NATURE

SATURDAY, JUNE 17, 1933

No. 3320 Vol. 131

CONTENTS

Editorial and Publishing Offices :
MACMILLAN & CO., LTD.
ST. MARTIN'S STREET, LONDON, W.C.2
Telephone Number : WHITEHALL 8831
Telegraphic Address : PHUSIS, LESQUARE, LONDON

Advertisements should be addressed to
T. G. Scott & Son, Ltd., 63 Ludgate Hill, London, E.C.4
Telephone Number : City 4211

Nationalism and Academic Freedom

GERMANY, responding to the call of a patriotic emotion—as she has more than once before, but never with such abandon—would appear to have handed herself over body and soul to Herr Hitler. Acting on a given view of history and a prescribed theory of racial and national regeneration, she seeks to purge herself of elements felt to be inimical or to stand in the way of the realisation of his ideal. A new communism, imposed by force, but accepted widely if not yet universally, with an enthusiasm which appears to have crossed the bounds of fanaticism, bids fair to reduce the whole of Germany as nearly as is humanly possible to one common denominator and to block every angle of vision but one in her political and intellectual kingdoms alike.

Both historian and anthropologist may look askance at the Hitlerian view of racial history and psychology as suspect in origin. They may dismiss with a smile the 'Aryan' claim to exclusive rights in the swastika. It is not the first time that ethnological facts have been 'edited' to bolster political aspiration or flatter national vanity ; nor will it be the last. If, in electing to remould herself as an 'organised State', Germany has chosen to rely on the hypnotic effect of a pseudo-scientific theory now exploded—an instrument which may break in her hand—that is her affair and concerns no one but herself. In expelling from public life those who, on racial or political grounds, are regarded as beyond the pale, Germany, by her own act, deprives herself of the services of some of her most eminent intellectuals. These are men prominent in the arts and sciences, in public life, in the professions and in education, who have raised and maintained her in the foremost ranks of intellectual achievement among the nations. This may well seem a blunder, at which the whole civilised world stands aghast, a misreading of history and a fatal misinterpretation of the conditions of progress in a modern society, in which, in these days of fierce competition, every resource of science is pressed into the service of social and commercial advancement. Yet even such action as this, although it has its international aspect, as a domestic matter, it is held, does not concern the outside world. But in forbidding men of German nationality, who have served their country loyally in peace and war, to exercise their talents, and in depriving them of the means of livelihood,

Germany has been guilty, in the eyes of the world, of an act of grave injustice, which has made intellectual companionship with her difficult.

It is fully in accord with the tradition of religious and political liberty in Great Britain that the first attempt on a comprehensive scale to organise a scheme of assistance for the scholars, men of science and university teachers who have been forced to relinquish their posts in Germany should have been made by their British colleagues. It was never in doubt that, for men of the first rank and of international fame, room would be found without delay in the universities of other countries. This belief has been justified by the event. It did not seem likely that it would be possible in the normal course for academic institutions outside Germany, however great their goodwill, to absorb more than a few of those of less outstanding repute, and that too, perhaps only after some considerable delay. The difficulties are enormously increased by financial conditions, collective and individual, in the academic institutions of all countries alike. In teaching and research, competition for appointments at the moment is intense ; and it would be neither fair nor practicable for a 'most-favoured nation clause' to be extended to displaced German teachers and research workers; while the requirements of the normal development of university work are such that it is unlikely that many universities would feel justified in making special provision for them. As the result of inquiry, it would appear that this is only too just an estimate of the position. Appointments will be available for only a small fraction of those in need.

It is in view of considerations such as these that, as already noted in NATURE (June 3, p. 793), the Academic Assistance Council has been organised. A provisional council has been formed which has issued a statement of the aims and methods to be followed, should the necessary support be received. The Academic Assistance Council will act in a double capacity. In the first place it will serve as a centre of information and as an organisation which will put the teachers concerned into touch with the institutions where they can work ; and secondly, it will seek to raise a fund to be used primarily, though not exclusively, in providing maintenance for displaced teachers and finding them a chance of work in universities and scientific institutions.

