences which were then arousing the interest and enthusiasm of many men whose names were destined to be world-famous. Limited in curriculum for the most part to the study of mathematics and the classical languages, restricted in membership to those who subscribed to the doctrines of the Established Church, the older universities seemed to stand for all that was conservative and reactionary. The movement for a new university was one aspect of the general attack on privilege which resulted in the Reform Act of 1832 and the social and legal reforms associated with the names of Bentham and Brougham.

The establishment of the ‘godless’ University College at Gower Street in 1827 was regarded not only with derision but also with alarm. Many public men were seriously concerned at the growth of the new ‘liberal’ spirit, and grave doubts were expressed in Parliament, in the Press and elsewhere as to the desirability of encouraging such an institution. The struggle for recognition was long and bitter, but eventually the Government was forced to give way, and the University of London came into being. Even then, it was only a compromise : the new University was constituted

solely as an examining and degree-giving body, and the teaching was entrusted to the two Colleges, University and King’s, which were already in existence. The despised infant, unwanted and debarred from its full rights, nevertheless thrived well, and soon began to show a lively interest in the new sciences. This was no doubt due to the composition of the Governing Body, which included some of the most eminent men of the Victorian age. The Charter of 1836 nominated as fellows and members of the Senate no less than fifteen fellows of the Royal Society, among whom were Airy—the Astronomer Royal—Neil Arnott, Francis Beaufort, John Shaw Lefevre, Peter Mark Roget, Nassau Senior. Michael Faraday, especially, played a prominent part in the affairs of the University for nearly thirty years. There was no lack of such men to carry on their policy : later there occur in the minutes of the Senate the names of Hooker, Huxley, Lister, Paget, Sharpey, Foster and Ray Lankester.

Under the guidance of these eminent men, the examination curriculum was established on a broad and truly liberal basis : and a high standard was set and maintained. Recognition was accorded to subjects previously either neglected or completely ignored, such as English, history, modern languages, chemistry. The pioneers justified the inclusion of these, not only as subjects worthy of study in themselves but also as providing a training for the mind equally as beneficial as that claimed for the more ancient studies. What Arnold of Rugby achieved for the Faculty of Arts, Faraday and others did for the Faculty of Science. A momentous step was taken when in 1860 degrees in science were instituted for the first time in England, and academic recognition thus obtained

for the scientific teaching which was being carried on in London and the provinces.

In medicine, too, great emphasis was from the beginning laid upon the necessity of adequate study of the pre-clinical sciences, and this did much to raise the standard of medical education—a sorely needed reform. Doctors of science were required to present a thesis which should stand the regulation test of the Royal Society and be judged to contain to some extent “an addition to knowledge”. The graduates themselves took a keen interest in matters of educational policy. They procured the recognition of the London medical degree as a licence to practise; and a resolution of Convocation in 1878 urged that encouragement should be given to the “cultivation of such higher and less usual branches of study as can be more conveniently or more efficiently taught by a central body”. To the very extent of its power, the University fostered the advancement of science, but its influence was, from the nature of things, only indirect. It had indeed one research institute, the Brown Institution, founded in 1871, and the names of successive professor-superintendents—Burdon-Sanderson, Horsley and Sherrington—are an eloquent tribute to the pioneer nature of its work.

In the colleges and institutions from which the University drew its candidates were many other leaders of science. University College established the first chemical and engineering laboratories in England. Chairs were established in geology, botany and zoology: the School of Anatomy and Physiology was made famous by Sharpey and his pupils, Michael Foster and Burdon-Sanderson. At King's College, founded in 1829 as the Tory counterblast to the Whig institution in Gower Street, the professoriate included Sir Charles Lyell, Charles Wheatstone, Clerk Maxwell, and later Lister himself. The great group of institutions founded in 1851 at South Kensington (later to be known as the Imperial College) was a pioneer in the teaching of science and technology, and reveres the names of Huxley, Tyndall and Unwin. For about sixty years, the University performed its function as an examining body. Though limited in scope, its influence on the development of secondary education in England (through the famous matriculation examination) was profound. On higher education, also, its influence was no less widespread and lasting, for to many of the provincial university colleges London acted as a sort of foster mother; and their students entered for the London examina-

tions until they themselves became fully-fledged universities.

As the nineteenth century drew to a close, there came the growing realisation that neither the University nor the teaching institutions it served were getting the fullest benefit from the existing relationship. After much debate and the deliberations of two Royal Commissions, a new constitution was granted in 1900. The University now took on all the functions of a teaching university. The existing institutions of university rank became Schools of the University, and then at last began the process of co-ordinating and unifying their vast resources. University and King's College, with their long and illustrious record of scientific achievement, were joined by the newly reorganised Imperial College, by the pioneer women's colleges such as Bedford and the London School of Medicine for Women, and by the medical schools attached to the great hospitals of the Metropolis. To these were later added several Schools devoted mainly to post-graduate study and research.

The last thirty years have seen an unprecedented advance in scientific knowledge and its practical application, and the University has had constantly to adjust itself to meet the growing demands upon it. New degrees and diplomas have been instituted, new subjects have been included in the curriculum. Chairs have been established in such diverse subjects as eugenics, aeronautics, social biology, chemical engineering, etc. The provision of scholarships and research funds and of spacious and well-equipped laboratories is the constant concern of the University and its Schools, which now possess some of the finest and most up-to-date laboratories in Great Britain. By the development of such specialised institutions as the London School of Hygiene and Tropical Medicine and the British Postgraduate Medical School, London is rapidly becoming a centre for advanced teaching and research for Europe and the Empire.

Delegates from universities and learned societies throughout the world will assemble in London to take part in the official celebrations of the centenary. Those from the United States include Prof. G. D. Birkhoff, dean of the Faculty of Arts and Science at Harvard, Prof. L. P. Eisenhart from Princeton, Prof. W. G. Whitman, head of the Department of Chemical Engineering at the Massachusetts Institute of Technology, Prof. H. Bateman of the California Institute of Technology, and Dr. R. E. Swain, chairman of the School of Physical Sciences at Stanford University. Distinguished

European men of science who are coming over include Dr. Jaroslav Heyrovský, who will represent the Charles University of Prague, the Bohemian Royal Society of Sciences and the Czech Academy of Sciences and Arts; Prof. Sem Saeland, Rector of the University of Oslo, who will represent also the Norwegian Academy of Sciences; Dr. Nils Svedelius, professor of botany in the University of Uppsala, and representative of the Royal Swedish Academy of Sciences and the Royal Society of Sciences, Uppsala; M. Jean Perrin, president, and M. Charles Fabry, of the Paris Academy of Sciences; Prof. P. Zeeman, Rector of the University of Amsterdam, and Dr. J. Huizinga, of the Royal Academy of Science, Amsterdam.

The celebrations include a special service at St. Paul's Cathedral, to be followed by a luncheon at the Guildhall given by the City Corporation. Evening receptions will be given by the Government and the London County Council. The Schools of the University will extend hospitality and be

open to inspection by the University's guests. At a reception to be given by the University, honorary degrees will be conferred on a number of eminent men. The degree of doctor of science will be conferred on Sir William Bragg, president of the Royal Society, on Prof. Albert Einstein and Prof. Max Planck in recognition of their great contributions to physical science, and on Prof. Johan Hjort, professor of marine biology at the University of Oslo and an outstanding scientific representative of the Scandinavian peoples. Sir Joseph Larmor, the distinguished mathematician, will receive the degree of doctor of laws, and Mr. H. G. Wells, who is a former student of Imperial College and who has done so much to promote interest in science and the scientific spirit through the medium of his pen, will become a doctor of literature. In honouring these men by admission to its society, the University adds lustre to its already brilliant record of service and achievement in the cause of science and learning.

## The Work of William B. Hardy

Collected Scientific Papers of Sir William Bate Hardy, Fellow of the Royal Society, Fellow of Gonville and Caius College, Cambridge

(Published under the auspices of the Colloid Committee of the Faraday Society.) Pp. xi+922 +15 plates. (Cambridge: At the University Press, 1936.) 63s. net.

**I**N a short preface Prof. Eric K. Rideal states that this volume of collected papers is published under the auspices of the Colloid Committee of the Faraday Society, but omits to mention that the Committee undertook this task at his suggestion. Contributions to the cost have been made by the Dominion Governments of Australia, South Africa and New Zealand; the master and fellows of Gonville and Caius College; the Royal Society and the Chemical, Biochemical, Physiological and Faraday Societies. The Cambridge University Press has produced the work in a style conforming to its usual high standard.

The contents of the volume fall into three very distinct groups: papers on physiological and histological subjects; papers on the fundamental problems of the colloidal state; and papers on the 'boundary state', that is, on the behaviour of liquids and solids at the interfaces between the two.

It is undoubtedly Hardy's work on colloids which has made his name familiar to the largest number of readers. The question of what led him to take up these researches is answered epigrammatically by the master of his college in a remark quoted in the preface: "Hardy once observed a cell divide under the microscope, and wondered why". If the elucidation of this process was his ultimate aim, the first steps towards it led him away from living matter. Dissatisfied with the prevailing views on protoplasm, based partly on *a priori* grounds and partly on brutal methods of staining and fixation, he investigated simple colloidal solutions. He established the connexion between electric charge and stability; clearly recognised the globulins as types of 'colloidal electrolytes', and went a considerable way towards elucidating the reversible sol-gel transformation. These investigations laid a great part of the foundations of modern colloid science, and the concept of the colloidal electrolyte in particular has been greatly extended by subsequent workers.

In view of the suggested stimulus to these researches, it is interesting to read Hardy's two addresses on "Living Matter", delivered in 1916 and 1928 respectively. In the first of these, parallels between processes in living matter and in

colloidal systems are still numerous, while the keynote of the second is a passage which must have chilled the audience (the Colloid Symposium at Toronto): "—let me state a belief which I have held for thirty years or more. It is that nothing is to be gained by claiming living matter as colloidal".

Since Hardy held this belief during the whole period of his work on colloids, it is obviously not disappointment in its outcome which induced him to turn to another set of problems: the effects on static friction between solid faces of films of lubricant "—when the solid faces are near enough together to influence directly the physical properties of the lubricant. What Osborne Reynolds calls 'boundary conditions' then operate, and the friction depends not only on the lubricant, but also on the chemical nature of the boundaries".

Investigations carried out with very simple means, yet with the most stringent exclusion of all sources of error, established two fundamental propositions: first that "resistance to slipping is due to cohesion even when a lubricant is present, and that a lubricant decreases friction by partly or wholly masking the cohesive forces of the solid; the second that a lubricant maintains its position against the normal pressure because its surface energy is a function of the thickness of the layer".

Hardy's researches, however, did much more than elucidate the effects of lubricants on static friction. By using friction—if the metaphor be permitted—as an indicator, he made the first complete study of films on solid surfaces and established the perfect continuity between their properties and those of liquid films on liquids, which are amenable to more direct methods of investigation and have been the subject of a vast volume of research.

It is highly characteristic that the first impetus to these researches was supplied by a trivial piece of domestic experience quoted by Lord Rayleigh: that tea cups would not slip on saucers wetted with water. Slight as the matter is, it gives rise to some reflections. No one will wish to imitate had examples by talking of 'English' science, but no one familiar with history can fail to remember that Hardy's whole procedure—the discovery of a problem in a set of facts either familiar or overlooked, its formulation, its investigation by new methods and the final demonstration of its unforeseen scope—has been that of a long line of English men of science. It may be a matter of taste or prejudice if one prefers their work to that of men who (to misquote Swift) consider themselves benefactors of the species for having made two methyl groups grow where only one grew before, and who report on these repeated labours in long strings of papers. There can, however, be little doubt that the papers written by the first-named group make the more attractive reading. What Hardy says of an old author applies to many of his writings: "His discussion is worth reading. It has the spacious dignity and charm which the hurry and specialisation of to-day have of necessity banished from scientific papers".

It is a piquant question whether they would ever have seen the light if Hardy had been a member of a foreign academy. One can scarcely imagine such a body receiving a paper on friction from a man who had achieved membership as a biologist with anything but a stern "Ne sutor ultra crepidam". But they are fortunately available, and those who still can spare time for reading original papers, even though their matter has long ago passed into text-books, will find plenty to repay them in the present volume. E. H.

## Birds of Beauty above Southern Seas

### Oceanic Birds of South America:

a Study of Species of the Related Coasts and Seas, including the American Quadrant of Antarctica, based upon the Brewster-Sanford Collection in the American Museum of Natural History. By Robert Cushman Murphy. Vol. 1. Pp. xxiv + 640 + 38 plates. Vol. 2. Pp. 641–1245 + plates 39–72. (New York: American Museum of Natural History, 1936.) 10.50 dollars.

THIS handsome and valuable work, published in two volumes, describes the appearance and habits of ocean birds of the southern hemisphere; birds which spend their lives normally on

the high seas, often at a great distance from the land to which they must periodically return to reproduce their species. Most of the birds described are unknown in British or even European waters, yet the habits and forms of not a few of them are akin to those of the ocean birds of the northern hemisphere, and in him who reads these volumes must arise the longing for an opportunity to voyage to those distant seas and lonely sun-drenched isles where these birds of beauty and grace have their home.

The first volume deals partly with the field work which has made possible the writing of the book. There is a full account of the geographical

background, and a most interesting section on ocean currents follows. The scope of the work may be realised from the places described. An imaginary circumnavigation of South America allows the reader to visit the Atlantic equatorial islands and the Atlantic sub-tropical islands. He then sails to the Atlantic sub-antarctic islands (the Falklands, Gough Island, Tristan da Cunha); to the Scotia Arc (South Georgia, the South Sandwich Islands, the South Orkneys and the South Shetlands), and to lonely and tempestuous Bouvet Island. After experiencing the rigours of the Antarctic, he rejoices in imagination when he is piloted to the Pacific sub-tropical islands of Juan Fernandez and others. In the section of the work dealing with the desert coast of South America he learns something of the wonders of the Guano Islands and their birds. The Galapagos Islands are described, and we are told that these islands are visited regularly by migrants from the north—the osprey, for example, and the swallow. The elusive island of Malpelo in the tropical Pacific bight “looming like a black iceberg” from ocean deeps gives sanctuary to sea birds of several species which “swarm above the unattainable summit” and which to this day have never been identified.

Part 2 of the work deals in detail with the ocean birds of the vast area described. This volume is most valuable since it is either first-hand information written with accuracy and vividness by Dr. Murphy himself, or descriptive accounts quoted from the writings of other careful observers.

An inspiring passage on St. Paul's Rocks is quoted here :

“I never properly realised the strength of an ocean current until I saw the Equatorial Current running past St. Paul's Rocks. Ordinarily at sea the current of course does not make itself visible in any way : one merely has its existence brought to one's notice by finding at midday, when the position of the ship is made known, that the ship is 20 miles or so nearer or farther from port than dead reckoning had led one to suppose she would be, and one is correspondingly elated or depressed. But St. Paul's Rocks is a small fixed point in the midst of a great ocean current, which is to be seen rushing past the rocks like a mill-race and a ship's boat is seen to be baffled in its attempts to pull against the stream.”

Again, we read :

“These Rocks lie in an ocean which is prevailingly stormless and cloudless, except during the brief tempests of the doldrum season. During even calm weather, however, they are usually beset by strong surf, which splashes them with spray to their summits and tends not only to wash away

the guano of the seabirds, but also to cause it to precipitate its salts in the form of a dense, shining, glassy layer. . . . So far as I can determine the resident birds are confined to three species, namely, the Brown Booby (*Sula leucogaster*) and both of the Atlantic noddies (*Anous stolidus* and *Anous minutus*).”

Moseley of the *Challenger* wrote and is quoted :

“FitzRoy visited St. Paul's Rocks on February 16 ; Ross on May 29 ; we on August 29 ; on all these occasions eggs and young birds were found. Hence breeding goes on all the year round.”

Remarkable birds of the ocean are described clearly and simply by Dr. Murphy, who has gathered considerable information that is new to science. There is a description of the curious flightless rail (*Atlantisia rogersi*) of Inaccessible Isle of the Tristan da Cunha group : of the fairy tern (*Gygis alba*), most ethereal of sea birds and so fearless that it can be caught by hand as it hovers inquiringly though without hostility about the human intruder ; of the Arctic tern (well-known in British waters) which for eight months of the year experiences no darkness, since after nesting in the Arctic, some at all events of these dainty fliers wander south and penetrate to the Antarctic seas, where they find again full summer and sunshine at midnight.

One of the most remarkable and beautiful birds described by Dr. Murphy is the snow petrel (*Pagodroma nivea*), which nests amid eternal snow and ice on the rocky frost-harried summits of south polar mountains. One colony of these strange birds was found nesting by the second Byrd Antarctic Expedition on a hill-top no less than eighty kilometres from the nearest sea (p. 673). There are arresting accounts of the boobies (*Sula*). The name is from the Spanish ‘bobo’, meaning a dunce. Boobies feed largely on flying fish, and these elusive fish the red-footed booby catches not only in the water but also in the air (p. 869).

Land is apparently as effective a barrier to the boobies of the South Atlantic as it is to the European gannet, which will fly many miles off its course rather than cross a narrow neck of land ; thus we are told that the Panama Isthmus is never crossed by boobies, with one possible exception, although pelicans pass over it confidently.

The limited range of the flightless cormorant (*Nannopterum harrisi*) of the Galapagos is a remarkable contrast to the immense ocean flights taken by the greater shearwater (*Puffinus gravis*), whose only known nesting grounds are on the islands of the Tristan da Cunha group. Many thousands of this large shearwater are found each summer on

the Grand Banks of Newfoundland, having travelled from the South Atlantic into the North Atlantic via the water of the tropical seas, which they cross without delay as though heat and cloudless weather were distasteful to them. Dr. Murphy makes the interesting suggestion that with these shearwaters an annual breeding season may have been replaced by a longer reproductive rhythm. The Manx and the sooty shearwater also move between the north and south Atlantic zones.

The volumes are illustrated by many excellent photographs, and beautiful coloured reproductions of paintings done by Francis L. Jaques. The print is good, and there are a clear index and bibliography. The work will rank as a standard one on the subject. Dr. Murphy must have travelled almost as widely as the greater shearwaters in writing it; must have had many adventures and have suffered many hardships which his modesty forbids him to mention.

S. G.

## Hindu Ideas of Self and Mind

### The Birth of Indian Psychology and its Development in Buddhism

By Mrs. Rhys Davids. A rewritten and enlarged edition of "Buddhist Psychology". Pp. xii + 444. (London: Luzac and Co., 1936.) 5s.

MRS. RHYS DAVIDS has long been recognised as one of the leading European authorities on Pali and Buddhist literature. In this work she endeavours to trace historically the rise and development of Hindu reflection on man and the human mind during a period of more than a thousand years. Embodying as it does the fruits of well-nigh half a century's labour, the volume cannot fail to be appreciated by all who are interested in Indian culture.

Her book, the author tells us (p. 355), is mainly concerned with beginnings. Accordingly, she devotes no small amount of space to the early Upanishads, and lays reiterated stress upon the distinction formulated in them between the man, or self, and the mind, conceived as an instrument of the self. To say that man is *ātman* or *ātmavant*, 'besouled', was equivalent to discerning in the self the potency of the divine nature, a 'being' that is in fact essentially a 'becoming', and as such surviving death. Moreover, as the 'subject' of mental experience, man was conceived as valuer and as user. He is, so it was inculcated, not body, sense or mind, but 'has' all these, uses them and values by them. In short, man's attributes were not thought of as going to produce a self as a product; contrariwise, in the self they had their basis and *raison d'être*. On the other hand, the mind (*manas*) was spoken of as a wherewithal to act upon the body. Man "seizes hold of" and animates the body "with the mind"; "with mind" he sees, hears, feels, etc.

In the Middle Upanishads we find, it is contended, partly through the wave of monasticism

then commencing to make itself felt, the inculcation of a definite religious practice of introspection, which we do not yet find in the earlier collection. Sāṅkhyān terms and ideas came to be introduced in Brahmanic teaching. Inquiries into origins, pre-occupation with causes, led to "a dethroning of the man from his identity with the Highest". "He has become a *pratipuruṣa*, an individual, opening the way to the 'plurality of selves' in Sāṅkhyā" (p. 168). Along with this adopted exoteric analytic attitude there is to be noted the gradually increasing prevalence of the esoteric intuitive attitude, known as *yoga*. The control of mind, rather than its systematic development, was the leading motive in the later Upanishads of the middle period.

But Mrs. Rhys Davids offers strong grounds for holding that the teaching of Gotama and of the missionaries (mainly Brahmins) who started the movement destined to grow into Buddhism was not thus impregnated with these new ideas. They appear, it is true, in the Nikāyas (the oldest complete canon of Buddhist teaching which has come down to us), but between the birth of Buddhism and its 'scriptures' there was an interval of some four hundred years, and during that interval it is practically certain considerable changes in general outlook must have occurred. Mrs. Rhys Davids makes the attempt to disentangle, out of the later records, fragments which may be taken to represent the earlier teaching. She looks upon 'original Buddhism' as an intensifying, so to speak, of what was most characteristic in the older Upanishads. It laid stress, she thinks, upon the notion of the self as that real being who valued things with mind, upon the man as having within, as it were, a Most or Highest, as being in potency the Divine, a potency which was realisable, not by gnosis and ritual, but in conduct. The mind was not a complex of so-called *khandha*'s, but a

way in which the man or self valued things, a way in which he acted, which when desire or purpose were included in the thinking was described as *mano*.

Mrs. Rhys Davids then proceeds to examine in detail the views set forth in the Nikāyas regarding the self and the mind. Here, alongside many survivals of the original teaching, she discerns in the main an aberration therefrom. Ultimately we reach what she describes as "the Humian position in Buddhism". The change was, she conceives, chiefly due to the growth in north India of monasticism, and to the increasing preoccupation of Indian culture with the analysis of mind, known as *sāṅkhya*. The noteworthy feature in the Nikāyas is, we are told, the substitution, unexplained and undefended, of 'mind' for the 'man' or 'self'; by being resolved into five bundles of mental and bodily states (*kandha's*) the self as such was lost from view. Thus, in place of the positive 'becoming' and of the life 'beyond', as taught by the founder, latter-day Buddhists prescribe "the monk-goal of a waning-out (*nir-vana*) into an emptiness that is not—Man" (p. 431).

I add only a few words by way of criticism. The

Upanishadic distinction between the self and mind may, I take it, be looked upon as a sort of primitive adumbration of the well-known Kantian distinction between the 'pure' and the 'empirical' ego. Modern psychologists are practically unanimous in rejecting that distinction. The assumption of a single entity somehow related to a manifold of mental states, and yet in essence independent of them, leads, indeed, to intolerable perplexities. But it is important to realise that, if the notion of a 'pure ego' calls to be abandoned, the notion of an 'empirical ego', or of a 'mind' as merely a complex of discrete states or processes, must go along with it, for they are in truth correlative notions. The unity of the experiencing self is, in other words, to be sought within its experiences, and not in a "something, we know not what", lying behind them or floating above them. In short, the processes of thinking, feeling, desiring and so on, evince themselves as transient modes or phases of an indivisible conscious subject; and I cannot see that this conception of the self or mind endangers any one of the interests which Mrs. Rhys Davids is anxious to safeguard.

G. DAWES HICKS.

## Popular Stratospherology

### Exploring the Stratosphere

By Gerald Heard. Pp. vii +98 +9 plates. (London and Edinburgh: Thomas Nelson and Sons, Ltd., 1936.) 3s. 6d. net.

THE author of this small volume sets out to tell the man in the street all about the stratosphere in simple language—a worthy enough object. If the stratosphere becomes the most favoured region for long-distance aeroplane flights, it will, of course, have great practical importance to the general public. No one will deny that the stratosphere is of the utmost importance to meteorology, and that the electrical conditions prevailing at high altitudes are of the utmost importance to radio engineers, that the discovery that cosmic ray intensity increases with increasing height has great significance, and that generally speaking, the upper layers of the earth's atmosphere have great geophysical and astrophysical interest; nevertheless, Mr. Heard seems to us to show a lack of perspective in his first chapter, a general introduction which is packed with references to Magellan and Copernicus on one hand, and the stratosphere explorers (*stratonauts*) and theoretical investigators of the expanding

universe on the other. ("A vast, embracing idea of the whole universe, the whole of reality, is to-day forming in the human mind. It is being hastened forward by stratosphere exploration.") Mr. Heard is one of the 'Bright New Things', a citizen of the 'Brave New World'; surely he is maligning our grandfathers in an uncalled-for manner when he suggests that they would almost have called "this unbelievable surprise" (the constancy of temperature with increasing height exhibited by the stratosphere) "a breach of a Law of Nature?"

A second chapter describes the actual balloon flights, of which some very interesting photographs are reproduced, and a third chapter describes "The Uses of the Stratosphere". The references to Dr. Goddard's experiments on rocket flights are disappointing and inadequate. The fourth and last chapter on "The Meaning of the Stratosphere" is written with an over-emphasis similar to that in the introduction. We may conclude by hoping that that section of the public which makes a serious effort to follow the remarkable movements in scientific thought which are taking place to-day will be able to draw a distinction between a good journalist writing about science and a good scientist trying to write journalism.

R. v. d. R. W.

**The Head-Hunters of Western Amazonas:** the Life and Culture of the Jibaro Indians of Eastern Ecuador and Peru. By Prof. Rafael Karsten. (Societas Scientiarum Fennica: Commentationes Humanarum Litterarum, 7, 1.) Pp. xvi+598+34 plates. (Helsingfors: Societas Scientiarum Fennica, 1935.) n.p.

To the outside world, the Jibaros, the "Head-Hunters of the Western Amazonas", are best known as the source of the shrunken human heads, which are to be found in most ethnological collections. To the anthropologist, they are the most important members of a race, or group of Indians comprising a large number of tribes, inhabiting eastern Ecuador and Peru, who exemplify the forest culture of South America.

Dr. Karsten has spent an extended period of observation among the Jibaro on two occasions—in 1916–18 and 1928–29. Some results of his first visit were published by the Smithsonian Institution of Washington, D.C., in a memoir which dealt with the technique followed in the preparation of the shrunken heads and the cultural setting of the custom, which plays such an important part in war and religious belief among the members of the tribe. This account, the first, and indeed the only, authoritative report on the practice, is incorporated in the present volume with additions from subsequent observation. This, however, though perhaps the most important, and certainly the most spectacular, result of Dr. Karsten's investigations, is far from exhausting their interest. His fully detailed account of Jibaro culture and economy, and more especially of their feasts and dances, is of no little importance as a contribution to the study of the indigenous peoples of South America.

Dr. Karsten's investigations also covered the Canelos Indians, a group of mixed origin, now some two thousand in number, Christian in name, though preserving many of their pagan customs and beliefs. The Jibaro, on the other hand, though in contact with Europeans from the early days of the Spanish invasion, have sturdily resisted change in culture and language. The effect of outside influence, however, is now growing rapidly, a fact which gives this book an added value.

### Mathematics of Modern Engineering

By Robert E. Doherty and Prof. Ernest G. Keller. Vol. 1. Pp. xxi+314. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1936.) 17s. 6d. net.

THE manifold problems of modern engineering are making great demands upon the applications of mathematics, and, as a consequence, many textbooks dealing with the mathematical principles underlying such problems are making their appearance. The present volume—one of a series written in the interest of the advanced course in engineering of the General Electric Company—belongs to this class, and, as stated in the preface, is the result of "the joint participation of a mathematician who has worked in engineering, and of an engineer who has

worked with mathematics". The book is therefore neither a text on mathematics nor on engineering; it aims rather at bridging the gulf in engineering between physics and mathematics.

The four chapters consist mainly of the mathematical formulation and solution of modern technical problems. After a short but thoroughly sound introductory chapter, the basic principles of mathematics, essential to the higher problems of engineering, are dealt with. Chapter ii is therefore concerned with differential equations, including graphical and numerical methods of solution; determinants, Fourier series, transcendental equations and dimensional analysis. Then follows a chapter on vector analysis, with special reference to the problems of mathematical physics, and finally, Heaviside's operational calculus is very ably dealt with in Chapter iv. The text is clearly printed and well illustrated, whilst problems and exercises are provided for the student.

Mention should also be made of the very interesting "Foreword for Instructors" which appears at the beginning. This reviews the increasing use which is being made of the applications of mathematics to practical problems, thus clothing the spectre of pure abstraction in a really useful garment.

### Electricity

By Prof. W. L. Bragg. Pp. xi+286+34 plates. (London: G. Bell and Sons, Ltd., 1936.) 8s. 6d. net.

PROF. W. L. BRAGG'S course of six lectures "adapted to a juvenile auditory" delivered at the Royal Institution at Christmas 1934 forms the basis of this book. The first three chapters deal with the behaviour of electric charges, electrical currents and magnets, and with such fundamental apparatus as cells, motors and dynamos. The other chapters deal with power stations and the transmission of electrical current, telegraphs, telephones and wireless. The demonstrations which are a feature of these lectures are, in the book, replaced by many excellent illustrations. Although the language used is simple and the style most pleasing, technical terms are freely used. Prof. Bragg holds the view that as in many cases no equivalent word can be found, it is simpler to explain each technical term as it arises and then to use it freely. There is no mathematics in the book. Units in which electrical quantities are measured are made more realistic by quoting figures from familiar examples.

It is a little regrettable that in such an authoritative account some of the careless abbreviations of units used by radio engineers should have been allowed to creep in, here and there. For example, on p. 261 a frequency of 1,000 kilocycles is mentioned and on p. 266 the statement "The frequency is about thirty million" is made. We are certain Prof. Bragg does not allow his students to talk of a "velocity of a hundred" or even of "a velocity of 100 ft."

The book can be confidently recommended to those who desire a reliable account of electricity. Teachers and lecturers will also find it a valuable source of ideas for demonstrations and illustrations of obscure points.



Landolt-Börnstein Physikalisch-chemische Tabellen Fünfte, umgearbeitete und vermehrte Auflage. Herausgegeben von Prof. Dr. W. A. Roth und Prof. Dr. K. Scheel. Ergänzungsband 3, Teil 1. Pp. viii+734. 108 gold marks. Teil 2. Pp. viii+735-1814. 162 gold marks. (Berlin: Julius Springer, 1935.)

THE third supplement of the familiar "Landolt-Börnstein-Roth" tables is divided into three parts since a very large amount of new matter has to be dealt with. The two volumes under review are Parts I and II; Part III, dealing with electrical, magnetic and thermal properties, is to appear during this year.

A glance at the contents reveals some of the directions in which active research has been prosecuted during the last few years. Part I contains large additions to the tables of dipole moments, and records a considerable amount of new work on the compressibilities of liquids and gases. A new table of the occurrence and relative abundance of isotopes is appropriately introduced, since nearly all the elements have now been analysed. Another new table which indicates the trend of modern work records the nuclear distances and vibration frequencies of simple molecules deduced from infra-red and Raman spectra.

Part 2 contains a large amount of new spectroscopic data, including a useful table of series and terms in line spectra. The Raman effect, which was first tabulated in the second supplement of these tables, occupies 280 pages in the third supplement. New tables in Part 2 include those dealing with hyperfine structure of spectral lines, with band spectra, and with the absorption of light in the infra-red.

There is no need to stress the immense value of the Landolt-Börnstein-Roth tables and their supplements. Physicists and physical chemists owe a debt of gratitude to the present editors, Profs. Roth and Scheel, which is increased by each new volume that is published.

S. S.

### L'Ethnie française

Par Prof. Dr. George Montandon. (Bibliothèque scientifique.) Pp. 240+48 plates. (Paris: Payot et Cie., 1935.) 30 francs.

PROF. MONTANDON opens his study of the racial characters of the population of France dramatically with the statement that there is no French race—a statement presumably *pour épater le bourgeois*, as it is one with which the vast majority of his colleagues in anthropology would have no quarrel, and, indeed, would scarcely regard as novel.

After an exposition of the hologenetic point of view in the origin and distribution of races on the lines of his previous works, of which an excellent summary appears in *Scientia* for September, 1935, Prof. Montandon describes the distribution of racial characters in the French population so far as it has now been observed, and bases thereon a classification of racial types. His classification, as he points out, differs in certain essentials from that of Deniker, which distinguishes six racial types, three of them belonging or closely related to the Alpine group, and

three to the Mediterranean. Prof. Montandon distinguishes four main types with sub-types, and three more or less localised groups, the most important innovation on Deniker's classification being the recognition of a Nordic element with its sub-types. The author maintains that it is possible also to distinguish a Basque type, this differentiation being based mainly on the form of the nose. This type was overlooked by Deniker through his reliance on a too limited number of characters as his basis of classification.

Dr. Montandon's study is a welcome reopening of a question which requires reconsideration in the light of modern methods of inquiry and recent theory.

### An Introduction to Astronomy

By Prof. Robert H. Baker. Pp. vi+312. (London: Macmillan and Co., Ltd., 1935.) 12s. 6d. net.

THE author of this book is professor of astronomy in the University of Illinois. In 1930 he wrote "Astronomy", containing five hundred pages and published by the Van Nostrand Company, New York. The new "Introduction to Astronomy" is a shorter, simpler, but more attractive book, which presents the more essential elements of astronomy in a clear way by means of careful writing, skilful diagrams and good photographs. The charm of the book is somewhat disturbed by examination or revision questions at the end of each chapter. For example, on page 282 is a section headed "Interstellar space is not empty"; and seven pages later comes the question "What are the reasons for believing that interstellar space is not empty?" There are, however, questions requiring some imagination, such as (p. 305)—"Describe the appearance of the heavens as viewed from somewhere in the arms of Andromeda Nebula". The request to "show that Kepler's laws completely disproved the Ptolemaic system" (p. 160) raises some interesting philosophical questions which recall Poincaré.

This book is entirely devoid of any mathematical formulæ or calculations. The publishers are, however, justified in recommending students to "retain it for your reference library. You will use it many times in the future". Students should not burn their books behind them. No doubt as the evil visage of examinations recedes into the background, there will be more pleasure in life, in astronomy and in the book under review.

### An Introduction to Cultural Anthropology

By Prof. Robert H. Lowie. Pp. xiii+365. (London: George G. Harrap and Co., Ltd., n.d.) 10s. 6d. net.

STUDENTS of anthropology will welcome an English edition of Dr. Lowie's valuable review of the field covered by the study of cultural anthropology, which appeared in the United States in 1934. In collecting illustrative material, good use has been made of the results which have accrued from the intensive ethnographical study of the tribes of California, now in progress for some years, but comprehensively not so widely known by British students as it deserves.

## Sexual Periodicity and the Causes which Determine It\*

By Dr. F. H. A. Marshall, C.B.E., F.R.S.

**S**EXUAL periodicity, like all vital phenomena, is conditioned by the environment. Under the term 'environment' are included food, light, temperature, the humidity of the atmosphere and in aquatic species of animals, the hydrogen ion concentration of the medium and all the other chemical and physical conditions of the surroundings.

In all animals with reproductive organs, there is a tendency to an alternation of periods of activity and periods of rest associated with the development of the gonads and their exhaustion after they have discharged their products, as seen especially in those animals which spawn in bulk. In the lower animals in which there is no nervous system, the environment must be supposed to act directly upon the organism, and so influence the rhythm of reproduction. But in the higher animals sexual periodicity is determined and regulated by special factors which, though generally similar, show great variation in passing from group to group and from species to species and even from breed to breed.

These factors are: (1) endocrine factors associated especially with the gonads (and their successive functional phases) and with the anterior pituitary; and (2) exteroceptive factors which through the intermediation of the nervous system act upon and modify the endocrine factors. In the male mammal the testes produce a hormone, testosterone, which is responsible for all the changes which take place in the accessory sexual organs and in the secondary male characters in association with the sexual season; the testis is acted upon by a hormone formed by the anterior pituitary, and the latter organ is influenced by exteroceptive and possibly also other stimuli coming from the outside environment. In the majority of animals, light is probably the most important factor, but there are others.

In this way, the sexual rhythm is normally brought into relation with the seasonal changes, and the activity of the anterior pituitary and that of the testes rise and fall almost simultaneously. The accessory organs may be brought into a state of activity outside the normal breeding season by the injection of testicular hormone, by the injection of an anterior pituitary hormone, and, in many species also, by light irradiation.

In the female mammal, the processes are similar but the matter is complicated by the occurrence of pregnancy and, in polyoestrous species, by the

recurrence of heat periods at short intervals within the sexual season. There are two main phases of ovarian activity: (1) the follicular or oestrous phase which is induced by the ovarian hormone, oestradiol; and (2) the luteal phase of pregnancy, pseudo-pregnancy and the short dioestrous interval (in polyoestrous species), which are generally controlled by the hormone progesterone formed by the corpus luteum. The oestrous-producing substances found in the urine and elsewhere during pregnancy and the oestrin in the urine of the male are to be regarded as metabolic products of no physiological significance in relation to the control of the cycle, and it is to be pointed out, first, that many other substances having oestrogenic properties when injected into animals experimentally, have been extracted from organisms both animal and vegetable or even have been prepared synthetically, and secondly, that the oestrins which are excreted during pregnancy occur in the urine mostly in a combined and inactive form.

The endocrine activities of the ovaries are themselves controlled by the anterior pituitary, but whether there is one or more than one gonad-stimulating hormone formed by the anterior pituitary is still doubtful. It appears certain, however, that the secretory activity of the anterior pituitary must vary quantitatively if not qualitatively in different phases of the oestrous cycle. In species like the rabbit and the ferret which normally only ovulate after the orgasm, the switch over from the oestrous to the luteal phase of the cycle is effected by the anterior pituitary, and can be induced experimentally by the injection of a pituitary extract or by electrical stimulation of the central nervous system, thereby producing a general stimulus comparable to the orgasm. Moreover, in the rat, which ovulates spontaneously, a comparable condition of pseudo-pregnancy can be induced by experimental stimulation. The duration of the corpus luteum therefore may depend upon a hormonal stimulus from the anterior pituitary.

Further, the condition of pregnancy apparently reacts upon the pituitary and so controls the duration of the corpus luteum of pregnancy, and in rats stimulation of the nipple by sucking or artificially by other means and without the secretion of milk, will react on the pituitary and maintain the corpus luteum of lactation. In the absence of any exteroceptive stimuli which alter the phases of the cycle, the alternation between the oestrous phase and the dioestrous phase may

\* Substance of the Croonian Lecture delivered before the Royal Society on June 18.

be controlled by the ovary and anterior pituitary acting and reacting on one another, the pituitary initiating the oestrogenic activity of the ovary, which then has a temporary inhibiting effect on the stimulating capacity of the pituitary until such time as the production of oestrin is reduced, when the pituitary responds by an increased production of ovary-stimulating hormone. There is certain experimental evidence for this view.

The phase of lactation, also, is believed to be controlled by the anterior pituitary, and a substance has been extracted from it which stimulates milk secretion. The same substance, which is called prolactin, will also stimulate the crop gland in the pigeon and induce incubation. This is in conformity with the view that the reproductive hormones were metabolic by-products before they acquired hormonal activities, and that other organs and tissues in the body gradually learnt, so to speak, to respond to their presence in the progress of evolution and so promote functional correlation between different parts of the body.

In the female mammal, like the male, light and ultra-violet irradiation may induce oestrus outside the breeding season, the stimulus probably acting

upon the pituitary. The same is true for many species of birds, but both in mammals and birds there is much species variation, each kind of animal requiring its own appropriate stimulus of light or other factors. The successive phases of the cycle in birds are likewise under the influence of anterior pituitary gonad-stimulating mechanisms, but they are very liable to be interfered with by exteroceptive stimuli.

In most birds ovulation depends upon coition, or at any rate on sexual display, and there is evidence that courtship phenomena play an important part in effecting the necessary synchronisation of the anterior pituitary processes in the male and female. Such a theory as to the biological value of sexual display and adornment may take the place of the Darwinian theory of sexual selection, and without encountering the difficulties in the way of that theory, one of the most formidable of which is the fact that birds of many species pair before they display and often pair for life. The biological disadvantages of an ineffective synchronisation between the various generative functions is illustrated from the domestic animals, in which temporary sterility is common.

## The Universities of Great Britain: Education for a Living and for Life

THE universities of Great Britain have shown remarkable buoyancy in the rough weather produced by the world-wide financial and economic stresses of 1930 and following years. So much is clear from the University Grants Committee's recently published report\* for the period 1929-30 to 1934-35. A perusal of the Committee's previous reports makes it equally clear that this steadiness in the face of adversity is attributable in no small measure to the Committee's own foresight, watchfulness, sympathetic understanding and wise counsel. Appointed by the Chancellor of the Exchequer in 1919 to advise the Government as to the needs of university education in Great Britain, this Standing Committee has used with such tact and good sense its unrivalled opportunities of insight into university affairs as to enable it to play, with acceptance, the far more exacting and delicate role of adviser to the universities. "There has been," to quote the words

of Dr. Ernest Barker in *The Times* of April 18, "fostering care without control; there has been guidance and suggestion without command. The British universities draw one third of their annual revenue from the Parliamentary grants distributed by the Committee; but it is safe to say that not one of them has felt a feather-weight of domination from the Committee."

The past six years saw notable increases in university student enrolments, and great improvements in accommodation for laboratories, libraries, medical schools, research institutes, halls of residence and students' unions. A statistical table elsewhere in this article shows an increase in student numbers of eleven per cent as compared with an increase in the preceding quinquennium of three per cent; but the rate of increase is now slackening. Accumulated deficits were brought down from £200,000 to £72,000; capital benefactions were at the rate of a million pounds a year; additions to general endowment funds amounted to £2,280,000; but endowment incomes dropped owing to reduction in interest rates.

After reviewing salient developments since 1929, the Committee proceeds to a consideration of

\* University Grants Committee. Report for the period 1929-30 to 1934-35, including Returns from Universities and University Colleges in receipt of Treasury Grant for Academic Year 1934-35. (London: H.M. Stationery Office, 1936.) 4s. net. The Report is signed by Sir Walter H. Moberly (chairman), Sir Arthur W. Hill, Sir Geo. Macdonald, Sir Humphry Rolleston, Prof. G. I. Taylor, Prof. W. P. Wynne, Miss Margery Fry, Sir Frederic G. Kenyon, Sir Stanley Leathes (the membership of the last three dating back to the first appointment of the Committee in 1919) and John Beresford, secretary.

present needs and problems, taking as a central theme the *quality* of the education the universities are able to offer to their students. If this fundamental question has for a whole generation been relegated to the background, this is attributable to the bewildering rapidity with which changes have followed one another in the universities since the vast increase in secondary schools inaugurated in 1902. Conditions have been such that the authorities "were of necessity occupied breathlessly in a day-to-day endeavour to meet each new need as it arose". That, at any rate, is the view of the Committee, which holds, however, that quantitative growth will be less rapid in the immediate future, and that it is now possible for the universities to devote their main energies to improving the quality of the education which they offer, "and nearly everywhere we see signs that they are doing so".

In accordance with this view, the present report is chiefly concerned with the human undergraduate, his needs and problems, with halls of residence and the social life of students, with such increases of staff as would make possible more personal contact between staff and student, with the provision of adequate facilities for physical training for all students, with the prospects of finding employment on leaving the university. Nor does the Committee shrink from giving an answer to the question underlying all discussion of the quality of university education: What is its purpose? The answer is given in the form of a question as to the estate of the university graduate on completion of a professional training. (The employment of the masculine pronoun and "man" is, needless to say, not in a sex-exclusive sense.) "Has he also received that stimulation and enrichment of the whole mind which will enable him to lead a fuller and more interesting human life and to play more adequately his part as member or leader of the community? In other words, does a university training notably enhance a man's equipment, not only as a skilled worker but as a member of society and a human being?"

This accords with the traditional English conception of the purpose of a university education. Although evolved at Oxford and Cambridge, and although its evolution was conditioned by their college systems, this conception has profoundly influenced their younger sisters. It differs widely, of course, from prevalent ideals in some foreign countries. The character and extent of its influence are discussed in a supplement to *Time and Tide* of February 23 and March 2, 1935, entitled "English Universities, Old and Young", by a member of the Committee (Miss Margery Fry).

It is in the mainly non-residential universities that nearly four-fifths of the student population

of Great Britain are to be found, and the report deals at some length with the problem how far it is practicable for the authorities to amplify the existing provision for the social life of the undergraduate so as to offer more opportunities for friendship and fellowship between students. It passes on to the relation between student and teacher, taking as text Sir Walter Raleigh's "a university consists not of pupils and teachers but of junior and senior students", recapitulates the arguments against compulsory lectures and offers some suggestions aimed at providing facilities for "the vivifying contact of minds in the tutorial hour".

Closely interlocking with the problem of means whereby an improvement of the quality of university education may be brought about is the question of the outlook for students who have received such an education and have to enter employment of some kind afterwards. The discussion of this question is prefaced by a review of the growth of the student population since the beginning of the century. It seems that the proportion of students to the general population has increased from 1 in 1827 in 1900-1 to 1 in 885. There are wide divergencies between England, Wales and Scotland, thus: in England the number of inhabitants per student decreased from 2,204 to 1,013, in Wales from 1,606 to 741, in Scotland from 868 to 473. Corresponding figures relating to the year 1934 for some other countries (Italy, 808; Germany, 604; Holland, 579; Sweden, 543; France, 480; Switzerland, 387; United States, 275) are quoted from a publication by the International Student Service entitled "Planless Education, an International Study of the Unemployment in the Learned Professions".

Statistics concerning the number of students in the universities of Great Britain are given below.

	FULL-TIME STUDENTS		
		1928-29	1934-35
Oxford and Cambridge	Men	8,900	9,231
	Women	1,312	1,333
	Total	10,212	10,664
London	Men	6,003	7,875
	Women	3,138	3,381
	Total	9,141	11,256
English provincial univs. (eight) and three independent colls.	Men	7,526	10,003
	Women	3,819	3,565
	Total	11,345	13,568
All England	Men	22,429	27,159
	Women	8,269	8,329
	Total	30,698	35,488
Wales	Men	1,660	2,562
	Women	1,004	938
	Total	2,664	3,500
Scotland	Men	7,321	7,478
	Women	3,626	2,768
	Total	10,947	10,246
Great Britain	Men	31,410	37,199
	Women	12,899	12,035
	Total	44,309	49,234

Although it is certain that unemployment among university graduates in Great Britain has not hitherto been nearly so serious as in some foreign

countries, the Committee endeavoured in the course of its visits to universities to ascertain what grounds there are for anxiety on this score. Its inquiries led to the conclusions that in England the output of graduates is not at present excessive in relation to the avenues of employment open to them; that in Wales (where the proportion of students to the general population increased from 1 in 1,005 to 1 in 741 in the years 1925-35) the waiting lists of graduates seeking employment as school teachers are far too long, and there is a certain amount of unemployment among other classes of graduates; and that in Scotland a temporary over-production of school teachers is in course of adjustment through a substantial diminution in the number of entrants to the universities, especially Edinburgh and Glasgow. In both Wales and Scotland the situation calls for vigilance on the part of the authorities.

In this connexion, the Committee points out that even where there is no actual unemployment, the situation cannot be regarded as satisfactory if much of the employment obtained is not suitable, involving a sense of frustration with consequent loss of efficiency. Accordingly it urges upon university authorities the pressing importance at the present time of perfecting means and methods of establishing effective contact between students and prospective employers.

In one field, that of Local Government service, which seems peculiarly fitted for and likely to derive very great benefit from the employment of university-trained recruits, the defenders of the present method of recruiting have hitherto successfully withstood not only the efforts of the Committee and the universities but also the representations on qualifications, recruiting, training and promotion of Local Government officers of the Royal Commission on Local Government and the Hadow Committee. The present report urges that local authorities, contributing as they do some £870,000 a year to the universities, should, by extending to university graduates all reasonable opportunity for obtaining work, "endeavour to reap a fair share of the harvest they have sown". For the rest, the Committee notes that a larger and larger number of industrial and commercial appointments are being thrown open to university graduates. "Industrial research and administration, the library service, journalism, the almoner service of hospitals and the like may, it is to be hoped, absorb increasing numbers."

It is well that the university authorities should bear continually in mind the practical necessities imposed by the operation of the laws of supply and demand in relation to recruitment for the various vocations, and the student's ambition to be qualified for earning a living; yet must they

guard against excessive preoccupation with vocational training. The Committee commends to the serious consideration of each of the universities severally the problem, "Has the time already arrived, or is it on the point of arriving, or is it still remote, when every addition to our numbers will tend to weaken the quality of the instruction and still more the value of the training for life which we seek to give?" The Committee emphasises the great importance, especially at the present time, of the impress received and the capacities developed by the student in the course of life as an undergraduate: "Every year 15,000 young men and women enter the universities. From their ranks, representing every section of society\*, are drawn the great majority of those who will become leaders in the national life. To ensure conditions of training which will enable them to go out into the world with minds richly informed, unsleeping in the exercise of a critical intelligence, and imaginatively alive to the human issues underlying the decisions they may be called on to make, is perhaps the highest form of service." Will the universities make haste to seize this opportunity of service, of leavening the whole community? We live in an age, as the Committee points out, when confidence in the power of human reason seems to be roughly shaken, when appeals to mass hysteria seem often more successful than appeals to reason.

This theme of training for life is further developed in connexion with the exceptional responsibility resting on the British universities at the present time, owing to the suppression in the universities of several European countries of all independent thought and critical discussion of the principles of government or of the meaning of life, while in other countries there is apparent both confusion of belief in regard to fundamental issues and apathy arising from failure to think seriously. "Certainly," says the Report, "it is no part of the duty of the university to inculcate any particular philosophy of life. But it is its duty to assist its students to formulate their own philosophies of life, so that they may not go out into the world maimed and useless. It should stimulate and train them, not of course necessarily to think alike, but at least to think, and to think strenuously about the great issues of right and wrong, of liberty and government, on which, both for the individual and for the community, a balanced judgment is essential to a rational life". The gap between these lofty aims and immediately practicable achievement is, no doubt, wide; the report essays to point the way towards bridging it.

\* Fifty per cent of the students in the provincial universities began their education in public elementary schools, and more than 43 per cent of Oxford and Cambridge students are assisted from other than personal and private sources.

## The John Innes Horticultural Institution

THE John Innes Horticultural Institution is a private foundation for research on plants. It was founded in 1910 under the will of the late John Innes, a resident of Merton, who died in 1904. The occasion of the present article is the completion of the first twenty-five years of work, which has been marked by the issue of a commemorative pamphlet by the Institution.

John Innes envisaged, in the first place, only a small training school for gardeners, but delay, due to litigation, in the drawing up of the scheme, and an unforeseen increase in the value of the estate, made it possible in 1909 for the trustees to embark upon a larger plan. The scheme as drawn up gave as the objects of the Institution "The promotion of horticultural instruction, experiment and research"; it was to "carry out investigations and research, whether of a practical or scientific nature, into any matters having reference to the growth of trees and plants generally". The Institution was established at Merton, some ten miles from central London. The property consists of about 15 acres of land close to John Innes's residence, the Manor House (now occupied by the Director). In the main garden are the biological and chemical laboratories, offices and library of the Institution, together with thirteen greenhouses and appropriate outbuildings for the garden establishment. The Institution also possesses ten dwelling-houses. The present staff consists of the director, Sir Daniel Hall, with sixteen scientific and seven administrative and technical workers, and forty-five gardeners and manual workers.

The intention of the founder with regard to the training of gardeners is met by the annual appointment, for a period of two years, of six student gardeners, who are paid a maintenance grant. These students are men of about twenty years of age, who must have had four years' gardening experience. They are accepted from all parts of the country. Lectures are arranged for them during the winter season, and they get a varied training in practical work. For the benefit of these students, a representative collection of indoor and outdoor plants is kept up. Since the foundation of the Institution, ninety gardeners have passed through this training. Of the former gardeners, sixteen are now in posts abroad, six are horticultural instructors in the county services and a large number are on the staffs of public parks and botanic gardens.

The trustees in 1909 appointed the late William Bateson to be the first director. Bateson having initiated the study of genetics in Great Britain, naturally turned his attention chiefly to plant breeding, though provision was made for cognate branches of study. The plants investigated in the early days included *Primula sinensis*, *P. kewensis*, *Pisum sativum*, *Lathyrus odoratus*, *Begonia*, *Pelargonium*, *Beta*, *Linum*, various fruit trees and a large range of forms showing variegation and somatic segregation. Four years after the work had begun, it was dislocated by the outbreak of the Great War, and came almost to a standstill in 1917.

After the War, when the threads were gathered together again, Bateson became converted to the importance of chromosome studies in connexion with genetics, and in 1922 he appointed W. C. F. Newton to the staff. Newton introduced a technique largely his own, and was able to solve problems of chromosome behaviour which had evaded previous workers on plant material. He found an apt pupil and ally in C. D. Darlington, who took charge of the cytological work on Newton's early death in 1927.

On Bateson's death in 1926, the directorship passed to Sir Daniel Hall, who maintained the general trend of the work, appointing J. B. S. Haldane to take charge of the genetics, and installing a biochemist. Research was continued on several experiments of long standing, including *Pisum sativum*, Mendel's classical subject, and *Primula sinensis*, which has a continuous genetic history since 1903, when it was first used as an experimental plant by Gregory and Bateson at Cambridge. Other genetical investigations were begun or extended: by J. Philp (now at Cairo) on Newton's poppy material; by C. J. Huskins (now at Montreal) on wheat and oats; by F. W. Sansome (now at Manchester) on *Lycopersicum*; by W. J. C. Lawrence (now curator) on *Dahlia*; with many other smaller problems. In a different branch of work, D. M. Cayley and A. W. McKenny Hughes discovered the virus origin of 'breaking' in tulips.

A considerable share of the experimental ground is taken up by the fruit department, the slow-maturing material of which needs a long period of cultivation. M. B. Crane has been in charge of this work since 1919. The experiments are planned from a theoretical point of view, but have several very practical bearings, particularly as regards cross-pollination and the improved varieties

which arise in the course of experiment. Government grants have recently allowed the Institution to engage two assistant pomologists to train under Crane's direction. The Institution is co-operating with various outside bodies, which are growing the new varieties of fruit trees and bushes to test their commercial value on a larger scale than could be done at Merton. A blackberry under the varietal name "John Innes" was recently put on the market through the medium of a trade firm.

The close co-ordination of genetics and cytology begun in 1922 has been continued and extended wherever possible, and is an essential feature of the Institution's method. In addition, there has grown up in the last ten years a school of pure cytology, developing its own special technique for studying heredity and variation and using as experimental material whatever organisms, plant or animal, lend themselves to the problems under investigation. In the last few years, with the advent of R. Scott-Moncrieff, a co-ordination of genetics with the biochemistry of flower-colour has begun, while the cytologists have been using X-ray technique in the solution of their special problems, apart from the use of such methods to induce mutations for genetic study. Sansome has collaborated with the Lister Institute on problems

of comparative vitamin C content in diploid and tetraploid strains of *Solanum Lycopersicum*.

The Institution has always welcomed visitors from home or abroad who were desirous of taking part in its work or carrying on suitable investigations of their own. There is room for about ten visitors in the various laboratories. Since 1910, some 176 men and women from all over the world have taken part in the scientific work of the Institution, and some six hundred scientific papers and communications have been published. The Institution was recognised in 1931 as a School of the University of London for higher degrees, though it does not accept students specifically to train for their Ph.D. It undertakes no formal teaching, but every two years or so a short course is organised in the summer (July 13-25 this year). On these occasions about forty lectures are given on the special studies of the Institution, and the course is open without fee to members of university and research station staffs and post-graduate students. The summer course is held in the hope of stimulating interest in genetics and cytology, which are as yet little encouraged in the universities, in the hope that these actively growing branches of science may come to take their place in the academic syllabus, and enable teaching to keep pace with research.

## The Total Solar Eclipse of June 19

### PRELIMINARY REPORTS

AT the time of going to press, the available information indicates that the observations of the total solar eclipse of June 19 were unusually satisfactory. By the kindness of Prof. B. P. Gerasimovič we have received news to the effect that at five out of the six stations from which he had received reports, the programmes were successfully carried out. The other—at Kustanay, where the Astronomical Observatory of Moscow, the National Geographic Society of Washington, and the Paris Observatory, were represented—unfortunately experienced rain. "In total, extremely successful eclipse" is Prof. Gerasimovič's summing-up.

The five successful stations were as follows:

(1) At Beloretchenskaya, where the Astronomical Observatory of Kharkov, the French Astronomical Society and the Leyden Astronomical Observatory were working.

(2) At Ak Boulak, near Orenburg. Here the Astronomical Observatory of Poulkovo and the Harvard College Observatory had planned extensive spectroscopic observations of the chromosphere

and corona in the ultra-violet and infra-red, and the programmes included the use of both fixed- and moving-plate cameras.

(3) At Sara, also near Orenburg, where a second expedition from Poulkovo and parties from the Astrophysical Observatory at Arcetri and the Astronomical Society of Czechoslovakia had prepared for further spectroscopic observations and direct photography of the corona.

(4) At Omsk, where a third group of observers from Poulkovo and expeditions from the observatories of Kyoto and Poland, as well as the British party under Prof. J. A. Carroll, were stationed. The programmes here included spectrophotometry and the study of polarisation phenomena, interferometric observations of chromospheric lines and internal motions in the corona, in addition to further direct photography of the corona and an attempt to obtain more complete records of the infra-red coronal spectrum.

(5) At Botchkarevo, where a party from the local observatory was engaged.

Prof. Stratton, who was in charge of the second British expedition, to Kamishari, in Japan, has cabled to us as follows: "Royds successful with Fraunhofer spectrum partial phase right up to totality. Flash spectrum observed through gathering clouds. Corona entirely spoilt by thick cloud". It appears, therefore, that the sun was obscured during the time of total eclipse by clouds which formed as a result of the fall of temperature, and dispersed shortly afterwards. It is clear, however, that observations during totality were not altogether prevented, and it seems that Dr. Royds, from the Kodaikanal Observatory, India, who joined this expedition for the purpose of observing the Fraunhofer spectrum of the sun at the limb just outside totality, has been successful, as the sky was apparently clear during the phases of the eclipse in which he was interested. Prof. Stratton's programme was an extensive one, involving much preliminary labour, and sympathy will be generally extended to him if his efforts have been fruitless. Elsewhere in the region of totality in Japan, the sky appears to have been cloudless, and Japanese and Polish astronomers are said to have made

successful observations. Dr. R. L. Waterfield, stationed in the Island of Chios, is reported to have had excellent conditions for observing. The sun was low in the sky, but the atmosphere was exceptionally transparent.

It is clear that if the work attempted at the many fortunate stations has been successfully done, some very valuable observations have been made. Good weather at every station was, of course, too much to expect, and while the failures must be regretted, there are good grounds for hoping that most, if not all, the results aimed at will have been achieved elsewhere. Prof. Carroll's success is particularly gratifying, coming, as it does, after four disappointments, and everyone will wish him a successful issue to his first opportunity of eclipse observation. There have been very few occasions on which the earliest post-eclipse prospects have been so favourable, and the astronomers of all the countries concerned are to be congratulated, and those of the U.S.S.R. and Japan warmly thanked for the ungrudging help they have given to their many visitors.

## Obituary

Sir George Hadcock, K.B.E., F.R.S.

THE death on June 4 at the age of seventy-five years of Sir George Hadcock has deprived artillery science of a research worker of great ability and acknowledged eminence.

The problems involved in the design and construction of modern ordnance call for the aid of the mathematician and physicist, no less than for the skill of the engineer and metallurgist, and Sir George possessed the experience and knowledge necessary for the investigation of such problems in their widest aspects. His early training as an engineer, coupled with his mathematical ability, enabled him to carry on the work begun by Sir Andrew Noble, whose fundamental researches may, very fairly, be said to have originated the study of artillery in Great Britain as a science. Thus, Noble had determined, by ingenious experiment, the gas pressures set up in a gun on firing, and had given curves relating the pressure to the position of the projectile in its motion down the bore. Such pressure-space curves, as they are called, are of fundamental importance to the gun designer, and Hadcock early set himself the task of developing a rational method which would give the required information, by calculation, from the data of the problem. He began with empirical formulæ but later developed analytical methods which enabled general internal ballistic calculations to be made.

Sir George Hadcock, indeed, had an abiding interest in internal ballistics, and made important

contributions to its mathematical theory in papers published by the Royal Society and the Royal Artillery Institution. His close association with a mathematician of the calibre of Sir George Greenhill was, no doubt, an incentive to him to carry out mathematical work, and he amplified some of Greenhill's investigations, notably those on the stability of spinning projectiles.

Sir George was always keen to follow up modern developments, and, being both a mathematician and a practical engineer, was able to combine theory and practice with happy results. This trait may be illustrated by his interest in the method of gun construction known as 'autofrettage', a method which utilises a single tube in place of the two or three common in the usual built-up gun; the hoop strength of the autofrettaged tube being increased by successive applications of internal pressure sufficient to overstrain its innermost layers. The effect is to make the outer layers behave as the shrunk-on outer tubes, in the built-up gun. The method had been developed abroad before the Great War, and certain French writers, notably Jacob and Malaval, had investigated the theory of plastic strain and its application to monobloc gun construction, calculation of the stress-strain system in an overstrained tube being possible, making certain simplifying assumptions.

The subject was investigated theoretically by Sir George, and he carried out, soon after the War, extensive experiments with the object of discriminating



between the rival theories in the field. These trials called for considerable ingenuity in the engineering technique employed, since very high pressures had to be maintained for a considerable time.

In other connexions, notably the design of apparatus to withstand high and rapidly applied pressures, Hadcock was an acknowledged expert, and his aid in this direction was sought not only by those engaged in research on artillery problems, but also by workers in purely scientific fields. He kept up to the last his interest in all matters connected with the science of artillery, and in his later years was glad to foster the work of younger contributors, always being generous in encouragement and advice.

C. A. C.

#### Prof. M. Baratta

MARIO BARATTA, the historian of Italian earthquakes and professor of geography in the University of Pavia, died on September 5, 1935, and his death leaves a gap, not only among the seismologists of his own country, but also among those of the world.

Baratta was born on August 13, 1868. At the close of his university career, he showed so marked a preference for the study of earthquakes that he was transferred to the geodynamic observatory of Ischia, then under the direction of the late Prof. G. Grablovitz. At the beginning of 1892, he was appointed an assistant in the Central Office of Meteorology and Geodynamics, where he served in the latter department until June 1896. It was here that he began his studies of Italian earthquakes that led up to his great work "I Terremoti d'Italia", published in 1901. A closely printed volume of 950 pages, it is certainly the most valuable history that we possess of the earthquakes of any country. Confining himself to earthquakes that were destructive or that verged on destructive power, he describes no fewer than 1364 such earthquakes between the beginning of the Christian era and towards the end of 1898. In the second part of the volume, he studies in detail the distribution of Italian earthquakes in 22 well-marked districts. A worthy successor to this history was his detailed report on the Messina earthquake of December 28, 1908, published in 1910.

## News and Views

### King's Birthday Honours

THE following names of men of science and others associated with scientific work appear in the list of honours conferred by the King on the occasion of His Majesty's birthday: *Viscount*: The Right Hon. Lord Dawson of Penn; *Barons*: Sir Herbert Austin, chairman of the Austin Motor Company, Ltd., for public services; Sir Malcolm Hailey, lately Governor of the United Provinces of Agra and Oudh; *K.C.B.*: Dr. A. S. MacNalty, chief medical officer, Ministry of Health and Board of Education; *Knights*: Prof. F. Anderson, emeritus professor of philosophy in the University of Sydney; Dr. H. N. Gresley, chief mechanical engineer, London and North Eastern Railway; Prof. C. S. Hicks, professor of human physiology and pharmacology in the University of Adelaide; Dr. G. T. Morgan, director of chemical research, Department of Scientific and Industrial Research; Dr. J. Morton, for services to the dye and colour industries; Captain H. A. S. Newton, member of Council and censor-in-chief, Royal Australasian College of Surgeons; Dr. E. O. Teale, mining consultant to the Government of Tanganyika Territory; Mr. F. J. West, for public services to Manchester.

*C.B.*: Dr. H. I. Bell, keeper of the Department of Manuscripts, British Museum; Dr. G. Rotter, director, Explosives Research Branch, Research Department, Royal Arsenal, Woolwich; *C.M.G.*: Dr. H. H. Scott, director of the Bureau of Hygiene and Tropical Diseases, London; *C.I.E.*: Prof. J. J. Harper-Nelson, formerly principal and professor of medicine, King Edward Medical College, Lahore; Dr.

F. J. F. Shaw, director, Imperial Institute of Agricultural Research and Imperial economic botanist, India; *C.B.E.*: Mr. R. W. Thornton, agricultural adviser to the High Commissioner for Basutoland, the Bechuanaland Protectorate and Swaziland, and director of agriculture, Basutoland; Mr. G. S. Whitham, assistant director of ordnance factories, War Office; *I.S.O.*: Mr. E. T. McPhee, Commonwealth statistician, Australia; Mr. M. P. Payne, chief constructor, Royal Corps of Naval Constructors, superintendent of Admiralty Experiment Works, Haslar; Mr. R. F. Taylor, statistical officer, Mines Department; *O.B.E.*: Mr. G. F. Clay, Colonial Agricultural Service, deputy director of agriculture, Uganda Protectorate; Mr. E. H. E. Havelock, secretary, Development Commission and administrative secretary, Agricultural Research Council; Mr. J. R. Hill, resident secretary in Scotland of the Pharmaceutical Society of Great Britain; Mr. J. Paley Yorke, principal of the London County Council School of Engineering and Navigation, Poplar; *M.B.E.*: Mr. M. R. Ry. Achariyar, executive engineer, Electricity Department, Madras; Mr. G. E. Bailey, accountant, National Physical Laboratory; Mr. F. H. Butcher, Madras Agricultural Service, lately curator, Government Gardens, Ootacamund, The Nilgiris, Madras; Mr. H. R. Edmunds, superintendent of agriculture, Kalimpong, Bengal; Mr. P. G. Lloyd, chemist and manager, Borough Sewage Works Department, Kingston-upon-Thames; Mr. M. R. Nayudu, acting chemical examiner, Madras; Mr. F. H. Newington, assistant analyst, Admiralty Chemist's Department, Portsmouth; Mr. E. W. Swanton, curator of the Haslemere Educational Museum, Surrey.

### Royal Society Elections

At the meeting of the Royal Society on June 25 it is proposed to elect Sir Thomas Middleton as a fellow under Statute 12, which provides for the election of persons who "either have rendered conspicuous service in the cause of science, or are such that their election would be of signal benefit to the Society". The following foreign members will also be elected: Prof. Sigmund Freud, Vienna; Prof. Ludwig Jost, Heidelberg; Dr. F. A. Vening Meinesz, Utrecht; and Prof. Hermann Weyl, Princeton.

Prof. H. E. Armstrong: Doyen of the Royal Society

WE are glad to have the opportunity of printing the following letter received by Prof. H. E. Armstrong from the president of the Royal Society:

"Dear Professor Armstrong,

"In the name of the Officers and Council of the Royal Society, and in my own, I send you hearty congratulations on your completion of sixty years in the Society's Fellowship and wish you continued health and activity in the years to come.

"Yours sincerely,

"W. H. Bragg, President R.S."

To the Royal Society's greetings we add our own to one who has long been a stimulating—and often provocative—contributor to our columns, and by his teaching and sympathetic guidance, has inspired several generations of students of various branches of chemistry. It may be recalled that on the occasion of Prof. Armstrong's golden wedding, a number of friends and old students presented to him a striking portrait by Mr. T. C. Dugdale, a photograph of which was reproduced in NATURE of September 10, 1927 (p. 379). Prof. Armstrong is the senior fellow of the Royal Society, having been elected in 1876; next in years of service come Sir James Crichton-Browne, elected 1883, and Sir J. J. Thomson, elected 1884. His fellowship of the Chemical Society, of which he was president so long ago as 1893–95, goes back even further, namely, to 1870. Scientific workers everywhere will wish to congratulate Prof. Armstrong on the accomplishment of so many years of fruitful activity.

### Sir Robert Mond and Industrial Chemistry

SIR ROBERT MOND has been elected president of the Société de Chimie Industrielle of France. Sir Robert, who was recently awarded the Messel Medal of the Society of Chemical Industry in Great Britain, is to deliver his medal address, on "Works as I have seen them grow", during the annual meeting of the Society in Liverpool on July 6–10. He has been, and still is, associated with a number of important firms in the chemical industry. A great deal of his original work has been in connexion with electro-chemical processes and industrial chemistry, and he was at one time associated in his work with Lord Kelvin. The Messel Medal of the Society of Chemical Industry is awarded every alternate year to a scientific worker who has attained eminence in applied chemistry.

### Nova Lacertæ 1936

A NOVA of the third magnitude was discovered on the night of June 18–19 by Dr. Nielsen, of Aarhus, Denmark, who happened at the time to be one of a party of astronomers on board the P. and O. steamer *Strathaird* which was going to view the total eclipse of June 19 from a station off the coast of Greece. The nova was observed through cloud in England on the night of June 19–20; estimates of the magnitude were difficult to make on account of the cloud, but the star was probably not brighter than the second magnitude. The spectrum was photographed at Greenwich and found to be of *F* type with strong absorption lines and weak emission bands, recalling the spectrum of Nova Herculis 1934 on December 23, 1934. Unfortunately, the weather has not been favourable for observations in and about London as we go to press, but according to Dr. Steavenson the nova is already decreasing in brightness. An accurate position was obtained at the Royal Observatory, Greenwich, with Airy's transit circle on the morning of June 21 by Mr. Symms, who estimated a magnitude of 3.0 m. The apparent position referred to the equinox of date (June 21, 1936) is R.A. 22<sup>h</sup>13<sup>m</sup>22.5<sup>s</sup>, Dec. +55° 17' 51". The nova may still be a naked-eye object for a few nights to come: since it is so far north, it is visible throughout these short nights, although the meridian transit takes place in the early morning. The nova should be identified readily as follows. Half-way between the constellation of Cassiopeia and the conspicuous figure of Cygnus is an equilateral triangle of stars formed by  $\delta$  Cephei,  $\zeta$  Cephei and the nova; half-way between the nova (the southernmost of the three) and  $\zeta$  Cephei is a centre star,  $\varepsilon$  Cephei.

### Louis Pasteur Film

THE Louis Pasteur film, of which a gala first night exhibition took place at the New Gallery Kinema, Regent Street, London, on Monday, June 22, in aid of St. Peter's Hospital, Covent Garden, was in more than one sense a remarkable event. The title role was taken by Mr. Paul Muni, who had obviously made a careful study of the great French savant in all his strength and weakness. Not only were his passionate ardour in research, dauntless courage in facing opposition and sympathy for human suffering admirably portrayed, but also his abruptness, outbursts of temper, and fits of despondency. It is, therefore, all the more regrettable that the film should contain many historical errors. We are shown, for example, Napoleon III, who in actual fact always took a warm interest in Pasteur's investigations, forbidding him to continue his researches on anthrax and to recant what he had already written on the subject, whereas his work on anthrax was not commenced until after the Emperor's death. Lister is represented as making a special journey to France to witness the results of Pasteur's inoculation of sheep against anthrax in 1881, whereas these two great men did not meet until 1892, when Lister represented the Royal Society at the ceremony held at the Sorbonne in honour of Pasteur's seventieth

## Recent Scientific and Technical Books

Volumes marked with an asterisk (\*) have been received at "NATURE" Office

## Mathematics : Mechanics : Physics

**Bragg, W. L.** Electricity. Ex. Cr. 8vo. Pp. xi + 286 + 34 plates. (London: G. Bell and Sons, Ltd., 1936.) 8s. 6d. net.\*

**Brun, E., et Jockey, E.** Chaleur (classes de mathématiques spéciales). 8vo. Pp. 488. (Paris: P. Lanore, 1936.)

**Davis, A.-H.** L'Acoustique moderne technique et industrielle. Traduit de l'anglais par M. Varinois. 8vo. Pp. xx + 422. (Paris: Dunod et Cie., 1936.) 86 francs.

**Duggar, Benjamin M.**, Edited by, with the co-operation of **Clark, Janet Howell; Cole, Kenneth S.; Daniels, Farrington; Failla, Giacchino; Packard, Charles; Popp, Henry W.** Biological Effects of Radiation: Mechanism and Measurement of Radiation, Applications in Biology, Photochemical Reactions, Effects of Radiant Energy on Organisms and Organic Products. (Prepared under the Auspices of the Committee on Radiation, Division of Biology and Agriculture, National Research Council, Washington.) Med. 8vo. Vol. 1. Pp. x + 676. Vol. 2. Pp. vii + 677-1343. (New York and London: McGraw-Hill Book Co., Inc., 1936.) 70s.\*

**Durell, Clement V.** General Arithmetic for Schools. Cr. 8vo. Pp. xvi + 572. (London: G. Bell and Sons, Ltd., 1936.) Without Appendix, without Answers, 4s.; without Appendix, with Answers, 4s. 6d.; with Appendix, without Answers, 5s. 6d.; with Appendix, with Answers, 6s.\*

**Filon, L. N. G.** A Manual of Photo-Elasticity for Engineers. Cr. 8vo. Pp. xii + 140. (Cambridge: At the University Press, 1936.) 5s. net.\*

**Freeman, H.** Examples in Finite Differences, Calculus and Probability. Supplement to "An Elementary Treatise in Actuarial Mathematics". (Institute of Actuaries Publications.) Demy 8vo. Pp. viii + 86. (Cambridge: At the University Press, 1936.) 8s. 6d. net.

**Gause, G. F.** Exposés de biométrie et de statistique biologique. 9: Vérifications expérimentales de la théorie mathématique de la lutte pour la vie. (Actualités scientifiques et industrielles, 277.) Roy. 8vo. Pp. 63. (Paris: Hermann et Cie., 1935.) 18 francs.\*

**Goursat, Édouard.** Leçons sur les séries hypergéométriques et sur quelques fonctions qui s'y rattachent. 1: Propriétés générales de l'équation d'Euler et de Gauss. (Actualités scientifiques et industrielles, 333.) Roy. 8vo. Pp. 93. (Paris: Hermann et Cie., 1936.) 20 francs.\*

**Koksmas, J. F.** Diophantische Approximationen. (Ergebnisse der Mathematik und ihrer Grenzgebiete, Band 4, Heft 4.) Roy. 8vo. Pp. 157. (Berlin: Julius Springer, 1936.) 18.40 gold marks.

**Kostitzin, V. A.** Exposés de biométrie et de statistique biologique. 8: Évolution de l'atmosphère, circulation organique, époques glaciaires. (Actualités scientifiques et industrielles, 271.) Roy. 8vo. Pp. 46. (Paris: Hermann et Cie., 1935.) 12 francs.\*

**Logsdon, M. I.** A Mathematician Explains. Enlarged edition. Roy. 8vo. Pp. xii + 190. (Chicago: University of Chicago Press; London: Cambridge University Press, 1936.) 11s. 6d. net.

**Menchoff, D.** La théorie des fonctions. 3: Les conditions de monogénéité. (Actualités scientifiques et industrielles, 329.) Roy. 8vo. Pp. 53. (Paris: Hermann et Cie., 1936.) 15 francs.\*

**Platrier, Ch.** Exposés de géométrie cinématique, Cours de l'École polytechnique. 1: Cinématique du solide et théorie des vecteurs. Roy. 8vo. Pp. 55. 12 francs. 2: La masse en cinématique et théorie des tenseurs du second ordre. Roy. 8vo. Pp. 82. 18 francs. 3: Ciné-

matique des milieux continus. Roy. 8vo. Pp. 35. 8 francs. (Actualités scientifiques et industrielles, 325, 326, 327.) (Paris: Hermann et Cie., 1936.)\*

**Pomey, J.-B.** Calcul des probabilités. 8vo. Pp. 87. (Paris: Gauthier-Villars et Cie., 1936.) 25 francs.

**Smith, William Griswold.** Practical Descriptive Geometry. Fourth edition. Med. 8vo. Pp. x + 275. (New York and London: McGraw-Hill Book Co., Inc., 1936.) 15s.

**Sorenson, Herbert.** Statistics for Students of Psychology and Education. Med. 8vo. Pp. vii + 373. (New York and London: McGraw-Hill Book Co., Inc., 1936.) 21s.

**Terry, Earle Melvin.** Advanced Laboratory Practice in Electricity and Magnetism. Revised by Hugo Bernard Wahlin. Third edition. Med. 8vo. Pp. xiv + 318. (New York and London: McGraw-Hill Book Co., Inc., 1936.) 18s.\*

**Zschokke, W.** Optik für Optiker. 8vo. Pp. 297. (Aarau: H. R. Sauerländer und Co., 1935.) 16 gold marks.

**Zuccani, L.** Trisection de l'angle et quatrième dimension: exposé simplifié d'une géométrie complexe. 8vo. Pp. 32. (Paris: Girardot et Cie., 1936.) 6 francs.

## Engineering

**Chapman, E. H.** Wireless To-day. (To-day and Tomorrow Series.) Demy 8vo. Pp. 158. (London: Oxford University Press, 1936.) 3s. 6d. net.

**Haslett, Caroline,** Edited by. The Electrical Handbook for Women. New and revised edition. Cr. 8vo. Pp. 428. (London: The English Universities Press, Ltd., 1936.) 5s. net.

**Hawks, Ellison.** Electricity for Boys. Demy 8vo. Pp. 392. (London: Ivor Nicholson and Watson, Ltd., 1936.) 7s. 6d. net.

**Hicknott, J. Russell.** Water Heating by Electricity. Cr. 8vo. Pp. 63. (London: Percival Marshall and Co., Ltd., 1936.) 1s. net.

**Judge, Arthur W.** Maintenance of High Speed Diesel Engines: a Practical Handbook for Diesel Engine Fleet Owners, Maintenance Engineers, Operators, Drivers and Mechanics. Demy 8vo. Pp. vi + 192 + 32 plates. (London: Chapman and Hall, Ltd., 1936.) 10s. 6d. net.\*

**MacGregor-Morris, J. T., and Henley, J. A.** Cathode Ray Oscillography. (Monographs on Electrical Engineering, Vol. 2.) Demy 8vo. Pp. xiii + 249 + 19 plates. (London: Chapman and Hall, Ltd., 1936.) 21s. net.\*

**Mallett, E., and Vinycomb, T. B.** Foundations of Technical Electricity. Cr. 8vo. Pp. 188. (London: Sir Isaac Pitman and Sons, Ltd., 1936.) 5s. net.

**Manning, G. P.** Reinforced Concrete Design. Second edition. Med. 8vo. Pp. xviii + 497. (London, New York and Toronto: Longmans, Green and Co., Ltd., 1936.) 21s. net.

**Moore, Herbert F.** Textbook of the Materials of Engineering. With a chapter on Concrete, by H. F. Gonnerman. Med. 8vo. Pp. xiv + 419. (New York and London: McGraw-Hill Book Co., Inc., 1936.) 24s.

**Reyner, J. H.** Radio Interference and its Suppression. Demy 8vo. Pp. viii + 130 + 11 plates. (London: Chapman and Hall, Ltd., 1936.) 9s. 6d. net.\*

**Tonkin, C. W.** Automobile Engineering. Cr. 8vo. Pp. 192. (London: Edward Arnold and Co., 1936.) 5s.

**Willheim, R.** Das Erdschlussproblem in Hochspannungsnetzen. Pp. viii + 342. (Berlin: Julius Springer, 1936.) 33 gold marks.

**Young, V. W., and Young, G. A.** Elementary Engineering Thermo-Dynamics. Med. 8vo. Pp. 200. (New York and London: McGraw-Hill Book Co., Inc., 1936.) 15s.

## Chemistry: Chemical Industry

**Department of Scientific and Industrial Research: Building Research.** Technical Paper No. 19: The Carbonation of Unhydrated Portland Cement. By D. G. R. Bonnell. Roy. 8vo. Pp. vii+59. (London: H.M. Stationery Office, 1936.) 1s. net.\*

**Gardner, William.** Chemical Synonyms and Trade Names: a Dictionary and Commercial Handbook. Fourth edition, much enlarged. Roy. 8vo. Pp. vi+495. (London: The Technical Press, Ltd., 1936.) 31s. 6d. net.\*

**Kortüm, G.** Das optische Verhalten gelöster Elektrolyte. (Sammlung chemische und chemisch-technische Vorträge, Neue Folge, Heft 26.) Sup. Roy. 8vo. Pp. 106. (Stuttgart: Ferdinand Enke, 1936.) 8.20 gold marks.

**Millard, E. B.** Physical Chemistry for Colleges: a Course of Instruction based upon the Fundamental Laws of Chemistry. (International Chemical Series.) Fourth edition. Ex. Cr. 8vo. Pp. ix+524. (New York and London: McGraw-Hill Book Co., Inc., 1936.) 21s.\*

**Mines Department: Safety in Mines Research Board.** Paper No. 95: The Inflammation of Coal Dusts—The Effect of the Fineness of the Dust. By T. N. Mason and R. V. Wheeler. Roy. 8vo. Pp. 16. 6d. net. Paper No. 96: The Inflammation of Coal Dusts—The Value of the Presence of Carbon Dioxide and Combined Water in the Dusts. By T. N. Mason and R. V. Wheeler. Roy. 8vo. Pp. 10. 6d. net. (London: H.M. Stationery Office, 1936.)\*

**Rosendahl, F.** Motoren-Benzol. (Sammlung chemische und chemisch-technische Vorträge, Neue Folge, Heft 27.) Sup. Roy. 8vo. Pp. 144. (Stuttgart: Ferdinand Enke, 1936.) 10.30 gold marks.

**Schönfeld, H.** Herausgegeben von. Chemie und Technologie der Fette und Fettprodukte. Zugleich zweite Auflage der Technologie der Fette und Öle, von G. Hefter. 5 Bände. Roy. 8vo. Band 1: Chemie und Gewinnung der Fette. Pp. 917. (Wien und Berlin: Julius Springer, 1936.) 145 gold marks.

**Siegel, W.**, Bearbeitet und herausgegeben von. Die Verfahren der anorganisch-chemischen Industrie. Sup. Roy. 8vo. Band 1: Berichtsjahr 1934. Pp. 501. (Berlin und Wien: Urban und Schwarzenberg, 1935.) 30 gold marks.

**Thieler, E.** Schwefel. (Technische Fortschrittsberichte: Fortschritte der chem. Technologie in Einzeldarstellungen, herausgegeben von B. Rassow, Band 38.) Pp. 136. (Dresden und Leipzig: Theodor Steinkopff, 1936.) 8 gold marks.

**Van Laer, Marc-H.** La chimie des fermentations. Pp. 350. (Paris: Masson et Cie., 1936.) 75 francs.

## Technology

**Allison, Archibald.** The Outline of Steel and Iron. Ex. Cr. 8vo. Pp. 191+20 plates. (London: H. F. and G. Witherby, 1936.) 6s. net.

**Barnard, J. E., and Welch, Frank V.** Practical Photomicrography. Third edition. Demy 8vo. Pp. xii+353+23 plates. (London: Edward Arnold and Co., 1936.) 21s. net.\*

**Dmitri, Ivan.** How to use your Miniature Camera. Demy 4to. Pp. 56. (London: The Studio, Ltd., 1936.) 10s. 6d. net.

**Dobson, Edward,** Based on the work of. A Rudimentary Treatise on the Manufacture of Bricks and Tiles. Fourteenth edition, thoroughly revised and rewritten and enlarged by Alfred B. Searle. Demy 8vo. Pp. xiv+226. (London: The Technical Press, Ltd., 1936.) 10s. 6d. net.\*

**Guillet, Léon.** Les métaux légers et leurs alliages: aluminium, magnésium, glucinium, métaux alcalins et alcalino-terreux. Tome 1: Historique, métallurgie, propriétés, situations économiques. Roy. 8vo. Pp. xiii+429+19 plates. (Paris: Dunod et Cie., 1936.)

**Hansen, M.** Der Aufbau der Zweistoff-Legierungen: eine kritische Zusammenfassung. Roy. 8vo. Pp. xv+1100. (Berlin: Julius Springer, 1936.) 87 gold marks.

**Heise, K.** Titanweiss. (Technische Fortschrittsberichte, Band 37.) 8vo. Pp. 100. (Dresden und Leipzig: Theodor Steinkopff, 1936.) 6 gold marks.

**Merry, E. W.** The Chrome Tanning Process: its Theory, Practical Application and Chemical Control. Pp. 143. (London: A. Harvey; New York: Chemical Publishing Co., Inc.; Toronto: Westman Publications, Ltd., 1936.) 10s. 6d. net.

**Mersereau, Samuel Foster.** Materials of Industry: their Distribution and Production. Revised edition. Ex. Cr. 8vo. Pp. xviii+541. (New York and London: McGraw-Hill Book Co., Inc., 1936.) 12s.

**Probst, E.** Handbuch der Betonsteinindustrie. Vierte völlig neubearbeitete Auflage vom Handbuch der Zementwaren- und Kunststeinindustrie. Roy. 8vo. Pp. 840. (Halle a.S.: Marhold Verlag, 1936.) 20.50 gold marks.

**Simpson, L. E., and Weir, M.** The Weaver's Craft. Second and revised edition. Cr. 4to. Pp. xiv+176. (Leicester: The Dryad Press, 1936.) 10s. 6d. net.

## Astronomy

**Stokley, James.** Stars and Telescopes. Demy 8vo. Pp. xiv+319+33 plates. (New York: Harper and Brothers; London: Hamish Hamilton, Ltd., 1936.) 10s. 6d. net.\*

## Meteorology: Geophysics

**Heard, Gerald.** Exploring the Stratosphere. Cr. 8vo. Pp. vii+98+9 plates. (London and Edinburgh: Thomas Nelson and Sons, Ltd., 1936.) 3s. 6d. net.\*

**Otto, W.** Starkregen in den Nordtiroler Alpen. 8vo. Pp. 74. (Würzburg: Konrad Tritsch, 1935.) 3.60 gold marks.

**Royal Meteorological Society.** Bibliography of Meteorological Literature. Prepared by the Royal Meteorological Society with the collaboration of the Meteorological Office. Vol. 3, No. 8 (July–December 1935). Roy. 8vo. Pp. ii+293–344. (London: Royal Meteorological Society, 1936.) 2s. 6d.\*

## Geology: Mineralogy

**Dacqué, E.** Versteinertes Leben. Sup. Roy. 8vo. Pp. 131. (Berlin: Atlantis-Verlag, 1936.) 5.60 gold marks.

**Dacqué, E.** Aus der Urgeschichte der Erde und des Lebens: Tatsachen und Gedanken. 8vo. Pp. 230. (München und Berlin: R. Oldenbourg, 1936.) 4.80 gold marks.

**Earle, Kenneth W.** The Geological Map: an Elementary Text Book for Students of Geography and Geology. Cr. 8vo. Pp. vii+96. (London: Methuen and Co., Ltd., 1936.) 3s. 6d.\*

**Gigmoux, Maurice.** Géologie stratigraphique. Deuxième édition entièrement refondue. Sup. Roy. 8vo. Pp. vii+709. (Paris: Masson et Cie., 1936.) 95 francs.\*

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### Miscellany

**Deming, Frank R.,** and **Nerden, Joseph T.** Teachers' Manual for Science in the World of Work. Demy 4to. Pp. 48. (New York and London: McGraw-Hill Book Co., Inc., 1936.) 1s.

"Ephesian" (Bechhofer Roberts). A. B. C.'s Test Case : an A. B. C. Hawkes Story. Cr. 8vo. Pp. 287. (London: Jarrolds (Publishers) London, Ltd., 1936.) 7s. 6d. net.\*

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**Hogben, Lancelot.** The Retreat from Reason. (Conway Memorial Lecture delivered at Conway Hall, Red Lion Square, W.C.1, on May 20, 1936.) Fcap. 8vo. Pp. xi+83. (London: Watts and Co., 1936.) Paper, 1s. net; cloth, 2s. net.\*

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birthday. Another objectionable feature is that we are shown Pasteur hurrying from one doctor's house to another on a rainy night to find an accoucheur for his daughter, the wife of one of his former opponents, and after a prolonged and fruitless search at last persuading the president of the Académie de Médecine, his chief antagonist, to carry out the confinement under antiseptic precautions. The doctor's consent, however, was only obtained on the condition that Pasteur signed a document to be published in the medical press that his researches in rabies had been a failure.

THE film, therefore, scarcely deserves the high praise given it by certain writers in the daily Press obviously unfamiliar with the details of Pasteur's life and work. A word of commendation, however, must be given to the producers, Messrs. Warner Brothers Pictures, Ltd., for the excellent background representing a doctor's consulting room in pre-antiseptic times, the rural scenery and Pasteur's laboratory. In a film of this sort, intended for entertainment rather than for instruction, it is possibly pedantic to expect absolute historic accuracy. It must be admitted that an average audience will probably obtain from the film some idea of what a scientific attitude implies. They will certainly realise something of the thrill of successful research, as well as the drudgery and self-sacrifice which it involves. Also, there will be no doubt left in their minds regarding the social implications of the work of the man of science. The film was shown by permission of Gaumont British.

#### Australian Research Ship

THE Commonwealth Council for Scientific and Industrial Research is about to build a specially designed Diesel-engined steel vessel for an extensive study of fish life in the ocean waters around Australia. Since the loss of the trawler *Endeavour* in 1914, with Dannevig on board and, presumably, the greater part of his records also, no systematic investigation of Australian fishing grounds has been carried on. The new vessel cannot be used for trawling, being designed mainly for the catching of surface swimming or pelagic fish by purse seine (and ring) nets; but it will be able to do a certain amount of work on demersal fish by means of Danish seine nets. The principal fish to which attention will be given at first are pilchards, Australian salmon, garfish, barracouta, members of the mackerel family including tunny, and other edible species. The length of the vessel will be 82 ft. and its beam 19 ft. Its extreme draught will be 8 ft. 4 in., and its displacement 108.5 tons. It will be capable of a speed of nine knots.

#### Australian Aborigines and Prospectors

AUSTRALIAN aborigines are said to have attacked and attempted to spear a party of gold prospectors who were searching for Lasseter's Reef, which is supposed to be rich in gold, and has been sought by such expeditions for years. According to reports from Alice Springs, it is stated in a dispatch from the Adelaide correspondent of *The Times* in the issue of

June 18, aeroplanes from Sydney reached Mount Bowley, a native reserve fifty miles from the West Australian border, on June 14, and the attack took place while the occupants were awaiting the arrival of the ground party with trucks. The blacks began by firing the porcupine grass, and after one of them had tried unsuccessfully to barter geological specimens, a group in war paint appeared and hurled spears. One prospector narrowly escaped being hit. The white party, which was armed with rifles and revolvers, then attacked and charged several times through the scrub, while further spears were thrown at them. No member of the party was injured. An investigation no doubt will be held. It will be important to know whether the attack was entirely unprovoked, or whether the party had unwittingly infringed what the tribesmen regard as their rights. The name of the tribe responsible is not mentioned, even if known; but neither the Arunta nor their neighbours, the Loritja, to whom the aggressors more probably belonged, according to recent accounts of them, are fiercely aggressive and liable to attack without reason, as are the northern saltwater black-fellows of Arnhem Land, who were responsible for the murder of Trooper McColl two years ago. Fear for their water supply is a frequent cause of trouble, and if prospectors for minerals are to be allowed to enter the reserves—generally it has been understood that this was forbidden—the risks of interference with tribal water-holes should be understood.

#### Transport Conditions in New York

AFTER studying transport conditions in America, Mr. J. P. Thomas, the manager of the London Transport Board railways, on his return to London gave an interview which is reported in *The Times* of June 19. He pointed out that New York would probably adopt a unified system of transport similar to that in use in London. He mentioned that the rush-hour problem in New York is as perplexing as in London, and intensive services have to be pressed into operation for very short periods at certain times of the day. In New York, certain business hours have been voluntarily altered by large offices and works so as to mitigate largely these rushes, with satisfactory results. If London firms would co-operate by altering the times of arrival and leaving of their staffs by 20 or 30 minutes, equally satisfactory results could be obtained, especially in the centre of the city. Mr. Thomas comments on the severely utilitarian appearance of New York's stations and on the difficulty of finding them, but he praises the efficiency of the underground staffs. He was impressed by the fact that the acceleration and retardation of trains in New York is much higher than in London, and yet they run equally smoothly. On some of the trains in New York, the acceleration is at the rate of three miles an hour a second and the retardation at the rate of four miles an hour a second. These rates are at least twice the rates at present adopted in London. Experiments have been carried out for some time in London on the 'Metrodyne' train. The experience gained in New York confirms the usefulness of this type of train, and the desirability of higher speeds.

### Submarine Light and its Biological Importance

SINCE submarine light was made accessible to accurate measurements through the development of the photo-electric cell, sub-surface light measurements have attracted an increasing number of workers in different countries. The vast importance of sub-surface daylight as a controlling influence on the photosynthesis of phytoplankton and on the movements of zooplankton has made marine biologists realise the necessity for observing and correlating this factor with phytoplankton growth, with the migrations on zooplankton and of fishes, and with the abundance of year-classes of the latter. At the 1936 meeting of the International Council for the Exploration of the Sea, a special session was devoted to "Submarine Daylight, its Measurement and Biological Effects". The biological importance of extensive observations on sub-surface illumination was especially emphasised by F. R. Russell and G. L. Clarke, both specialists on marine biology, the other authors considering more particularly the physical aspects of the observations.

H. H. POOLE dealt at the meeting with the various sources of error inherent in such measurements, and with the precautions necessary for their reduction or elimination. C. L. Utterback described a long series of measurements on the penetration of various spectral bands in Pacific waters, carried out with apparatus in some respects in advance of any used by other workers. The important question as to the unit of light intensity to be recommended for workers in the field was raised by A. Ångström, who pleaded for the cal./sq. cm./min. unit used in studies of solar radiation in lieu of the less well-defined photometric unit, lux or metre-candle, which is at present widely used. He suggested a method of standardisation by means of sunlight with suitable pyrheliometer measurements. H. Pettersson described his work on the direct measurements of the transparency of sea-water to artificial light. This method enables variations in opacity to be rapidly and accurately examined. Messrs. Ångström, W. R. Atkins (of Plymouth), Clarke, Pettersson, Poole and Utterback were appointed as a special committee for the purpose of working out definite proposals for instruments, methods of measurement, and choice of units, to be laid before the next meeting of the International Council in 1937.

### Congress on Photoluminescence

AN International Congress on Photoluminescence was held under the auspices of the Institute of Experimental Physics of the University of Warsaw and the Polish Physical Society at Warsaw on May 20-25. The central theme of the invited papers and the discussions was the mechanism of production, interpretation and theoretical aspects of absorption, fluorescence, and phosphorescence spectra. Belgium, France, Germany, Yugoslavia, Latvia, Poland, Rumania and the United States were represented by the 149 physicists attending the congress. At the opening ceremony, the members were welcomed by the Polish Minister of Education; and the President

of the Polish Republic, who was himself a professor of physical chemistry, received the group at his residence. Papers read and presented at the Congress are being published in a forthcoming issue of *Acta Physica Polonica*.

### Control of Rabbits

AN article on this subject in NATURE of May 16 referred to D. G. Stead's book "The Rabbit in Australia" in which the use of 'Cyanogas' is advocated. Capt. C. W. Hume, honorary secretary of the University of London Animal Welfare Society, which is acting as agent in Britain for Mr. Stead's book, informs us that 'Cyanogas' can be obtained from Messrs. George Monro Ltd., Waltham Cross, Herts, while 'Calcid' is supplied by the London Fumigation Co., Marlow House, E.C.4. A British product known as 'Cymag', having generally similar effects, can be obtained from Imperial Chemical Industries, Millbank, S.W.1. A fairly powerful pump is required and such pumps can be obtained from the above firms or from Messrs. W. J. Craven Ltd., 50 Port Street, Evesham, Worcestershire. Capt. Hume states that the principal obstacles to the control of rabbits are the reluctance of farmers to adopt a new and unfamiliar method and the difficulty of securing concerted action between neighbouring farmers. The following motion, drafted by the University of London Animal Welfare Society, for the appointment of a select committee was moved by Lord Merthyr in the House of Lords on May 14, and carried: "That a Select Committee be appointed to consider whether any measures, and if so what, ought to be taken for better protection of Agriculture and the land against the ravages of rabbits, and to what extent, if any, the prohibition of the use of Gin Traps would affect the attainment of the object aforesaid".

### Lily Year Book

THE Royal Horticultural Society's "Lily Year Book" for 1935 (from the Society's Office, Vincent Square, S.W.1. 5s. paper, 6s. cloth) is something more than a mere review of progress; some very fundamental contributions are set before its readers. It is perhaps not invidious to give pride of place to Dr. Fred Stoker's "List of Lily Names and Synonyms", as this is a very painstaking and complete attempt to reach orderliness and exactitude in lily nomenclature. Nearly 540 species, varieties, forms and crosses have been considered, accepted names are indicated clearly, and synonyms are printed in italics. Dr. M. A. H. Tincker describes "Experiments with Lilies at Wisley", Mr. W. E. H. Hodson writes on the control of lily pests, and the late Dr. D. Griffiths, an American authority on vegetative propagation of lilies, is represented by an article on "Vegetative Propagation of Hybrid Lily Clons". Mr. J. Ingram ministers to seed propagation by a paper on "Development of Lily Seedlings". Geographical distribution is a fascinating subject, and articles upon the native lilies of western America (Mr. Carl Purdy), eastern Asia (Mr. A. D. Cotton) and Asia Minor (Mr. E. K. Balls) are included. Mr. T. Hay has



reviewed "Some Lily Literature", while the various aspects of garden technique and the horticultural setting for lilies have called forth many articles, and inspired most of the plates. The volume is quite equal to the Royal Horticultural Society's high standard of literary production, and should commend itself to all who take delight in the beauty and skill of the garden.

#### The National Physical Laboratory

THE Report for 1935 is 249 pages in length and is published at 12s. It has the unfortunate duty of announcing the deaths of the first two Directors of the Laboratory. Other changes of staff have been few. At the silver jubilee of King George, medals were awarded to fifteen members of the staff for their distinguished work. The new photometry building has been completed, and it is hoped to make an early start in extending the acoustics building to meet the demand for information as to the sound insulation of floors. A new high-speed wind tunnel of the return flow type and one for investigating the effects of turbulence on larger scale models are under consideration. The general demand for assistance by industry has increased during the year. The provincial lectures on the work of the Laboratory have been continued, more than a dozen towns having been visited. Each department of the Laboratory gives an illustrated account of its activities in language which is not too technical for the average reader. A good example of the result of co-operation between several departments is the proof that the slip bands in a single crystal under stress contain disintegrated crystal fragments of size generally greater than  $10^{-5}$  cm. and dislocated grains generally greater than  $10^{-4}$  cm.

#### Forestry in Great Britain

*Forestry*, the journal of the Society of Foresters of Great Britain (9, No. 2, December 1935. Oxf. Univ. Press) opens with a presidential address to the Society by Sir Alexander Rodger in which he discusses the varying importance which forestry has attained in different countries. After alluding to the different types of areas set apart for the recreation of the public in the United States, Sir Alexander dealt with the position in Great Britain. There is at present an absence of a forestry sense; and owing to this absence the work of the Forestry Commissioners does not prove so easy to carry out as might otherwise be the case. The constitution of an informal committee composed of members of the Council for the Preservation of Rural England and members of the Forestry Commission was alluded to. It is hoped that this committee will help to disseminate a knowledge of the aims of forestry in Great Britain.

#### Care of Children and After-care of the Injured

WHEREAS arrangements for the supervision of the health of children up to the age of two years or thereabouts appear to be generally satisfactory, the Minister of Health does not consider that enough attention is being given in many areas to the health

of young children between eighteen months and five years. The Minister has therefore issued a Circular (Circular 1550. London: H.M. Stationery Office. 1d.) directing that it is essential that in all areas there should be systematic periodical health visiting of those young children who are not in attendance at school, and making suggestions for 'toddlers' clinics' and day nurseries. A representative Inter-Departmental Committee has also been appointed by the Minister of Health and the Secretaries of State for the Home Department and for Scotland to inquire into the arrangements made in Great Britain for the restoration of the working capacity of persons injured by accidents. This matter arose after consideration of a report upon the treatment of fractures issued in February 1935 by the British Medical Association.

#### Czechoslovak Scientific Expedition to Iceland

AN expedition to Iceland has been planned for this summer by a party of Czechoslovak men of science. The objects of the expedition include a geological and chemical study of the hot springs, geysers and volcanoes. The botanical members of the party, which is under the direction of Prof. Joseph Kunský, will make as comprehensive a collection of the flora as is possible during their visit. Film photographers are included in the party, and the taking of Nature study films constitutes one of the important objectives of this expedition.

#### Giovanni Canestrini

THE first centenary of the birth of the eminent Italian naturalist, Giovanni Canestrini, was recently celebrated at Trent on the initiative of the Museum of Natural History and the Society of Studies of Venezia Tridentina, when an address was delivered by Prof. Pasquini. Canestrini was born at Revo near Trent on December 26, 1835. He studied medicine at Vienna under Hyrtl and Brücke and shortly after qualification in 1860 was elected professor of comparative anatomy and physiology at the University of Padua, where he founded a laboratory for bacteriology, and was the first teacher of this branch of medicine. In addition to translating almost all Darwin's books into Italian, he was the author of original works on the fish of Italy, the origin of man, the theory of evolution, a critical exposition of Darwin's theory, Italian arachnids and Italian acari.

#### Dresden Meeting of the German Association

THE German Association of Naturalists and Physicians (Gesellschaft Deutscher Naturforscher und Aerzte) is to meet this year in Dresden on September 20-23. There were earlier meetings in Dresden in 1826, 1868 and 1907. Dresden has been for long a city of fine arts; its fame is founded on its picture gallery with the Sistine Madonna, its opera and its theatre. For more than a century it has been a nursery of scientific, medical and technical research. More lately it has become a city of public health, since the first international hygiene exhibition in 1911.

There is now a German Hygiene Museum and a Rudolf-Hess hospital; just for this year there is a German flower-show. The invitation is not only to members and to Germans, but also to all whether within or beyond the frontiers who are interested in scientific work in Germany. Applications for regular membership should be made to the G.D.N.A. Geschäftsstelle: Leipzig C1, Gustav-Adolf-Str. 12. Membership cards for the Dresden meeting are 10 RM. for old members but associate members for this one meeting are also admitted at 20 RM. Communications concerning the Dresden meeting only may be addressed to Prof. Dr. Rud. Zaunick, Dresden—A 16, Eisenstr. 4.

SOME of the more general addresses to be given at the forthcoming Dresden meeting concern cosmic radiation, measurement of gravity, intestinal auto-intoxication, chromosomes and heredity, high-frequency oscillations and ultra-sound, filterable virus, recent treatment of bone-fractures, chemo-therapy of streptococcus infections, Röntgen rays, the German Himalaya Expedition and television. The detailed programme will be ready in July. The draft already issued indicates possible sectional sittings (Abteilungssitzungen) ranging from 1a (Mathematics) to 37 (Balneology and Rheumatism). There are also the allied associations (Befreundete Gesellschaften) comprised in the Zweckverband and now forty-three in number. Only some of these are meeting in Dresden, but their additions to the programme include elements beyond uranium, colloid research, heredity, etc.

#### Announcements

HIS GRACE THE DUKE OF BEDFORD has resigned from the presidency of the Zoological Society of London after thirty-seven years tenure of the office. The Earl of Onslow has been elected president until the next anniversary meeting. Lord Onslow is president of the Society for the Preservation of the Fauna of the Empire, and has also recently been elected president of the Society for the Promotion of Nature Reserves.

DR. ALEX. R. TODD, Beit Memorial research fellow in the Department of Medical Chemistry, University of Edinburgh, has been appointed to the staff of the Department of Biochemistry of the Lister Institute as from October 1.

MR. E. J. FORSDYKE has been appointed director and principal librarian of the British Museum in succession to Sir George Hill. Mr. F. N. Pryce has been appointed to succeed Mr. Forsdyke as keeper of the Department of Greek and Roman Antiquities, and Mr. E. S. G. Robinson to be deputy keeper of the Department of Coins and Medals.

AN Institute for the Medicine of Sport has been founded at Hamburg under the direction of Prof. W. Knoll.

THE Minister of National Education in Rome has forbidden the professors and assistants of Italian

universities to join the Federation of Eugenic Societies, which aims at promoting the eugenic movement in Scandinavian, German and Anglo-Saxon countries, as well as sterilisation and birth control.

THE recently published January–April issue of *Guy's Hospital Reports* represents the centenary number of this well-known medical journal. In an introductory paper, Sir Humphry Rolleston points out that though the first number of St. Thomas's Hospital Report was published in 1835, there was an interval of thirty-four years in which no volumes were published. In addition to numerous contributions to medical science during the last hundred years, the *Guy's Hospital Reports* contain numerous obituary notices of members of the medical school.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:

An assistant master in the Engineering Department of the Newport Technical College—The Director of Education, Education Offices, Charles Street, Newport (July 1).

A civilian senior technical officer in the Admiralty Technical Pool (mechanical engineering)—The Secretary of the Admiralty (C.E. Branch), Whitehall, London, S.W.1 (July 3).

A civilian assistant (Grade III) in the Admiralty Technical Pool (electrical engineering)—The Secretary of the Admiralty (C.E. Branch), Whitehall, London, S.W.1 (July 3).

A chemist in the Department of the Government Chemist—The Government Chemist, Clement's Inn Passage, Strand, W.C.1 (July 4).

An assistant lecturer in agricultural bacteriology in the University of Reading—The Registrar (July 4).

A lecturer in mathematics in the Sir John Cass Technical Institute, Jewry Street, Aldgate, E.C.3—The Principal (July 6).

A lecturer in aeronautics in University College, Southampton—The Registrar (July 7).

An assistant lecturer in physics in University College, Gower Street, W.C.1—The Secretary (July 7).

A vice-principal of the Technical Institute, Royal Tunbridge Wells and the Technical Institute, Tonbridge—Dr. J. Lister, Technical Institute, Tunbridge Wells (July 11).

A lecturer in mathematics in the North Staffordshire Technical College, Stoke-on-Trent—The Clerk to the Governors, Town Hall, Hanley, Stoke-on-Trent (July 13).

A secretary and curator of the Jamaica Institute, Kingston, Jamaica—The Secretary, Museums Association, Chaucer House, Malet Place, London, W.C.1 (July 15).

A Corporation professor of electrical engineering in the University of Cape Town—The Secretary, Office of the High Commissioner for the Union of South Africa, Trafalgar Square, London, W.C.1 (July 28).

A lecturer in physiology in the Portsmouth Municipal College—The Registrar.

## Letters to the Editor

The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 1076.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

### Diffraction and Selective Adsorption of Atoms at Crystal Surfaces

IN two interesting papers on the reflection and diffraction of helium from crystal surfaces, Frisch and Stern<sup>1</sup> have shown that reflected and diffracted beams are sometimes unexpectedly weak. They examined the conditions under which this anomalous behaviour occurred, and found that it depended on the existence of a relation between the components of momentum of the impinging atoms. The results are reproduced in Fig. 1. Each small circle gives the

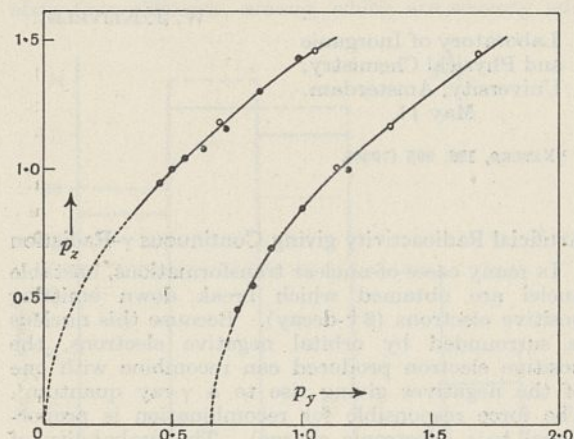


FIG. 1. The experimental results of Frisch and Stern and the theoretical curves.

relation between the component of momentum parallel to one of the axes in the surface lattice ( $p_y$ ) and that perpendicular to the surface ( $p_z$ ) for an incident beam which gave weak reflection. Each dot gives the components of momentum of a weak diffracted beam ( $p_y'$  and  $p_z'$ ). This figure shows clearly that the relation between  $p_y$  and  $p_z$  for weak reflection is the same as that of  $p_y'$  and  $p_z'$  for weak diffraction, and that the sets of points lie on two distinct curves.

These results may be explained quite simply. The potential field between an atom such as helium and a solid such as lithium fluoride can be represented by the first few terms of a Fourier expansion:

$$V_0(z) + V_1(z) [\cos ax + \cos ay] + V_2(z) [\cos 2ax + \cos 2ay] \dots \quad (1)$$

where  $x$  and  $y$  are suitable rectangular co-ordinates in the surface and  $z$  is normal to it. The function  $V_0(z)$  must be such as to have a single minimum at a finite distance ( $z = z_0$ ) from the surface, and for each value of  $z$  the magnitudes of  $V_1$  and  $V_2$  may be taken to be small compared with  $V_0$ . If there were no periodic terms in  $x$  and  $y$ , the motion in  $x$  and  $y$

would be unquantised and that in  $z$  would have a finite number of discrete negative energy levels (reckoned from a zero in which the atom is at rest at infinity) and a continuous positive range. All atoms would then be perfectly reflected if there were no interchange of energy at the surface.

The periodic field along the surface, represented by the second and third terms, causes diffraction. The solution of the appropriate wave equation for the motion in a field of the type (1) contains terms which correspond to first order diffraction with momenta components of  $p_x \pm ah/2\pi$ ,  $p_y \pm ah/2\pi$ , and terms which correspond to second order diffraction. One such diffracted beam has components of momentum  $p_x', p_y', p_z'$  given by

$$p_x' = p_x, \quad p_y' = p_y + \frac{ah}{2\pi}, \quad p_z'^2 = p_z^2 - \frac{ah}{\pi} p_y - \frac{a^2 h^2}{4\pi^2} \quad (2)$$

when there is no change of energy at the surface.

These relations hold for all positive values of  $p_x, p_y$  and  $p_z$ , provided  $p_z'$  is positive. When the expression for  $(p_z')^2$  becomes negative, a diffracted beam of the type  $p_y + ah/2\pi$  will not occur. But an exceptional case occurs when the relation between  $p_z$  and  $p_y$  is such that

$$p_z^2 - \frac{ah}{\pi} p_y - \frac{a^2 h^2}{4\pi^2} = -2mE_r, \dots \quad (3)$$

where  $E_r$  is one of the quantised levels of an adsorbed atom in the field  $V_0(z)$ . The atom is then no longer diffracted at a finite angle from the crystal, but ricochets along it with positive  $p_x$  and  $p_y$  and an oscillatory motion in  $z$ . The atom is captured by the surface field of the solid, a process which we may call *selective adsorption*. This causes a weakening in the intensity of the reflected beam.

The parabolic relation (3) fits the observations of Stern and Frisch remarkably well, as may be seen from Fig. 1 (where the unit of momentum is  $ah/2\pi$ ). From the fact that there are two such parabolas, we infer that there are at least two oscillatory states for an adsorbed helium atom on lithium fluoride. The values of the energy levels thus deduced are  $-57.5$  cal. and  $-129$  cal. If the latter is the lowest energy level, then this is equal to the heat of adsorption.

The weak *diffracted* beams can be explained in a similar way as due to the capture of the second order diffracted beam. It is easy to show that the condition for this is

$$p_z^2 - \frac{2ah}{\pi} p_y - \frac{a^2 h^2}{\pi^2} = -2mE_r, \dots \quad (4)$$

which, using (2), is equivalent to a relation between  $p_y'$  and  $p_z'$  exactly the same as (3).

The critical directions of the incident beam which lead to selective adsorption are given by the curves

of intersection of the parabolic cylinders (3) and (4) and a sphere the radius of which is equal to the momentum ( $P$ ) of the incident beam. (These curves also lie on the circular cylinders  $p_x^2 + (p_y + nah/2\pi)^2 = P^2 + 2mE_r$  where  $n = 1$  and  $2$ .)

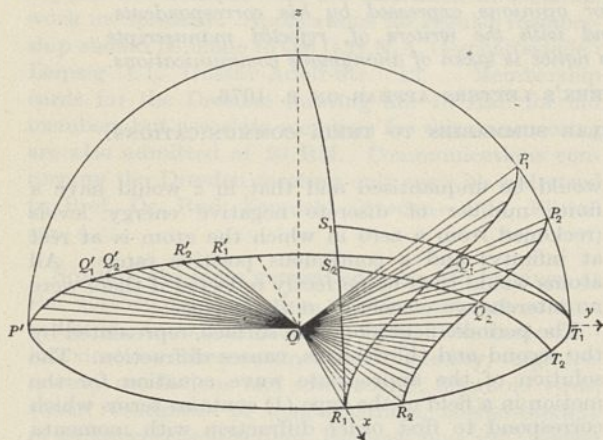


FIG. 2. The critical directions for selective adsorption.

The directions given by (3) are illustrated for a particular case in Fig. 2. The directions of the lines joining the curves  $P_1R_1$ ,  $P_2R_2$ , . . . to the origin are the critical directions. For each such incident direction there is a diffracted beam  $OP'$ ,  $OR'$  . . . in the plane of the crystal. There are similar critical directions  $S_1T_1$ ,  $S_2T_2$  . . . obtained by changing  $p_y$  to  $p_x$  in the equations (3) and (4). The direction  $OQ_1$ , where  $Q_1$  is the point of intersection of  $P_1R_1$  and  $S_1T_1$ , is doubly critical, for atoms may then be selectively adsorbed in two ways. As the radius of the sphere changes, the point  $Q_1$  will trace out a parabola in the plane  $p_x = p_y$ . A tangent to this parabola will give the direction where the most pronounced effect may be expected, when a non-monochromatic beam is used, provided the mean energy has the right value.

The fact that the theory here given is successful in explaining the observations suggests that helium atoms moving with the energy of the beams which Stern and Frisch used (corresponding to a temperature of 300° absolute) migrate freely along the surface. It seems reasonable, too, to infer that the inverse process takes place in Nature. Atoms moving along the surface with the right energy and in the right direction may be diffracted so as to leave the surface with positive energy and thus be evaporated. This is a new mechanism of evaporation which has not previously been suspected.

J. E. LENNARD-JONES.  
A. F. DEVONSHIRE.

University Chemical Laboratory,  
Cambridge.

<sup>1</sup> Frisch and Stern, *Z. Phys.*, **84**, 430 and 443 (1933).

### Raman Spectrum of Gaseous and Liquid Sulphur Dioxide and its Solutions in Water

THE Raman spectrum of gaseous sulphur dioxide at a pressure of 12 atmospheres was determined with large dispersion (Hilger  $E_1$  spectrograph). Only the strong frequency  $1150.5 \pm 0.5$  was found, whereas Bhagavantam<sup>1</sup> gives 1154. The two weak, diffuse lines of the molecule could not be obtained, probably

owing to the fairly strong background inevitable in very long exposures.

The frequencies of the liquid were redetermined, and the influence of the temperature on them was studied at 30° and 80°. Only a small displacement of the strong, sharp line towards higher values, with increasing temperature, was found ( $1144.3 \pm 0.2$  at 30°;  $1144.9 \pm 0.3$  at 80°). No influence on the broad and diffuse lines  $524.5 \pm 1$  and  $1336.0 \pm 1$  was perceptible.

For the frequencies of the  $SO_2$  molecule in water solutions at 60° the values  $531 \pm 1$  (0, br., diff.),  $1150.0 \pm 0.5$  (4 sharp) and  $1331 \pm 1$  ( $\frac{1}{2}$ , d) were obtained. No lines attributable to the ions  $SO_3^{''}$  or  $HSO_3'$  were found. (As the solution, although it was freed from oxygen and kept in an evacuated, sealed tube, became yellow owing to disintegration, very long exposures were impossible.) It is interesting to note that the larger part of the  $SO_2$  molecules in the solution are present as such, and that the frequency of the stronger Raman line agrees nearly completely with that of the gaseous  $SO_2$  itself. The state of the molecules in the solution is apparently comparable with that in the free gas.

H. GERDING.

W. J. NIJVELD.

Laboratory of Inorganic  
and Physical Chemistry,  
University, Amsterdam.  
May 11.

<sup>1</sup> NATURE, **126**, 995 (1930).

### Artificial Radioactivity giving Continuous $\gamma$ -Radiation

In many cases of nuclear transformations, unstable nuclei are obtained which break down emitting positive electrons ( $\beta^+$ -decay). Because this nucleus is surrounded by orbital negative electrons, the positive electron produced can recombine with one of the negatives giving rise to a  $\gamma$ -ray quantum<sup>1</sup>. The force responsible for recombination is proportional to  $e$  (electronic charge). The probability of such a recombination thus involves the factor  $e^2$ . Therefore the ratio of the probability of observing a  $\gamma$ -ray quantum to that of finding a positive electron must be of the order of magnitude  $e^2/hc \sim 10^{-2}$  ( $e^2/hc$  being the only dimensionless number which can be formed from  $e$ , the Planck constant  $h$  and the velocity of light  $c$ ).

We conclude that any  $\beta^+$ -emission must be accompanied by a weak  $\gamma$ -radiation. In analogy to the theory of optical dispersion, we can consider the decayed nucleus plus the (positive and negative) electrons as an *intermediate state*. If a transition from the *initial state* (non-decayed nucleus plus orbital electrons) to the *final state* (decayed nucleus plus a  $\gamma$ -ray quantum) is energetically possible, such a transition can occur even if the energy is too small to reach the *intermediate state* (decayed nucleus plus positive electron plus orbital electrons).

Artificial  $\beta^+$ -activity occurs, if the energy difference between the decayed and the undecayed nucleus is greater than  $mc^2$ . Emission of a continuous  $\gamma$ -ray spectrum (not accompanied by  $\beta^+$ -emission) should be observed if this energy difference is less than  $mc^2$ , but greater than  $-mc^2$ . The mean life of such a  $\gamma$ -active nucleus is about a thousand times longer than that of a  $\beta^+$ -active nucleus. It seems worth while to look for this new form of radioactivity.

*Note added in proof:* Only in one of 137 cases of decay is a  $\gamma$ -quantum emitted. In all other cases an unobservable and monochromatic neutrino radiation appears. Prof. W. Pauli remarked in a discussion that this radiation must be followed by emission of the characteristic X-ray spectrum of the atom preceding the unstable element in the periodic system. A complete account will be published in the *Helv. Phys. Acta*.

E. C. G. STUECKELBERG.

Institute of Physics,  
University of Geneva.  
May 7.

<sup>1</sup> Bloch and Møller, *NATURE*, **136**, 911 (1935); M. Fierz, *Helv. Phys. Acta*, **9**, 245 (1936); G. Rumer, *Sov. Phys.*, **9**, 317 (1936).

Distribution of Atomic Nuclear Spins

I HAVE previously pointed out<sup>1</sup> that the distribution of atomic nuclear spins appears to be entirely different in the two types of odd atomic weight nuclei, namely, class *A*, those possessing an odd nuclear proton, and class *B*, those possessing an odd nuclear neutron. Since then quite a number of nuclear spins have been added to those known, data now being available for sixty-four elements, among which are seventy odd

to arise from orbital moments (*l* values) of 0, 1 and 2 (and possibly even from 3 and 4 if cases exist in which five neutron spins add together). Further, *l* values of 2 and 3 would tend to give nuclear spins of  $\frac{3}{2}$  and so on. This view, therefore, accounts for the preponderance of spins of  $\frac{1}{2}$  and of low values in general. In class *A*, only *l* values of zero produce spins of  $\frac{1}{2}$  with certainty, *l* values of 1 resulting in both  $\frac{1}{2}$  and  $\frac{3}{2}$  spin values.

The distribution of the spins of even atomic weight atoms has received practically no attention. In 1932<sup>4</sup> I pointed out a relationship between nuclear spin and mass defect in the lighter elements. Only the atoms on the lower spur of the mass defect curve (atomic weights multiples of 4) definitely have zero nuclear spin. All the odd atoms and a number of even atoms lie on the upper spur. It was suggested that the less tightly bound particles which cause the large positive mass defect are likely also to produce nuclear spin. At that time the spin of <sup>14</sup>N=1 was the only spin greater than zero known to be exhibited by an even atom. I predicted, from the mass defect curve, spins of 1 for <sup>6</sup>Li and <sup>10</sup>B. We now know that the spins of the atoms <sup>2</sup>H, <sup>6</sup>Li, <sup>14</sup>N are equal to 1. All lie on the upper spur, and therefore it is now very reasonable to predict a spin of 1 for <sup>10</sup>B.

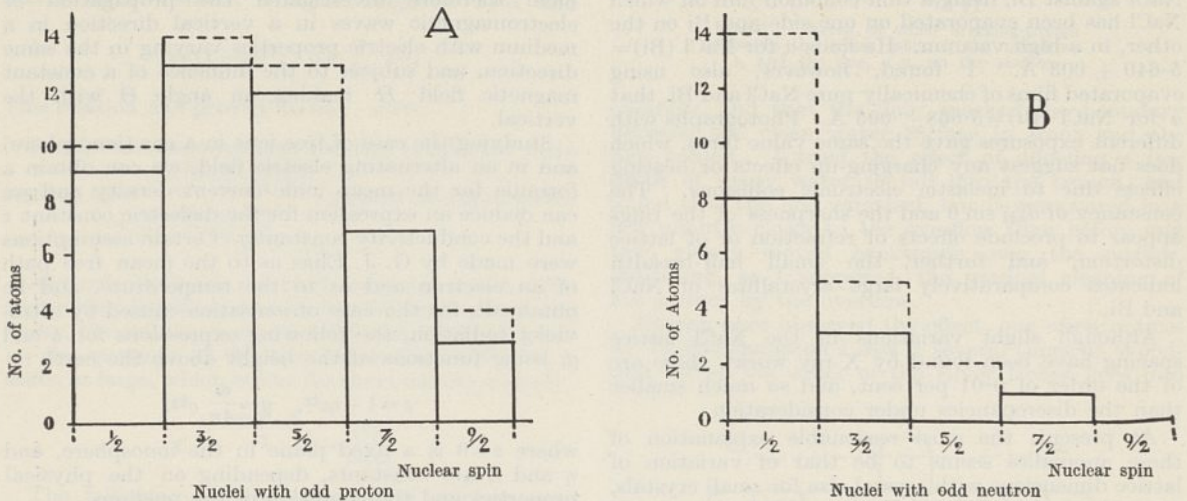


FIG. 1. Distribution of nuclear spins among the odd atomic weight atoms.

isotopes and seven even atoms. Improved distribution curves can thus be drawn, as in the accompanying diagram (Fig. 1). The full lines show the spin values known with certainty, and above these (dotted) are included the spins about the value of which there is yet some doubt (generally occasioned by the observation of fine structure in terms with *J* values insufficient to permit full fine structure multiplicity to be reached).

Inglis<sup>2</sup> has discussed this distribution with relation to the stabilities of the nuclear particles. The most striking feature of the curves is the preponderance of the spin  $\frac{1}{2}$  in class *B* nuclei (and of low values in general in this group). The improved curves show even better than before, that, as I have already suggested, in class *B*, neutron spin and orbital moments tend to oppose each other. This explains the differences in the two curves. According to the theory of Tamm and Altschuler<sup>3</sup> the total neutron spin in a nucleus can have the value  $\frac{1}{2}$  or  $\frac{3}{2}$  according to circumstances. Thus a nuclear spin of  $\frac{1}{2}$  will tend

With regard to <sup>18</sup>O and onwards, Bartlett's evidence<sup>5</sup> for the beginning of a new nuclear shell at <sup>16</sup>O suggests that any prediction for <sup>18</sup>O and onwards must be accepted with caution. Thus in Bartlett's first group, the even atoms divisible by four all have zero spin and the others have a spin of 1, if the view put forward here is correct. In the latter cases the spin is due to the odd neutron and proton combining with mechanical moments in parallel, and as the magnetic moments of these particles are of opposite signs, the resulting *g(I)* factors will be small and therefore the fine structures will be minute. This has been observed in the fine structures of <sup>6</sup>Li and <sup>14</sup>N, and may be expected for <sup>10</sup>B.

Physics Department,  
University, Manchester.  
April 22.

S. TOLANSKY.

<sup>1</sup> *NATURE*, **135**, 620 (1935).  
<sup>2</sup> Inglis, *NATURE*, **135**, 998 (1935).  
<sup>3</sup> Tamm and Altschuler, *C.R. Acad. Sci. U.S.S.R.*, **1**, 455 (1934).  
<sup>4</sup> *Z. Phys.*, **78**, 71 (1932).  
<sup>5</sup> *NATURE*, **130**, 165 (1932).

### Anomalous Values of Lattice Spacings obtained by Electron Diffraction

SEVERAL observers have recently reported discrepancies in the lattice spacings calculated from the ring or spot patterns given by electron diffraction. When the thin film traversed by electrons ( $\sim 30$  k.v.) contains two crystalline substances, the ratios of the spacings are not always in accord with those given by X-ray diffraction. The variations are of the order of 1 per cent, and are far greater than can be accounted for by experimental error.

G. I. Finch and S. Fordham<sup>1</sup> have shown that this is so in the case of the alkali halides referred to gold as standard, and Dr. E. R. Cooper and I<sup>2</sup> obtained discrepancies in the case of two metals aluminium and bismuth, and in metal-metal oxide patterns, Bi-Al<sub>2</sub>O<sub>3</sub>, Zn-ZnO, Cd-CdO. Finch and Fordham find that  $a$  for NaCl (assuming the X-ray constants for gold) = 5.666 Å., using NaCl films 'flashed' *in vacuo* ( $a$  for NaCl (X-ray) = 5.628 Å.).

V. E. Cosslett<sup>3</sup>, using films formed by evaporation of a dilute salt solution, has reported variations of  $a$  with order of reflection, which he suggests are due to refraction or surface lattice effects.

J. Gnan<sup>4</sup>, in a measurement of  $h/m$ , has calibrated NaCl against Bi, using a thin collodion film on which NaCl has been evaporated on one side and Bi on the other, in a high vacuum. He finds  $a$  for NaCl (Bi) = 5.640 ± 0.03 Å. I found, however, also using evaporated films of chemically pure NaCl and Bi, that  $a$  for NaCl (Bi) = 5.668 ± 0.005 Å. Photographs with different exposures gave the same value for  $a$ , which does not suggest any charging-up effects or heating effects due to inelastic electronic collisions. The constancy of  $d_{hkl} \sin \theta$  and the sharpness of the rings appear to preclude effects of refraction or of lattice distortion, and further, the small half-breadth indicates comparatively large crystallites of NaCl and Bi.

Although slight variations in the NaCl lattice spacing have been found by X-ray work<sup>5</sup>, these are of the order of 0.01 per cent, and so much smaller than the discrepancies under consideration.

At present, the most reasonable explanation of these anomalies seems to be that of variation of lattice dimensions with crystal size for small crystals, as emphasised by Finch<sup>1</sup>. The use of films evaporated *in vacuo*, the normal relative intensities of the rings, and the absence of extra rings or bands makes improbable any lattice expansion due to gas absorption. On the other hand, the binding in Bi is of a homopolar nature<sup>6</sup> (valency link binding), whilst the NaCl lattice is governed mainly by ionic forces, so that, according to the simple theory of Lennard-Jones,  $a$  for NaCl(Bi) should be less than  $a$  for NaCl (X-rays), whereas experimentally the reverse is found.

These anomalies may invalidate the results of electron-wave methods for measuring atomic constants, as in the case of Gnan and possibly of S. v. Friesen<sup>7</sup>, the latter's results depending on the cross grating pattern obtained by transmission of electrons through the very thin fragments projecting on the surface of an etched crystal. Whatever the origin of the discrepancies we have been discussing, their existence is amply proved, and measurements by electron diffraction can scarcely yet be trusted to give accurate relations between the fundamental physical constants.

It is hoped to obtain more definite evidence by using films of bismuth evaporated on to a cleavage flake of mica, since the mica spacings should be reliable, and the Bi rings can be compared with the spot ( $N$ ) pattern given by the mica.

E. PICKUP.

Physical Laboratory,  
University, Manchester.  
April 30.

<sup>1</sup> *Proc. Phys. Soc.*, **48**, 264 (1936).

<sup>2</sup> Unpublished.

<sup>3</sup> *Trans. Far. Soc.*, **31**, 1119 (1935); *NATURE*, **136**, 988 (1935).

<sup>4</sup> *Ann. Physik*, **20**, 361 (1934); A. H. Jay's X-ray values for the Bi lattice have been used, *Proc. Roy. Soc.*, **A**, **143**, 465 (1933).

<sup>5</sup> "X-Rays in Theory and Experiment", Compton and Allison, 1935, p. 677.

<sup>6</sup> F. Hund, Report Int. Conference Physics, p. 36, 1935.

<sup>7</sup> *NATURE*, **135**, 1035 (1935).

### Propagation of Electromagnetic Waves

IN view of the interpretation of measurements concerning the reflection of radio waves by the ionosphere, it is desirable to calculate the reflected amplitude for a special case, making certain suppositions about the electric properties of the ionosphere and assuming an external magnetic field. I have therefore investigated the propagation of electromagnetic waves in a vertical direction in a medium with electric properties varying in the same direction, and subject to the influence of a constant magnetic field  $H$  making an angle  $\theta$  with the vertical.

Studying the case of free ions in a gas (ionosphere) and in an alternating electric field, we can obtain a formula for the mean ionic current density and we can deduce an expression for the dielectric constant  $\epsilon$  and the conductivity constant  $g$ . Certain assumptions were made by G. J. Elias as to the mean free path of an electron and as to the temperature, and he obtained<sup>1</sup>, for the case of ionisation caused by ultra-violet radiation, the following expressions for  $\epsilon$  and  $g$ , being functions of the height above the earth:

$$\epsilon = 1 - \eta e^{kz}, \quad g = \frac{\omega}{4\pi} e^{kz},$$

where  $z=0$  is a fixed plane in the ionosphere, and  $\eta$  and  $k$  are constants, depending on the physical properties and the condition of the medium.

Owing to the presence of a constant magnetic field, the relations between the ionic current and the electric force components are given by a tensor (as is the case in any anisotropic medium). Using Elias's assumptions, the components of this tensor  $\tau$  have been calculated.

A system of axes was introduced, the positive  $z$ -axis being in the vertical direction, the  $y$ -axis lying in the  $H$ - $z$  plane and the  $x$ -axis perpendicular.

With the components of  $\tau$  and putting  $\mu=1$ , I derived from the Maxwell equations two simultaneous equations of the second order for  $E_x$  and  $E_y$ . These equations can be connected in such a way that two ordinary equations for  $E_x \pm iE_y$  are obtained.

In obtaining this result, I neglected some terms; this being permissible for sufficiently short waves and for a sufficiently small value of  $H$ . Strictly, the reflected waves are elliptically, when the incident ones are circularly, polarised.

So we have one wave, characterised by

$$E_x + iE_y = 0 \quad (+\text{wave}) \\ E_x - iE_y = 0;$$

and the other by  $E_x - iE_y \neq 0$  (-wave)  
 $E_x + iE_y = 0$ .

When propagated along the +z-axis, the +wave is righthanded polarised; and when propagated along the -z-direction, being the direction in which reflection takes place, the +wave is lefthanded. The +wave will hence be called lefthanded and the -wave the righthanded one.

The equations for  $E_x \pm iE_y$  can be transformed into two Bessel equations with complex argument and imaginary order. Now the solution shows a certain point where the absolute value diminishes rapidly with increasing height<sup>2</sup>; this point lying at a different height for the right- and the lefthanded waves. When the z-component of H is negative, this 'reflection point' is higher for the lefthanded wave; but, on the other hand, the absorption is found to be less for this one. As might be expected, this has opposite effects upon the reflection coefficient. Finally, the reflected amplitude for the lefthanded wave is found to be greater than that for the righthanded one; the incident amplitudes being equal.

With the opposite sign of  $H_z$ , the same result is found for the righthanded wave.

Elias pointed out the following relation between the amplitudes of the reflected and the incident waves in a medium without magnetic field and

$$\epsilon = 1 - \eta e^{kz}, \quad g = \frac{\omega}{4\pi} e^{kz}.$$

This relation was proved<sup>3</sup> to be:  $e^{-p/\eta}$ .

In my case this relation for the lefthanded wave is given by  $e^{-\frac{p[\eta - 2\eta_1 \cos \Theta]}{\eta[\eta - \eta_1 \cos \Theta]}}$ ; and for the righthanded one by  $e^{-\frac{p[\eta + 2\eta_1 \cos \Theta]}{\eta[\eta + \eta_1 \cos \Theta]}}$ .

Any reflected wave can be decomposed into a right- and lefthanded wave and so, the incident wave being linear, the relation between their amplitudes is given by the quotient of the two expressions above ( $\eta$  is taken as large, which is true for short waves), namely:

$$e^{2p \frac{\cos \Theta \cdot h}{\eta}} = \frac{qH}{mc\omega}.$$

The following are the meaning of symbols used above:

- $\eta$  = quantity in the expression for  $\epsilon$ .
- $\eta_1$  = " " " " "  $\tau$ ;  $\eta_1 = \eta \frac{qH}{mc\omega}$ .
- $k$  = exponential constant, determining the variability of  $\epsilon$  and  $g$ .
- $\omega$  = frequency multiplied by  $2\pi$ .
- $c$  = velocity of light *in vacuo*.
- $\Theta$  = angle between H and the z-axis.
- $p = 2\omega/c k$ .
- $q$  = charge of an electron ( $q$  being negative).
- $m$  = mass of an electron.

C. TH. F. VAN DER WYCK.

74 Laan Copes van Cattenburgh,  
 The Hague,  
 April 19.

Line on the Surface of Water

I WAS interested in Prof. W. Schmidt's letter in NATURE of May 9, as nearly thirty years ago I noticed the 'line' he describes and have often seen it since, but not previously in print. I first noticed it on the surface of water in a stone drinking-trough at a farm-house in Hayfield, near Stockport. Water came into the trough at the back and left it by overflowing at a notch in the front side. The 'line' was seen curving round the outlet (Fig. 1). I concluded at the time that the surface of the water at the back of the trough was covered with an invisible film which had been partly removed by the action of the

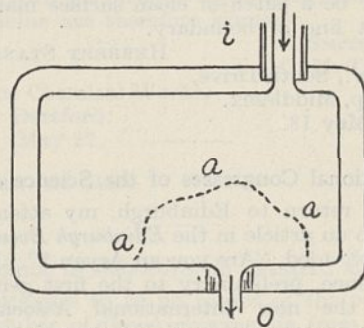


FIG. 1. Sketch of stone drinking-trough showing the water inlet, i, the overflow, o, and the line, a, a, on the surface.

overflow, and that the 'line' marked the boundary between the clean water surface in front and the film behind. I tried the effect of allowing a few drops of soapy water to fall into the trough, and found that the line vanished, but it reappeared in a few minutes closer to the overflow than before and then slowly moved backwards over the surface, indicating, as I supposed, the gradual cleaning of the surface by the overflow.

Having once observed the effect, one often notices it. In Southampton I saw it several times at Woodmill, where the water of the River Itchen goes into

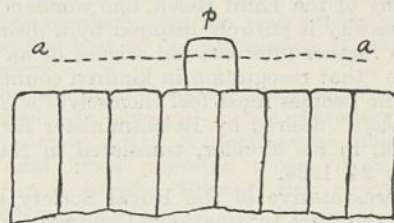


FIG. 2. Sketch of the front end of the raft. p is a projecting plank an inch or two below the surface of the water; a, a, is the line on the surface.

the old mill through a grid of iron bars. There was usually an accumulation of floating material close to the bars, and the surface contamination extended a few feet up-stream. The 'line' was often visible, apparently marking the boundary between the stationary film-covered surface and the cleaner moving surface of the approaching water.

I photographed the 'line' a few years ago from a raft on a little lake or pond at Fionnay in Switzerland. It was particularly well marked one day after rain when the surface of the water was covered in places with some material apparently washed down from trees growing on the bank. The trees were conifers

<sup>1</sup> G. J. Elias, *Tydschrift v. h. Nederl. Radio Genootschap* Maart 1926, deel III, no. 1.  
<sup>2</sup> G. J. Elias, *Proc. Inst. Radio Eng.*, May 1931.  
<sup>3</sup> G. J. Elias, *Elektr. Nachr. Technik*, 8, 4 (1931).

so the material was probably resinous. When the raft was moving, it carried some of the surface layer along with it, and the line could be clearly seen travelling over the surface of the water but stationary with respect to the raft and a short distance in front (Fig. 2). As the sun was shining, I obtained photographs like Fig. 1 of W. Schmidt's letter, showing the bright line image formed by the 'line' on the bottom of the pond.

My son, who helped me to obtain the photographs at Fionnay and is now at Cambridge, supplied me with the sketch in Fig. 2 and confirms my recollections. He adds: "I often see the line on the river here; in any place where water is eddying up from below there may be a patch of clean surface marked with the bright line of boundary."

HERBERT STANSFIELD.

"Maloca", South Drive,  
Ruislip, Middlesex.  
May 18.

#### International Congresses of the Science of Man

ON my return to Edinburgh, my attention was directed to an article in the *Edinburgh Evening News* of May 5, headed, "Are you an Aryan?". It reports "a conference, preliminary to the first general congress of the new International Association for Ethnology to take place in Edinburgh next year", that "met in the Deutsche Forschungsgemeinschaft" [*sic*]. Seeing that the International Congress of Prehistoric and Protohistoric Sciences holds its second meeting in Oslo this year, the International Congress of Anthropological and Ethnological Sciences in Copenhagen in 1938, the utility of a third organisation might be questioned.

I should not, however, trespass upon valuable space in *NATURE* to discuss questions of convenience. The next sentence in the newspaper article raises much graver issues. It runs: "The German Research Institute propose to pay the entire cost of printing involved in the production of an atlas of ethnology covering all Northern Europe". In view of the connexion between ethnology and the political philosophy of the Third Reich, one wonders whether this generosity is entirely inspired by a disinterested desire to further international science or an attempt to secure "that recognition in kindred countries that the Nordic peoples must feel themselves a *Schicksalgemeinschaft*" desired by Reichsminister für Innern, Dr. Frick, in his circular, translated in *NATURE* of February 24, 1934.

As representative of the Royal Society of Edinburgh at the First International Congress for Anthropological and Ethnological Sciences and of the University of Edinburgh at the Oslo Congress, I feel bound to direct the attention of readers of *NATURE* to this engagingly frank report lest they find themselves supporting an organisation in competition with the two *genuinely* international congresses. These, it may be recalled, were established to deal with every aspect of the science of man precisely because the immediate successor of the pre-War "Congrès international d'anthropologie et d'archéologie préhistoriques" was held to be constituted on a too definitely 'Ally' basis, to the detriment of scientific workers from 'ex-enemy' countries.

V. GORDON CHILDE.

Department of Prehistoric Archaeology,  
University, Edinburgh.  
May 29.

#### A Tribute to NATURE

I AGREE with Snawley that "She [Natur] is a holy thing"; some readers may think with Mr. Squeers "She's a rum 'un", too, at times. Many therefore will have welcomed in your obituary notice of Sir Frederick Macmillan, in *NATURE* of June 6, the feeling reference to the great service the Macmillan firm has rendered to the cause of scientific progress, by the faith that it has shown in the journal and the freedom that has been accorded to critical contributors to its columns. The firm may even have taught their first editor a thing or two: I can recollect early tussles with him for freedom of expression, which were quite amusing. At one time, J.N.L. was definitely the editorial Hitler. Probably there is no journal with less editorial bias—certainly none which so nearly approaches to being completely scientific in its breadth and fullness of outlook.

I am led to think that I shall not be presuming if, as a senior, speaking for the scientific brotherhood at large, I re-echo with all possible fervour your expression of our indebtedness to the Macmillans. *NATURE* may not have paid its way over a considerable period; none the less, from the beginning, it must have been an asset of special value to the firm. The position taken by the journal, throughout the cultured world, is indeed unique. *NATURE* is a holy thing. May it continue to be so regarded and be kept whole: no light task. I have already expressed my anxiety, in reviewing Sir Norman Lockyer's *Life* (Dec. 8, 1928). One pressing need is to simplify the language—if such a word can be applied—in which communications are made. If nations be not yet on terms of mutual understanding, the world of scientific workers is clearly prepared to work in harmonious co-operation and even to mix with the public on equal terms: jargon, not language, alone forbids; this must be stamped out; its use is due both to conceit and to lack of thought; knowledge has to be made the common property of the world. The late Prof. Sylvester saw in the very title *NATURE* an effulgent blaze of possible ideas. Such a dream was permissible to one who could discuss the philosophy of *The Mathematical Forms called Trees*. In the interval, an effulgent blaze of scientific achievement beyond all dreams has, without doubt, been placed upon record in the columns of this journal. It is no longer the concern of an individual firm: it is a national asset—a trust. You, in your forty-three years of service, have done much to further the good work—may it be permitted to you at least to celebrate your jubilee in office and within the period to make due provision for the future.

HENRY E. ARMSTRONG.

55 Granville Park,  
Lewisham, S.E.13.

[AFTER the publication of the Jubilee issue of *NATURE*, on November 6, 1919, many congratulatory messages from leading scientific men and societies at home and abroad were published in the issue of the following week. It is kind of Prof. Armstrong to express similar appreciation now, particularly of the part played by the publishers in establishing the journal. From the editorial point of view, all we wish to say in grateful acknowledgment is that the position which *NATURE* occupies as an international organ of scientific work and opinion is due solely to the active interest and co-operation of scientific men themselves.—EDITOR.]



### Occurrence of Rotenone in *Tephrosia macropoda* Harv.

IN an investigation of the contact insecticidal properties of a number of tropical plants, Tattersfield and Gimmingham<sup>4</sup> found that the roots of a specimen of *T. macropoda* Harv. from Natal possessed a definite toxicity to *Aphis rumicis*. Other members of the genus known to possess insecticidal action have been examined chemically<sup>1,2,3,5,6</sup>, and have been found to contain members of the rotenone group of fish-poisoning compounds. We have recently been able to carry out preliminary tests upon a specimen of *T. macropoda* kindly sent to us by the Natal Herbarium, Department of Agriculture, Durban. The material was collected by Mr. Moses, agronomist attached to the African Explosives and Industries, Ltd.

Qualitative insecticide tests using a cold alcoholic extract of the finely-ground root diluted with saponin solution were made upon *Aphis rumicis*. At concentrations equivalent to 0.25 and 0.1 per cent of the root, the percentages of moribund and dead insects recorded on the third day after spraying were 95 and 50 per cent respectively. The root thus shows a decided toxic action to this insect.

When an ether extract, amounting to approximately 4 per cent of the root, was taken up in warm carbon tetrachloride and allowed to stand overnight, crystals were deposited. These after recrystallisation from absolute alcohol melted at 162° C., and showed a methoxyl content of 15.75 per cent. There was no depression of the melting point on admixture with pure rotenone. The rotenone was present to the extent of 0.3-0.4 per cent of the root. By steam distillation of the resin extracted from the root by means of alcohol, 'tephrosal' was obtained. Other crystalline derivatives of the rotenone group were isolated, but the work is to be extended, and the detailed examination of the roots will be reported later.

It would appear, however, that *Tephrosia macropoda*, which is to be found to varying extents over the greater part of South-East Africa, merits further investigation of its insecticidal properties, and it may well be that, by selection and suitable cultural means, a sufficiently rich variety could be obtained which would prove of value, particularly for the control of local insect pests.

J. T. MARTIN.

Dept. of Insecticides and Fungicides,  
Rothamsted Experimental Station,  
Harpenden.

<sup>1</sup> E. P. Clark, *J. Amer. Chem. Soc.*, **52**, 2461 (1930).

<sup>2</sup> E. P. Clark, *Science*, **77**, 311 (1933).

<sup>3</sup> M. Harriot, *C.R.*, **144**, 150 (1907).

<sup>4</sup> F. Tattersfield and C. T. Gimmingham, *Ann. App. Biol.*, **19**, 253 (1932).

<sup>5</sup> R. R. Le G. Worsley, *Ann. App. Biol.*, **21**, 649 (1934).

<sup>6</sup> *Bull. Imp. Inst.*, **13**, 61 (1915).

### New Alkaloids of Ergot: Ergosine and Ergosinine

WE recently reported<sup>1</sup> the isolation of a new ergot alkaloid which was characterised mainly by its phenolic properties, the m.p. 228° (decomp.), the specific rotation  $[\alpha]_{5461}^{20} + 522^{\circ}$  (in chloroform,  $c=1$ ), the sparing solubility in methyl alcohol and the ease with which it crystallises. It was assigned a provisional formula  $C_{30}H_{35}O_5N_5$ .

The high dextro rotation suggested that the substance was a member of the group which includes

ergotinine,  $\psi$ -ergotinine, ergotaminine and ergometrinine, all of which have high dextro rotations in chloroform solution, and that like these alkaloids it might be convertible into an isomeric or analogous alkaloid by treatment with acids. This is in fact the case, and the alkaloid,  $[\alpha]_{5461}^{20} + 522^{\circ}$ , for which we propose the name ergosinine has been converted in this way into a new alkaloid with the specific rotation  $[\alpha]_{5461}^{20} - 194^{\circ}$  (in chloroform,  $c=1$ ), for which the name ergosine is suggested. It melts at 228° (decomp.), retains the phenolic properties of the parent substance and crystallises with ease from a number of solvents. Analyses of the crystalline base are in agreement with the formula  $C_{30}H_{35}O_5N_5$ , and ergosine and ergosinine are therefore isomeric.

S. SMITH.

G. M. TIMMIS.

Wellcome Chemical Works,  
Dartford.  
May 27.

<sup>1</sup> *NATURE*, **137**, 111 (1936).

### Occurrence of *Saccocirrus* in Western Canada

THERE appears to be no record of the occurrence of any member of the Archiannelida from the west coast of North America; indeed any records outside Europe seem to be rare. It is therefore of interest to note the appearance of enormous quantities of a *Saccocirrus* at Departure Bay, B.C., during the past month. They were first found at a point marking the entrance to the bay from the open Strait of Georgia in the surface layer of a rather coarse sand-bed at the low limit of a low spring tide on April 23. At this time they were so thick in the sand that every cubic inch contained a hundred or so individuals. Mature representatives of both sexes were present. On April 25 there did not seem to be so many, but this may have been due to the fact that the tide did not reach so low a mark. The appearance is the more interesting in that I have visited the beach on which the *Saccocirrus* was found at the low tides in April, more or less regularly, for the past fifteen years or so, and, to the best of my knowledge, it was never present before.

It is uncertain to what species the specimens should be attributed. In size and in the character of the setæ they correspond to *S. papillocerus* Bobretzky, but the anal lobes resemble those of *S. major* Pierantoni more closely. Possibly they represent an undescribed species.

The only record I have been able to find of the occurrence of a *Saccocirrus* in the North Pacific area is that by Uchida of *S. major* Pierantoni, from Japan<sup>1</sup>.

E. BERKELEY.

Pacific Biological Station,  
Nanaimo, B.C.  
May 13.

<sup>1</sup> T. Uchida, *Proc. Imp. Acad. Tokyo*, **9**, 128 (1933).

### Heavy Water of Crystallisation

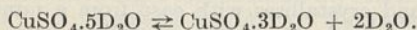
THE dissociation pressures of copper sulphate pentadeuterate,  $CuSO_4 \cdot 5D_2O$ , as found by a tensiometric method<sup>1</sup>, are: at 25° C.,  $p_1 = 6.655$  mm. Hg.; at 30° C.,  $p_2 = 9.285$  mm. Hg. From these figures

the heat of combination with liquid deuterium oxide is given by the equation :

$$Q = 4.576 \cdot \frac{T_2 - T_1}{T_2 \cdot T_1} \log \frac{p_2 | \pi_2}{p_1 | \pi_1}$$

where  $\pi_1$  and  $\pi_2$  are the vapour pressures of deuterium oxide.

With  $T_1 = 298$ ,  $\pi_1 = 22.65$  mm.; and  $T_2 = 303$ ,  $\pi_2 = 27.934$  mm.<sup>2</sup>, this gives  $Q = 4,437$  gm.cal. This is the value for 2 molecules of liquid D<sub>2</sub>O if the reaction is



The corresponding value for ordinary water, 2H<sub>2</sub>O, is 5,560 gm.cal. As would be expected, the value for heavy water is appreciably lower.

Further experiments on this and similar systems are in progress.

J. R. PARTINGTON.  
K. STRATTON.

Queen Mary College,  
London.  
June 5.

<sup>1</sup> NATURE, 137, 707 (1936).

<sup>2</sup> G. N. Lewis and R. T. Macdonald, *J. Amer. Chem. Soc.*, 55, 3057 (1933); NATURE, 132, 248 (1933).

### The Scanning Principle in Television

IN his recent discourse at the Royal Institution<sup>1</sup>, Sir Richard Gregory refers to some of the earliest suggestions for systems of television. As perhaps being of some historical interest, I should like to note with regard to scanning—a fundamental principle—that Mr. Llewelyn B. Atkinson in a note, appended to a letter on "Seeing to a Distance by Electricity" in the *Telegraphic Journal and Electrical Review* (Dec. 13, 1889, p. 683), says :

"The idea of using an integrating apparatus for producing the whole image from one element in the time during which the image will remain on the retina was first, I believe, published in the *English Mechanic* about 1881 or 1882, and was then, as far as publication goes, new."

The communication thus referred to was entitled "The Telectroscope, or Seeing by Electricity", and appeared under my initials in the *English Mechanic*, April 21, 1882, p. 151.

WILLIAM LUCAS.

9 Shanklin Road,  
Crouch End,  
N. 8.

<sup>1</sup> NATURE, 137, 981 (1936).

### Points from Foregoing Letters

PROF. J. E. LENNARD-JONES and A. F. Devonshire suggest an explanation of the anomalous reflection and diffraction of helium atoms by lithium fluoride, observed by Frisch and Stern. They show that atoms incident on a solid surface may, under certain conditions, be diffracted *along* and not away from the surface, a process they call 'selective adsorption'. From the observations, they are able to deduce information about the energy levels of adsorbed helium atoms on a lithium fluoride crystal.

The Raman spectrum of the light scattered by sulphur dioxide as a gas, as a liquid and in aqueous solution has been determined by Prof. H. Gerding and W. J. Nijveld. They find a close agreement in the position of the sharper lines of the spectrum of the gas and of the solution, and conclude that the state of the molecules in solution is comparable with that in the free gas.

Prof. E. C. G. Stueckelberg calculates the probability of gamma radiation being formed by the combination of the positive electrons (liberated in certain radioactive changes) with the negative electrons in the outer shell of the atom. He concludes that every emission of positive electrons should be accompanied by weak gamma radiation, but finds that in only one out of 137 cases of decay is gamma radiation emitted.

Diagrams showing the distribution of nuclear spins in atoms of odd mass are submitted by Dr. S. Tolansky. The preponderance of spin of value  $\frac{1}{2}$  in the case of nuclei with an odd neutron indicates, according to Tolansky, that neutron spin and orbital moments tend to oppose each other. The author also discusses the relation between nuclear spin and mass defect in atoms of even mass.

E. Pickup directs attention to discrepancies in the calculations of lattice spacings of films containing two crystalline substances, when using the electron

diffraction method, as compared with values obtained from X-ray diffraction. These discrepancies and anomalies may invalidate the results of the electron-wave method for measuring atomic constants.

In order to throw light on the mechanism of the reflection of radio waves in the upper atmosphere, C. Th. F. van der Wyck considers the propagation of electromagnetic waves in a vertical direction, when the electric properties of the medium vary in the same direction, and a magnetic field is present making a definite angle with the vertical. He arrives at an expression for the dielectric constant and the conductivity constant of the medium.

Further observations and sketches of the 'line' seen on the surface of slowly moving water when it encounters an obstacle are supplied by Prof. H. Stansfield. He has noticed the phenomenon in a drinking trough, in front of a raft in a pond, where water from a river with a clean surface passes under floating material accumulated at the bars of a grid, etc.

The root of the African plant *Tephrosia macropoda* has a toxic action upon the bean louse *Aphis rumicis*. Dr. J. T. Martin attributes this insecticidal action to the presence of the fish-poisoning compound rotenone and to allied substances which he has isolated from the roots. He believes that a variety of the plant, sufficiently rich in these substances could be obtained to be of value in the control of local insect pests.

Dr. S. Smith and G. M. Timmis write that ergosine, a dextrorotatory alkaloid which they recently obtained from ergot, changes on treatment with acids to a levorotatory isomer, which they propose to call ergosinine.

The appearance in large numbers of sand-worms belonging to the genus *Saccocirrus* at Departure Bay, Western Canada, is recorded by E. Berkeley.

## Research Items

### Nodule Implements

THE late Dr. E. Hugh Kitchin was for some years an assiduous collector of what he considered to be a hitherto undescribed type of flint implement, which he found in gravel pits of the Bournemouth district and of which he had prepared a description at the time of his death ("Nodule Implements in the Bournemouth District". Pp. v+41. Cambridge: W. Heffer and Sons, Ltd. 4s. 6d. net). Search in the gravels of the Canford pit from 1928 onward had produced three types of implements new to the district: a series of flakes similar to those of the Cromer Beach series, rostro-carinates and half a dozen Clactonian cores. In five years 1,030 flakes were collected. Hand axes were also found in the proportion of one to nine flakes. The 'nodule', to which attention was then turned, is a simple nodule of flint, showing some working, chiefly a 'sharpening blow'. In the simplest form there is a single flake-scar at one or other end of the implement. This is invariably on the longest side or edge of the nodule. Thus the axis of the implement is always oblique. The principle of determination is the shape of the nodule—it was naturally suitable for the purpose its maker had in view. The shape therefore is more important than the working, though the proof of the implement is in the combination. The working is usually simple, consisting of sharpening blows, truncating blows, and shaping blows. The sharpening blows are rarely more than three in number. The truncating blows present some difficulty, especially as a naturally truncated flint was used. The shaping blows serve to make the nodule symmetrical. In the examination of a number of specimens the same type of shaping blow will be found to recur again and again. With these implements, familiarity breeds conviction. The Bournemouth pits afford no evidence of age, as implements are found in confusion; but two flints recognised as of the nodule type come from East Anglia, one from the sub-erag at Bawdsey, Suffolk, and one from Forest Bed flints at Cromer.

### Domesticated Sheep

In a study of the origin of domesticated sheep, Dr. Max Hilzheimer (*Antiquity*, June 1936) points out that as domestication can only have originated where the wild sheep had its home, this at once excludes the whole of Africa. Europe also is eliminated, as the wild breed was extinct before the glacial epoch, a small remnant establishing itself in Corsica and Sardinia, where it is represented to-day by the moufflon. Asia only is left, and there it must have originated in the country lying between the Mediterranean and the Pamirs, though certain Asiatic types may have originated still farther east. With the exceptions noted, the wild breeds are confined to Asia and part of North America. They are not found in the high mountain regions only, as is often assumed, but appear also in the low-lying plains of Central Asia and Siberia, east of the Yenisei to the Polar Sea. The sheep must have been first domesticated in the lowlands around the Caspian and Aral Seas, to the south of the Salt Range in the Panjab, in Baluchistan and in south Persia. It is probable that of the four

groups recognised, the Moufflon, the *Vignei*, the Argali and the Bighorns, the first three produced domestic descendants. These vary so much that they already present characters found in the domesticated sheep, but domestication produced even greater variability. In the West, the sheep is among the earliest of domesticated animals. Its remains are found in the neolithic Danish kitchen middens. Mesopotamia shows the near beginnings if not the actual origins of sheep-breeding. In the Jemdet Nasr period there are already three breeds, a fleecy, a broad tail and a hairy sheep. The last-named is probably the most primitive and the most closely related to the wild, as it has not yet developed a fleece. In Egypt the sheep goes back to the second prehistoric culture. The broad-tailed and fat-rumped sheep do not appear to have reached Europe, where the sheep was always of the fleeced variety. Three lines of ancestry are found for the domestic sheep, all to be looked for in Asia: the Asiatic moufflon, the *Vignei* type and the Argali, the last of no importance for European breeds.

### Eelworm Injury of Tomatoes

UP to 1935, the tomato plant was not included in any British list as susceptible to injury by the eelworm *Heterodera schachtii*, but thirty-two cases of such infestation have occurred in Yorkshire since 1928, and a further instance has recently been recorded from Lancashire. Recently, L. R. Johnson and H. W. Thompson have shown that, unless precautionary measures are taken, there is considerable danger that this trouble will become more general, particularly in areas where potato sickness is common, since it is now established that the same strain of eelworm is able to infect both plants (*J. Min. Agric.*, 43, 48). Routine practice of steam sterilisation is undoubtedly the only satisfactory method of treating the soil. Growers who have adopted the cold Dutch house method of tomato culture and who need not remain permanently on the same site, may be unwilling to incur the expense of steam sterilisation; but it is shown that the cost of the sterilising is not much greater than the removal of the house to another site, and only with the former method can one be certain that eelworm-free soil is secured. The difficulty of obtaining uninfected soil is bound to increase with time, particularly as viable potato eelworm cysts have been found in fields that had not carried this crop for ten years, so that it is unsafe to assume that a soil is clean until after a very long period has elapsed.

### Sterility of Droitwich Brine

THE Droitwich brine, used for the Spa treatment, is pumped from a depth of two hundred feet, and is a highly concentrated solution of salts, mostly sodium chloride, amounting to about 2½ lb. to the gallon. According to Dr. Inglis Dawson and Mr. Harold Salt (*Edinburgh Med. J.*, June 1936, p. 402), when pumped the brine is almost sterile, yielding at most one bacterial colony per millilitre. After use in a bath, comparatively few bacteria are present, the brine evidently exerting a bactericidal action. Thus, with

the swimming bath in use for a week without change of water, the bacterial content at the start on the Monday morning was almost nil, and it rose slowly in the course of the week until on the Sunday evening the bacterial content was even then less than 200 per millilitre. Some experiments were also done by inoculating brine with organisms, such as *Bacillus coli*, *Staph. aureus* and *Strep. faecalis*, and determining their fate over forty-eight hours. Starting with many millions of organisms per millilitre, it was found that sterility was attained within twenty-four hours, all the organisms being destroyed by the brine.

#### Trend-line of the Himalaya

IN a paper on this subject (*Himalayan J.*, 8; 1936), Mr. D. N. Wadia refers to the similarity and continuity in structure, petrology and stratigraphy in the two flanks of the Himalayan syntaxis in the north-west of India. Around the angle south of the Pamir plateau the rock series on the Kashmir and the Hazara sides show no discordance. This angle was ascribed by Suess to the meeting and conflicting of the Hindu Kush with the Himalayas, with the result that both systems underwent a deflection at the contact. Mr. Wadia, however, supports the view that the explanation is to be found in the folds of the Himalayan geosyncline being moulded on the triangular projection of the resistant shield of peninsular India. The axial continuity of the folds has not been traced far to the west yet, and to the extreme east the continuation is still a matter of conjecture. Mr. Wadia favours the theory that the folds do not extend into China, but turn southward into Burma around the obstruction offered by the former plateau to the west. He holds that the Shan plateau is comparable with the Tibetan plateau and is not traversed by Himalayan folds, which practically go no farther eastward than the Tsangpo gorge. Thus the head streams of the Salwen, Mekong and Yangste flow in trenches longitudinal to the strike of the mountains, and do not cut across the folds.

#### Theory of River Flow

No. 280 of the series "Actualités scientifiques et industrielles" (Paris: Hermann et Cie., 18 francs) is entitled "Hydrodynamique fluviale, régimes variable". It is by Dr. Pierre Massé, who deals with the waves which are propagated along a river or canal when at a point the flow is suddenly augmented for a short time. The form and speeds of the disturbances propagated up and down stream are calculated and are compared with the observations made on the Seine and on the Aar. The principal features of the theory are verified, but not the details, although there are no actual contradictions.

#### A Portable Air Velocity Meter

AN extremely convenient portable air velocity meter has been developed by Messrs. Air Conditioning and Engineering Ltd., 4-12 Palmer Street, London, S.W.1. It meets a definite requirement in certain operations upon the mass movements of air, where a portable and robust instrument, giving direct readings over a large range of speeds, is necessary. Most of the accurate methods of determining gas velocities, such as the Pitot tube, U-tube, anemometer, etc., need auxiliaries that tend towards the reverse of portability, and are generally delicate. This instrument, known as the "Alnor Velometer", is entirely self-contained within a small moulded plastic case. It

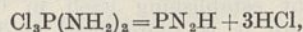
can be stood in the air current, or if more convenient, a rubber tube carrying an exploring jet at the end can be attached to it. The measuring device consists of a vane, upon which the air impinges, balanced against hair control springs, a watch movement and a magnetic damping system. A pointer travels over a scale, behind a glass face, graduated in two ranges 0-250 or 300 and 0-6000 feet per minute. Special scales can obviously be fitted to order. The case is made in three types, with a shutter, orifice, or external tube. The shutter model is simply stood in the air stream, and the shutter manipulated so that the air passes through ports appropriate to its speed. The orifice type has detachable orifices in place of the ports, more suited to high air speeds. The tube type carries a rubber tube with various forms of jets, in the place of the shutter. The jet can thus be moved about and readings can be taken in restricted spaces. Special jets can be designed for cases such as surging currents, readings in enclosed ducts, etc. The meter will work in the reverse direction for suction readings.

#### 'Extra' Spots in Electron Diffraction Patterns

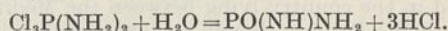
V. A. KOLPINSKY, of the Physical Institute, University of Leningrad, writes to point out that the 'extra' spots in a remarkable silver single crystal electron diffraction pattern recently published by L. Brück (*Ann. Phys.*, 26, 254; 1936) can be accounted for in the same way as G. I. Finch and H. Wilman explained the appearance of 'extra' diffractions from graphite (*NATURE*, 137, 271; 1936). According to this view, these diffractions correspond to fractional Laue orders of normally occurring diffractions, and are due to lattice row periodicities being incompletely developed in one or more directions owing to the thinness of the crystals.

#### Reactions of Ammonia with Phosphorus Pentachloride

H. MOUREU and P. Rocquet (*Bull. Soc. Chim.*, 3, 821; 1936) find that the first product of the action of dry liquid ammonia on phosphorus pentachloride is the pentamide,  $P(NH_2)_5$ . This can lose two molecules of ammonia to form a white amorphous  $PN_3H_4$ , which polymerises mainly to  $(PN_3H_4)_3$  and  $(PN_3H_4)_4$ , identical with the products of the action of ammonia on the phosphonitrile chlorides  $(PNCl_2)_3$  and  $(PNCl_2)_4$ . On heating, the compound  $PN_3H_4$  loses a molecule of ammonia to form phospham,  $PN_2H$ . Gerhardt, by the action of water on the product of the reaction of ammonia gas with phosphorus pentachloride, obtained a white insoluble phosphamide,  $PO(NH)NH_2$ , and he postulated the intermediate formation of chlorophosphodiamide,  $Cl_2P(NH_2)_2$ , which, by the action of heat, gave phospham:



and by the action of water formed phosphamide:



Moireu and Rocquet find, however, that their product of the action of ammonia on phosphorus pentachloride is completely soluble in water, and they consider that phosphamide is formed by a secondary reaction, perhaps from  $PO(NH_2)_3$  formed from  $POCl_3$  and ammonia, the  $POCl_3$  being produced by the action of water on  $PCl_5$ . The hydrolysis of  $PN_3H_4$  proceeds quite differently, giving rise to a mixture of a hydrate,  $(PN_3H_4)_3 \cdot H_2O$ , and ammonium tetrametaphosphate,  $(ONH_4)_4P_4N_4O_4H_4$ .

## The Electric Supply System of Berlin

IN a paper read to the Institution of Electrical Engineers on May 13, M. W. Davies gave an account of the electric supply system of Berlin and of recent changes and developments that have taken place in it.

Berlin is a rapidly growing city. At the time of the Great War, it was still comparatively small, but was surrounded by a number of satellite towns each possessing its own electric supply system. In 1920 these towns were combined to form Greater Berlin, which is to-day more than half the size of Greater London, and has half its population. It covers an area of 300 square miles and has a population of more than four millions. The average density of the population is almost the same as that of London, but in Berlin the greater part of the population lives in flats, with the result that only 28 per cent of the total area is fully developed. The central district is bordered by lakes and woods covering a further 27 per cent. The remaining 45 per cent is mainly undeveloped country and small holdings. As a result of this concentration, the actual density of the population in central Berlin is very high.

In Great Britain a considerable part of the electric energy sold for domestic purposes is used for heating; but in many parts of the Continent, owing to the extensive use of steam-heating, the development of an electrical heating load is very difficult. In winter, the temperature is often below zero. Most of the flats are equipped with steam central-heating, and so it is not easy to get a satisfactory market for electric cookers and water heaters. Mr. Davies made a special study of the Berlin Power and Light, Co.—known in Germany as the 'Bewag'. He describes how the Company in 1924 attempted to solve the distribution problem for this great industrial city by treating it as a single unit. In 1929 and during

subsequent years, this method had to be modified in the light of experience.

The bulk of the electrical power in Berlin is supplied from two large central stations, Klingenberg on the east of the city and Kraftwerk West on the west. A large part of the power for the base load is imported over 100 kv. lines which bring power from two large stations on the lignite field in central Germany. These stations are relics of the War, and are gradually being extended. The only other station of importance is the one at Charlottenburg, which was reconditioned in 1929. It is fitted with pass-out turbines connected directly to a public steam-heating system. In addition, it has Ruths steam accumulators and so can deliver 73,000 k.w.h. per charge at a maximum rate of 50,000 k.v.a.

These steam accumulators are of great value in enabling the system to get over the peak load, which formerly caused some of the lines to be 'tripped' out of the supply. They can be put on to full load in a few seconds and so prevent a stoppage. A 25,000 k.w. steam accumulator is kept constantly on the lines, and furnishes part of the basic load. The average load of the whole system is very high, being 36.2 per cent of the maximum possible. The total consumption of electricity in Berlin is about 350 units per head of the population, which is larger than most other Continental cities.

For local government purposes, Berlin is divided into twenty districts, and sixteen of these are now supplied with electricity by the Bewag. The unification was not a sudden achievement, but was the result of careful planning. The movement started with the pooling of generating resources and was afterwards followed by that highly desirable result, the pooling of common tariffs.

## The Flax Industry in Great Britain

AN interesting account of the history of flax production in Great Britain and the possible line of its development was given by Mr. G. O. Searle at the Annual Conference of the Textile Institute held in London on June 3-5. Though demands are increasing, the production of flax in Great Britain has fallen. In 1864 the total acreage in flax was 320,000, but in 1930 only a tenth of this, since when it has been even lower and rather variable. With the exception of a few hundred acres in East Anglia, flax-growing remains a peasant industry centred in Northern Ireland. Careful selection and breeding has resulted in the production of varieties yielding nearly fifty per cent more fibre per acre than the older commercial seed.

The re-establishment of a flax industry in England depends on changing radically the sequence of processing operations and substituting mechanical methods for manual labour. A flax factory must do more than merely centralise the simple handcraft methods still largely used. Improved methods and new machinery must be developed for the four

operations of handling, de-seeding, retting and scutching. Inasmuch as for the last three the flax is required in a thin layer, the expedient of sewing it into mats has been adopted, but this has not as yet been done in the process of harvesting. Such mats greatly simplify the handling of the fibres, and avoid the lifting, untying and re-tying of bundles as at present. The fibres remain in mats during the retting, drying and scutching, a machine for scutching which will take the flax laterally as supplied continuously in the mat, having been developed. With these improvements in processing, the re-establishment of a flax industry in England on a permanent basis is possible.

Various aspects of the question of separating flax fibres from the plant stem were discussed at the Conference by Dr. W. H. Gibson, director of the Linen Industry Research Association. He emphasised the fact that, in the long run, the best results can be efficiently achieved only on the basis of a more profound knowledge of the character of the fibres, and of the tissues in which they are embedded, than

is at present possessed. While much information as to the arrangement of the fibre within the stem has been obtained by microscopic examination, separation depends on the chemical nature of the tissues adjacent to the bundles.

Separation is usually effected by the biological process of retting, but this process is difficult to control and, with the present organisation of the industry in Northern Ireland whereby the grower himself carries out the retting, results in great irregularity in the quality of the flax. A mechanical flax-breaker has just been developed, effectively loosening the ring of fibre bundles from the wood, which may then be knocked out in scutching. If this operation could be carried out by the growers, the partially separated but unretted fibres could be transported cheaply to the flax spinners, who could

then treat the fibres so as to obtain a more uniform product.

Chemical retting has been much investigated of recent years and lends itself to proper control. The fibre obtained differs somewhat from biologically retted material, being denser and lighter in colour. At present, mechanical difficulties of handling the flax in the various operations have prevented the large-scale development of chemical retting processes.

By treating the fibres so that they break up into their ultimate fibre strands, flax may be spun on cotton machinery and incorporated in mixed yarns. This 'cottonisation' process may provide an outlet for low-quality flax grown for linseed, and make possible the utilisation of waste flax for the manufacture of high-grade paper.

## Fishery Research in the Eastern Mediterranean\*

THE eastern basin of the Mediterranean still offers almost a virgin field for the marine biologists. Apart from such occasional visits as those of the German *Pola* and the Danish *Thor* Expeditions, the main source of information now comes from the Fisheries Research Directorate of Egypt. This Directorate, founded originally as a Fisheries Research Office in 1919 under the direction of Mr. G. W. Paget, has passed through various vicissitudes; but it should now be sufficiently established to prove its value. As in most such undertakings, work of this nature starts from small beginnings. The foundations were well laid by Mr. Paget in his broad surveys of the lake and sea fisheries and his careful study of the sponge grounds; and by his inauguration of a system for the collection of necessary statistics. Special attention was then also paid to the growth and culture of the grey mullets which make up so large a proportion of the catches from the Delta lakes.

Owing to political upheavals, fisheries research lapsed for the period 1924-27. After that time, the office was once more opened under the direction of Mr. R. S. Wimpenny. Research was further developed under his regime, and two important additions were made to the facilities for investigation. A special research vessel, designed on the lines of a modern large steam trawler, H.E.M.S. *Mabahiss*, was completed by Messrs. Swan, Hunter, and Wigham Richardson, and a research laboratory was built near Fort Kait Bey on the eastern harbour of Alexandria. Interesting experiments were also carried out on the transport by air of grey mullet fry to the inland lake Qarûn, which appears to have been successfully stocked. On Mr. Wimpenny's departure at the end of 1931, the direction was taken over by Dr. Hussein Faouzi.

In 1932 the *Mabahiss* was lent by the Egyptian Government for the Sir John Murray Expedition to the Indian Ocean under the leadership of Lieut.-

Colonel R. B. Seymour Sewell, and Dr. Faouzi also accompanied the expedition. The experience thus gained should prove of great value to the Directorate, and it is gratifying to see that research is being advanced in another direction by facilities offered to visiting research workers at the Fisheries Laboratory. A distinguished visitor in 1933 was Prof. Adolf Steuer, co-director of the Italo-German Institute of Marine Biology at Rovigno d'Istria, and results of his work and that of a number of specialists are now appearing in the "Notes and Memoirs" published by the Directorate.

The preliminary report on the fishery grounds near Alexandria contains interesting observations on the seasonal sequence of the plankton. There is a big outburst of phytoplankton in September and October which appears to be determined by the Nile flood, and the influence of this water extends over a large area. It has recently been shown by Liebman<sup>1</sup> to affect even the waters of the Palestine coasts, where the planktonic sequence is similar to that at Alexandria. Such observations should have important bearings on the movements of sardines and other fish. A further noteworthy feature is the occurrence of the green algæ, *Caulerpa* and *Halimeda*, down to the fifty fathom line off the Egyptian coast, an index of the excessive transparency of the water.

Another activity of the Fisheries Directorate is the attempt to restock with fish the springs of the Siwa oasis. This is an experiment that will necessarily require careful watching. Preliminary observations have shown that the bolti (*Tilapia*) which are being used do not feed on the cyprinodonts reared to feed on mosquito larvæ, but do feed on the latter. It is to be hoped that they do not change their habit and repeat the effects of the previous introduction of an ill-judged species which devoured the cyprinodonts so carefully inserted by the Department of Hygiene.

Now that research is on so sound a footing, the Egyptian Government should see grounds for fostering and furthering investigations in this most interesting region. There can be no doubt that knowledge so gained will prove of immense value in predicting and controlling the extent of the fisheries.

F. S. RUSSELL.

\* Rapport sur les Pêcheries d'Égypte en 1932. Par Ibrahim Abd-El-Gallil Abou-Samara. Direction des Recherches des Pêcheries. Administration des Gardes-Côtes et des Pêcheries. Ministère des Finances. Le Caire, Imprimeries Nationales, Boulac 1935.

The Fishery Grounds Near Alexandria. (1) Preliminary Report. By Adolf Steuer. *Ibid.* Notes and Memoirs No. 8, 1935. (2) A Bottom Sample taken at Alexandria. By Aristocle Vatova. No. 9. (3) Cirripeds. By Hjalmar Broch. No. 10. (4) Some Marine Mites from Alexandria. By Karl Viets. No. 11. (5) Ostracoda. By Walter Klie. No. 12.

<sup>1</sup> Oceanographic Observations on the Palestine Coasts. By E. Liebman. *Comm. Int. Explor. Sci. Mediterr., Rapp. Proc. Verb.*, 1935.

## Magic and Medicine in Early England

PROF. CHARLES SINGER, professor of the history of medicine in the University of London, delivered the Fison Memorial Lecture in the anatomical theatre of Guy's Hospital Medical School on June 18. The subject of the lecture was "Magic and Medicine in Early England".

Prof. Singer pointed out that there must have been a mass of magico-medical material of combined Celtic and Roman, Pagan and Christian origin in use in England before the advent of the Anglo-Saxon culture. This early material has almost entirely disappeared; only faint traces of it have been recovered by folk-lorists in any recognisable form. Early Celtic elements have disappeared almost entirely even from the manuscript texts. Considering the labour that has been put into it for over a century, the results of folk-lore research in England are very disappointing and singularly destitute in positive results. Most so-called 'native' folk-lore is part of the general European heritage and strongly coloured by Roman civilisation and Roman Christianity. In so far as English folk-lore is medical, it is largely in line with and probably derived from the herb-lore of Salerno in southern Italy. That town, of mixed Latin, Greek and Saracen culture, was the purveyor of such material to Europe throughout the Middle Ages at least from the tenth century onward. The leech books that have come down to us from Anglo-Saxon times, however, whether in Latin or in the Anglo-Saxon language, contain a certain amount of material of distinctive character, some of which is of genuinely early and even of pagan origin. In these early leech books magical and simple herbal remedies are inextricably mixed. The Anglo-Saxon leech books are largely commonplace books in which, from time to time, supposedly useful recipes, both for men and beasts, were jotted down.

There has been some discussion as to who were the men who used, read and wrote these books. At least some of the leech books were certainly not produced nor could they have been used by priests. For the administration of many of the remedies, the prescriptions specifically state that a priest must be called in. Some few of the magical devices are of obviously pagan tone and it is most unlikely that they were either written or used by anyone in orders. There are a considerable number of representations of leeches in Anglo-Saxon art and these never show the tonsure. It is probable that the Anglo-Saxon leeches were men of the yeoman or farmer class who combined with their calling a hereditary knowledge of leechcraft much as was the case until quite modern times in certain families in Wales and the Gaelic-speaking highlands of Scotland.

There are in all about twenty manuscripts of Anglo-Saxon origin and of magico-medical interest. Practically all are in the libraries of the British Museum, the Bodleian and Corpus Christi College, Oxford and the preservation of most of them is due to the foresight exhibited in the sixteenth century by Sir Robert Cotton and Archbishop Parker.

As regards the actual remedies in the leech books, the overwhelming majority represent corrupted and misunderstood classical medicine of Greek origin from which, however, all rational elements and all theoretical considerations have almost wholly departed. A certain amount consist of direct translation of Salernitan material. Ecclesiastical elements

are strong throughout and many remedies are suggested by or are modelled on the ceremonies of the Church. Wandering Syrian traders and Celtic missionaries or Italian priests must have been introduced, for tags of Irish, Byzantine and Syriac theurgy are traceable here and there. In several places a few words of Greek, Irish, Syriac and Hebrew are recognisable and a number of 'Pythagorean' charms have survived which use misunderstood Greek letters. Among the strangest survivals of all is a Hebrew alphabet which accords to the Samaritan type, and is to be found in an Anglo-Saxon manuscript in Exeter Cathedral library.

The leech books provide evidence for some direct traffic in Anglo-Saxon times between south Italy and England. Apart from the Salernitan elements, there is evidence of direct copying of figures from that source. Some of the Anglo-Saxon leech books are handsomely illustrated by figures of plants, and it can be shown that many of these represent Mediterranean and not British forms. Again, a number of representations of the scorpion—a favourite theme in these manuscripts—are obviously copied from the work of artists who were familiar with this part of southern Europe.

Among the magical spells in the leech books are a few exhibiting pagan Saxon elements. In almost all of these there has been a systematic attempt to Christianise the original form. In one, however, of about 1100 or a little later, the name of the god Woden has been allowed to stand. Thus traces of an almost open paganism must have survived in England at least as late as the twelfth century.

Perhaps the most curious of all the pagan survivals, and one which lasted well into Norman times, is a group of Latin prayers addressed to the pagan classical 'Queen of Heaven'. Owing to the somewhat obscure wording this deity was evidently mistaken for the Virgin.

Despite the persistence and interest of these traces of paganism, there can be no doubt that pagan elements, whether classical Anglo-Saxon, Celtic or other are very few and unimportant. The material and spirit of the early English leech books are overwhelmingly Latin and Christian and all other elements are obviously rapidly receding.

## Educational Topics and Events

CAMBRIDGE.—The Anglo-American Corporation of South Africa, the Central Mining and Investment Corporation, the Consolidated Goldfields of South Africa, the New Consolidated Goldfields and the Union Corporation have each made a donation of £1,000 to the Cavendish Laboratory.

Miss G. L. Elles of Newnham College has been appointed reader in geology. R. F. Kahn of King's College has been appointed University lecturer in economics, C. W. Gilbert of Jesus College, University demonstrator in physics, Dr. E. C. Childs of Clare College, University demonstrator in soil science, C. H. Waddington of Christ's College, University lecturer in zoology, D. H. Valentine of St. John's College, University demonstrator in botany and Dr. G. A. Millikan of Trinity College, University lecturer in physiology. H. P. Whiting of Queens' College has been appointed assistant to the Director of the Museum of Zoology.

LONDON.—Mr. H. L. Eason has been re-elected Vice-Chancellor for the year 1936–37.

Dr. G. C. McVittie has been appointed as from October 1 to the University readership in mathematics tenable at King's College. Since 1934 he has been lecturer in applied mathematics in the University of Liverpool.

Dr. W. V. Mayneord has been appointed as from July 1 to the University readership in physics tenable at the Royal Cancer Hospital (Free). Since 1927, he has been physicist to the Radiological Department of the Hospital.

OXFORD.—The Curators of the University Chest have been authorised to receive from the Rockefeller Foundation a sum not exceeding £1,600 annually for five years from October 1, 1936, for researches in the Dyson Perrins Laboratory on the synthesis of proteins.

Mr. G. J. Whitrow has been appointed to a 'lectureship' (the equivalent of a research fellowship) in mathematics at Christ Church. Mr. C. S. Elton, director of the Bureau of Animal Population in the Department of Zoology, has been elected a research fellow of Corpus Christi College.

A full professorship in social anthropology has been created in the place of a readership, and application for the chair should be made before September 19. The new professorship will be attached to All Souls College.

SHEFFIELD.—The following appointments have been made: Dr. A. E. Barnes to be professor of medicine, in succession to Prof. A. E. Naish; Dr. H. W. Swift to be professor of engineering. Mr. R. G. Bellamy and Dr. J. Dick, assistant lecturers in mechanical engineering, have been made lecturers.

## Science News a Century Ago

### The Faraday Dark Space

IN 1836, Faraday began those experiments on the electric discharge which form part of his researches in electrostatics, and which are described in the Twelfth and Thirteenth Series of his *Experimental Researches in Electricity*. At first he examined the nature of the brush and spark discharges from balls and points in air, and the influence of shape, separation and other factors on the discharge between two opposed electrodes. Afterwards, he had a glass globe constructed, with openings at opposite sides through which brass electrodes could be passed, and with a third opening and stopcock for connexion to an air pump. This apparatus, with which he intended to examine the discharge or arc between the electrodes in air and gases at low pressures, was first brought into use on June 21. After some preliminary experiments, described in the "Diary", he writes:

"The ends within the globe were brought in contact—the globe exhausted thoroughly—and a continuous current at the conductor used. On opening the ends, gradually a peculiar and constant appearance of great beauty was observed. At the moment of separation, a glow of light came over the end of the *negative* wire, the positive being dark. As the distance increased, a purple stream or haze went right out from the end of the P. wire towards the N. end; this elongated as the distance increased, but there was *always* a dark space between the end of it and

the haze on the N. wire. The space was nearly invariable in its width and also its position relative to the N. wire, nor did the glow on the N. end vary. It was curious to see the P. purple haze diminish or lengthen as the wires were separated: and the dark space is probably an important point to understand."

Thus Faraday described for the first time the beautiful appearances in an exhausted discharge tube which afterwards on many occasions excited his admiration, and recorded his first observation of the dark space, now so well known, which bears his name.

### Communications in South Africa

AT a meeting of the Royal Geographical Society held on June 27, 1836, a paper by Major Mitchell was read entitled "On the Roads and Kloofs in the Cape Colony". Major Mitchell was the Surveyor at the Cape of Good Hope, and in its report of his paper, the *Athenæum* said: "The vast importance of our colonial possessions in Southern Africa, covering an extent of territory equal to the whole British Isles, gives great interest to any information tending to facilitate communication. A range of mountains running parallel to the western and southern coasts at a distance of about 40 miles from the sea, forms a barrier cutting off communication with the interior, which can only be traversed at certain mountain passes which retain the Dutch name of kloofs. In the western range there are nine of these mountain passes, in most of which it is necessary to take a waggon to pieces, carry it and its cargo piece-meal through and then put it together and re-load; yet, if a good road were constructed at Nostert's Hoch Pass, which might be done, Major Mitchell said, for £8,000, there would be no absolute necessity for any other in the range. In Major Mitchell's view, if Government would expend £20,000 on making roads and bridges in Cape Colony, no further outlay would be required for two centuries to come, by which time the colony would be fully equal to provide for itself."

### The Reorganisation of the British Museum

ON June 28, 1836, *The Times* published a note on the British Museum saying: "The Committee of the House appointed last session to inquire into the affairs of this establishment with a view to extend its public utility has, we understand, nearly concluded its labours: and we congratulate our readers on the probability of their receiving some substantial benefits from the contemplated alterations in the government and arrangements of the national museum. We trust that our manufacturers will not, hereafter, be compelled to send to France for patterns for their workmen, it being the intention of the Government among other improvements, to establish a School of Design, to form an integral part of the British Museum, which cannot fail, in course of time to obviate the unpleasant necessity of applying to our neighbours, and greatly to promote the success of our arts and manufacturers. . . . With regard to the Museum Inquiry, we understand, that for whatever benefits the public may derive from it, they are chiefly indebted to Mr. John Millard, who for the last three years has devoted the greater part of his time and attention to the subject." On July 2, *The Times* published a letter from R. T. Stothard, who claimed that the improvement of the British Museum for the last eight or ten years had been the subject which "had occupied every moment of his leisure hours".



## Societies and Academies

## DUBLIN

Royal Dublin Society, May 26. Report of the Radium Committee for the year 1935. Records are included of the treatment of 451 cases of malignant disease and 149 cases of non-malignant disease with radon supplied by the Society's laboratory. The chief feature of interest is the tendency towards the use of larger doses, the average activity of each capillary issued having risen from 5.1 millicuries in 1934 to 6.5 in 1935, and the average quantity of radon issued per case being 27.6 as compared with 19.9 in 1934. Many successful results are recorded, especially in cases of surface disease. KENNETH C. BAILEY and W. E. CALCUTT: The inhibition of chemical reactions (6). The influence of ether and nitrobenzene on the absorption of ethylene by sulphuric acid. The rate of absorption of ethylene by sulphuric acid is diminished sharply by the presence of small quantities of ether or nitrobenzene, both of which are positively adsorbed at the surface of the acid. This retarding effect is very much smaller if the surface of the acid is moving too rapidly for the surface-active retarder to accumulate there. The kinetics of the reaction have been examined, and lead to relationships between the efficiency of the retarders and their concentrations at the surface of the sulphuric acid. No relationship was found with the concentrations in the bulk of the liquid. The retarders probably act at the gas-liquid interface. A. FARRINGTON: The glaciation of the Bantry Bay district.

## PARIS

Academy of Sciences, May 18 (*C.R.*, 202, 1629-1724). GABRIEL BERTRAND and ANTON PHILIP WEBER: The combined action of folliculin and certain mineral catalysts on the development of a yeast. The joint action of hormone and mineral catalyst on the development of the yeast *Rhodotorula glutinis* var. *Saitoi* was examined. Whilst folliculin alone increased the yield from 12 to 16 per cent, and zinc alone 10 per cent, their joint action increased the yield 79-150 per cent. LUCIEN DANIEL: Variations of the decapitated dandelion. LUBOMIR TCHAKALOFF: A generalisation of Rolle's theorem for polynomials. E. J. GUMBEL: The distribution of compatible events. L. ERMOLAEV: Study of a correspondence between curves and surfaces. ANDRÉ KOLMOGOROFF: Relative cycles. The theorem of duality of M. Alexander. NATAN ARONSAJN: *N*-dimensional homotopy. TIBÈRE POPOVICIU: A problem of the maximum of Stieltjes. KARL MENGGER: Minimising non-rectifiable curves and general fields of curves admissible in the calculus of variations. CHARLES PLATRIER: The problem of Barré de Saint-Venant for a homogeneous, non-isotropic, imperfectly flexible body. EMILE JOUGUET: Remarks on the preceding communication. ALBERT GRUMBACH: The variable period of flow of a liquid in an indefinite capillary tube. VICHNIESKY: The relation between the vibratory phenomenon accompanying detonation, the period of increase of pressure and the value of the maximum pressure during the combustion in an internal combustion motor. MLE. GEORGETTE DE NOCKERE: The analytical representation of the

lunar relief. JEAN HÉLY: A synthetical theory of gravitation and of electromagnetism. LOUIS ROUTIN: An automatic repeater designed for the physical cultivation of the memory. LUCIEN DELAVENNA and JEAN MAILLARD: The electrolytic oxidation of sodium chloride into sodium chlorate. The modified method proposed avoids production of chlorine, is free from the danger of detonating gas, gives hydrogen capable of utilisation, and furnishes crystalline sodium chlorate of 99.5 per cent purity. MLE. SUZANNE VEIL: Electrometric potential and concentration of the electrolytes. MLE. CÉCILE STORA: The influence of pH on the Becquerel effect of coloured electrodes. MME. RENÉE HERMAN-MONTAGNE, LEWIS HERMAN and RAYMOND RICARD: Photographic photometry in the extreme ultra-violet. J. M. BAČKOVSKÝ: A method of obtaining soft X-rays in the case of gases, particularly the *K* spectrum of neon. EDOUARD TOPORESCU: The depolymerisation of water by capillarity and the inversion of sugar. MME. MARIE FREYMANN: Comparison of the infrared absorption spectra and the Raman spectra of some primary fatty and aromatic amines. MLE. MARIE THÉODORESCO: The study by the Raman effect of two borotartaric complex compounds in solution. GEORGES LÉVY: The sulphonation of  $\beta$ -ethylnaphthalene. The synthesis of 2-ethyl-6-naphthol. JEAN VÈNE: Preparation of monoalkyl and monoaryl substitution derivatives of  $\beta$ -campholide and of the corresponding acid  $\delta$ -alcohols. PIERRE PASTUREAU and MLE. MARGUERITE VEILER: Some boric esters of substituted glycerols. JEAN DÉCOMBE: The preparation of  $\beta$ -chloroethyl ketones and  $\beta$ -vinyl ketones. LOUIS ROYER: The orientation of crystals of potassium fluoborate by mica and barytes and of crystals of sodium sulphite by mica. GEORGES JOURAVSKY: The chemical composition of the titanomagnetites. MAURICE BREISTROFFER: The stratigraphy of the middle Cretaceous in Chartreuse. GILBERT MATHIEU: The coal measure fragments of Ville-Dé-d'Ardin and of Fougereux (Deux-Sèvres). HENRY HUBERT: The limits of the aerial currents in West Africa. MAURICE QUENDIAC: The solubility of the tannic compounds of chestnut wood. MAURICE HOCQUETTE: Elaboration by the secreting cell and the phenomena of secretion in *Primula obconica*. GILBERT RANSON: The so-called degeneration of *Navicula fusiformis* (*N. Ostrearia*). ALBERT DEMOLON and ANTOINE DUNEZ: The fatigue of soils. Cause and remedies. PH. JOYET-LAVERGNE: The role of the cytoplasm of the male gamete in the phenomena of fecundation. RAOUL LECOQ and JOSEPH M. JOLY: The influence of disturbed food equilibrium on the respiratory quotient and basic metabolism of the pigeon. MLE. N. CHOUCROUN: Superficial electrification, a specific character of micro-organisms. ANDRÉ BADINAND: Modifications of function of ascorbic acid, as an activator of hepatic cathepsine, under the influence of metals added either in ionisable form, or forming part of complex derivatives of vitamin C. MLE. IRÈNE KOPACZEWSKA and W. KOPACZEWSKI: The plurality of zones of flocculation and of seric gelatinisation. ALFRED BOQUET and ROGER LAPORTE: Experimental sero-fibrinous pleurisy by intra-peritoneal inoculation of bovine tubercle bacilli of the smooth dysgonic type. MME. ANDRÉE ROCHE, MARCEL DORIER and LOUIS SAMUEL: The meaning of the ratio albumen to globulin, in normal and pathological human serum.

## MELBOURNE

Royal Society of Victoria, April 16. A. B. EDWARDS: Occurrence of quartz-tourmaline nodules in the granite of Clear Creek, near Everton. Nodules composed essentially of quartz and blue tourmaline occur, associated with aplite. The tourmaline has replaced the orthoclase of the granite *in situ*. They seem best explained as originating from bubbles of boron that have risen into the semi-crystalline, viscous upper part of the granitic magma as a result of some sudden release of pressure, and have reacted with the orthoclase crystals when the temperature of the granitic magma has decreased sufficiently. The nodules constitute about one per cent of the granite, which is equivalent to about 1.5 tons of boron per 100,000 tons of granite, or 0.05 per cent of  $B_2O_3$ . EDWIN SHERBON HILLS: Physiographic history of the Victorian Grampians. For thirty years, Victorian physiographers have accepted, without question, Hart's view that the Grampians are typical block mountains, deriving their topographic form from Tertiary fault movements. Physiographical and stratigraphical investigations of critical localities indicate, however, that the Grampians owe their relative elevation to the resistance to erosion of the massive sandstones of which they are dominantly composed.

## Moscow

Academy of Sciences (*C.R.*, 1, No. 9, 1936). N. A. ACHYESER and M. KREIN: Two problems of the minimums connected with the problem of moments. A. DANILEVSKIY: A theorem by M. G. Krein. M. J. DEISENROTH-MYSSOWSKY, G. D. LATYSHEV, L. I. RUSSINOV and R. A. EICHELBERGER: The problem of boron disintegration by means of slow neutrons. B. MOLDAVSKIY and H. KAMUSCHER: Catalytic cyclisation of carbohydrates of the fat series. B. S. BUTKEVICH and L. K. OGNICKAYA: Role of formic acid in the biochemical formation of oxalic acid. N. A. ILJIN: Experimental moult in animals which do not moult naturally. A moult in the normally non-moulting races of merino sheep can be induced by introduction into the organism of certain chemical substances. This suggests that the genetic difference between the two groups of races is less fundamental than it appears. A. ZAVARICKIJ: Lavas of the volcanoes in the environs of Merghen, Manchuria.

(*C.R.*, 1, No. 6, 1936). M. KURENSKIY: A method for the solution of the problem of deformation of surfaces. N. KALABUKHOV: The internal photo-effect in potassium chloride under illumination with ultra-violet light. A. FILIPPOV, J. LARIONOV and A. SEIDEL: The fluorescence of terbium salts in solutions. M. F. NEUBURG: Discovery of saporin on the Tomi River, Kuznetsk basin. I. A. REMESOV: The synthesis of  $\Delta^4$ -dehydro-androsterone ( $\Delta^4$ -3-oxysterone-17) produced directly from cholesterol. F. F. MAZKOV: A new rapid method for the recognition of the living, dead and injured tissue of a green plant. When soaked in weak solution (0.1-0.3N) of hydrochloric acid for 15-20 minutes, living tissue remains green, the dead becomes brown, and the injured spotted with brown. I. STRELNIKOV: Water metabolism and diapause in *Loxostege sticticalis*. Diapause can be induced by dry food, by food of high nutritional value, and by low temperature. L. V. POLZHAJEV: Regulation of primordial eye and production of the lens from epithelium.

## Forthcoming Events

[Meetings marked with an asterisk are open to the public.]

Tuesday, June 30

WARBURG INSTITUTE, at 5.30.—Dr. E. A. Lowe: "Roman Culture before and after the Carolingian Reform as reflected in Latin Manuscripts".\*

CHEMICAL ENGINEERING CONGRESS OF THE WORLD POWER CONFERENCE, June 22-27.—To be held in London.

SOUTH-EASTERN UNION OF SCIENTIFIC SOCIETIES, June 30-July 4.—Annual Congress to be held in Oxford.

June 30, at 8.30.—Prof. G. D. Hale Carpenter: "Charles Darwin and Entomology" (Presidential Address).

INTERNATIONAL CONGRESS ON GLASS, July 2-11.—To be held in London and Sheffield.

July 3, at 4.30—at the Institution of Electrical Engineers, Savoy Place, London, W.C.1.—Dr. J. C. Hostetter: "The Casting of the 200-inch Telescope Disc".\*

## Official Publications Received

## Great Britain and Ireland

British Chemical Plant, 1936; the Official Directory of the British Chemical Plant Manufacturers' Association. Pp. 140. (London: British Chemical Plant Manufacturers' Association.) [285]

Proceedings of the Royal Society of Edinburgh, Session 1935-1936, Vol. 56, Part 1, No. 3: Studies in Clocks and Time-keeping, No. 5: The Suspended Chronometer. By Prof. R. A. Sampson. Pp. 13-25. (Edinburgh: Robert Grant and Son, Ltd.; London: Williams and Norgate, Ltd.) 1s. [295]

Air Ministry: Aeronautical Research Committee: Reports and Memoranda. No. 1668 (Strut. 248, 298): Abstract—Stress-Calculation in Frameworks by the Method of "Systematic Relaxation of Constraints", 1, 2 and 3. By R. V. Southwell. Pp. 2, 2d. net. No. 1671 (Strut. 258): Flexural and Shear Deflections of Metal Spars. By I. J. Gerard and H. Boden. Pp. 13+1 plate. 9d. net. No. 1676 (I.C.E. 917, 996): Abstract—Ice Formation in Carburetors. By W. C. Clothier. Pp. 2, 2d. net. No. 1678 (F.M. 234): Lamina Boundary Layer on the Surface of a Sphere in a Uniform Stream. By S. Tomotika. Pp. 14+5 plates. 1s. net. No. 1680 (1202): Abstract—On the Synthesis and Analysis of Simply-Stiff Frameworks. By Dr. H. Roxbee Cox. Pp. 2, 2d. net. (London: H.M. Stationery Office.) [66]

## Other Countries

U.S. Department of the Interior: Office of Education. Bulletin, 1935, No. 16: Elementary School Graduating Examinations. By David Segel. Pp. v+64. 10 cents. Pamphlet No. 64: Significant Programs of High-School Parent-Teacher Associations; a Study of Current Practices in a Selected Number of Associations. By Ellen C. Lombard. Pp. 42. 5 cents. Pamphlet No. 66: Education of Teachers; Selected Bibliography, June 1, 1932, to October 1, 1935. By Benjamin W. Frazier. Pp. vi+42. 5 cents. Pamphlet No. 67: Training of Elementary Teachers for School Health Work. By Dr. James Frederick Rogers. Pp. iii+27. 5 cents. Pamphlet No. 68: What every Teacher should know about the Physical Condition of her Pupils. By Dr. James Frederick Rogers. Pp. 30. 5 cents. (Washington, D.C.: Government Printing Office.) [275]

University of California Publications in American Archaeology and Ethnology. Vol. 36, No. 3: Wappo Ethnography. By Harold E. Driver. Pp. iii+179-220. (Berkeley, Calif.: University of California Press; London: Cambridge University Press, 1936.) 2s. 3d. net. [275]

U.S. Department of Agriculture: Bureau of Entomology and Plant Quarantine, Division of Insecticide Investigations. Lonchocarpus Species (Barbasco, Cuba, Haiari, Nekoe and Timbo) used as Insecticides. By R. C. Roark. Pp. 133. (Washington, D.C.: Government Printing Office.) [285]

Proceedings of the American Academy of Arts and Sciences. Vol. 71, No. 1: A study of the Nolanaceae. By Ivan M. Johnston. Pp. 87. 1.45 dollars. Vol. 71, No. 2: Revision of the Nearctic Raphidiodea (Recent and Fossil). By F. M. Carpenter. Pp. 89-157+2 plates. 1.20 dollars. (Boston, Mass.: American Academy of Arts and Sciences.) [285]

Brooklyn Botanic Garden. Memoirs, Vol. 4: Twenty-fifth Anniversary Papers presented May 15, 1935. Pp. xiii+133. 1.00 dollars. (Brooklyn, N.Y.: Brooklyn Botanic Garden.) [285]

National Research Council of Japan. Report, Vol. 2, No. 4. 1934-1935—March 1935. Pp. ii+245-345. (Tokyo: National Research Council of Japan.) [285]

N.Z. Department of Scientific and Industrial Research. Christchurch Magnetic Observatory: Annual Reports for 1931, 1932, 1933. Pp. xviii+132. (Wellington: Government Printing Office.) 10s. [285]

Indian Central Cotton Committee: Technological Laboratory. Technological Bulletin, Series A, No. 30: The Effects of Storing Cotton Bales in the Open and inside a Shed at Karachi. By Dr. Nazir Ahmad. Pp. ii+24. (Bombay: Indian Central Cotton Committee.) 8 annas. [26]