There are several points arising out of this appeal which call for comment. Of these the most considerable is the effect of German action on science at large. While Germany may claim as a matter of domestic concern to lay down such regulations for appointments in and admissions to her academic institutions as she may deem fit, apart from all questions of justice it is a matter of concern to the whole scientific world that a number of workers, now considerable, be they Jews, or members of any religious or political group whatsoever, are deprived of the opportunities they have hitherto employed in adding to the sum total of scientific knowledge—researches by which ultimately the whole world has benefited, irrespective of nationality. It requires no special pleading to show that while Germany persists in her present attitude towards Jews and other men of science within her jurisdiction who do not conform to type, it is of advantage to the whole scientific world and an international obligation to ensure that everything possible is done to secure the continued benefit to science of the services of these displaced workers. The international appeal of the situation and the need for international action has not been overlooked by the provisional council. It is in relation, not merely with British universities, but also with bodies formed for a purpose similar to its own in other countries.

Unfortunately, the situation in Germany is not unique ; and the Council proposes to utilise any funds entrusted to it for the purpose of assisting university teachers and scientific workers of whatever country who on grounds of religion, political opinion or race are unable to carry on their work in their own country. There is no doubt, however, that for the moment the situation in Germany is the most critical. The appeal records the names of a long list of teachers who have been dismissed, have resigned on account of student action, or are on enforced leave. Yet long as it is, it is confined to professors, extraordinary professors and *Privatdozenten* in institutions of university rank, and is stated to be incomplete.

It should be no matter for surprise that, while the appeal has been received with much sympathy, it has aroused misgiving, in view of the financial situation and the difficulty of finding appointments for trained scientific men, many with high qualifications, from our own universities and places of higher education, while among school teachers the position is equally, if not more, grave. Obviously it would be far from politic, and indeed unfair to the displaced teachers and research workers, to offer them posts in a market which is already overstocked. The Academic

Assistance Council has shown itself fully alive to the situation. Its proposals will, it is understood, take the form that any funds raised should be devoted to the creation of special posts and lectureships *ad hoc*, and that these will be of limited duration, a term of years at the end of which it may be anticipated that a process of adjustment will have worked itself out.

The appeal of the provisional council, of which Sir William Beveridge and Prof. C. S. Gibson act as secretaries, has already received a substantial measure of support. Office accommodation has been placed at the disposal of the Council by the Royal Society, and the appeal carries the names, among others, of Sir Frederick Gowland Hopkins, president of the Royal Society and of the British Association, Lord Buckmaster, Lord Cecil of Chelwood, Lord Crawford and Balcarres, Sir William Bragg, Mr. H. A. L. Fisher, Sir George F. Hill, director of the British Museum, Sir Frederic Kenyon, Mr. J. M. Keynes, Lord Lytton, Dr. Allen Mawer, Dr. Gilbert Murray, Lord Eustace Percy, Sir William Pope, Lord Rutherford, Sir Josiah Stamp, Sir J. J. Thomson, Sir Michael Sadler, Sir Charles Sherrington, and Prof. G. Elliot Smith.

The Development of Indian Thought

(1) *A History of Indian Philosophy.* By Dr. Surendranath Dasgupta. Vol. 1. Second impression. Pp. xvi+528. 30*s*. net. Vol. 2. Pp. xi+620. 35*s*. net. (Cambridge: At the University Press, 1932.)

(2) *Outlines of Indian Philosophy.* By M. Hiriyanna. Pp. 419. (London: George Allen and Unwin, Ltd., 1932.) 16*s*. net.

A COMPARATIVE study of Eastern and Western thought cannot but widen the understanding of philosophy as a collective effort to apprehend the ultimate sources of knowledge and life. It would also suggest to thinkers of either tradition, new methods of approaching these fundamental problems. A great deal of pioneer work still has to be done in both directions, in order to facilitate the accessibility and interpretation of the existing texts. The West has already published a large amount of original writings, critical editions and historical studies of its leaders of thought; but the East has the technical disadvantage of having entered rather late in the field of practical scholarship. Prof. Dasgupta tells us, for example, how the publication of the second volume of his great "History of Indian Philosophy" was delayed, among other reasons, by the fact that he had to read numerous unpublished and unknown texts, and to decipher patiently the handwriting of old and moth-eaten manuscripts.

Indian philosophy is so rich and complex, that it is impossible to estimate its progress without the help of an expert guide who would initiate one into the technicalities and intricacies of a difficult but most inspiring subject. We owe therefore a debt of gratitude to Prof. Dasgupta and to Prof. Hiriyanna, for their historical and exegetical efforts. Though their aims are different, their works are fully equal to their respective purposes. While Prof. Hiriyanna aims at no more than giving a well-balanced general outline of Indian philosophy, Prof. Dasgupta intends to give a detailed exposition of Indian thought strictly on the basis of the original texts and commentaries. Yet, they both follow almost the same order in their exposition, though Prof. Dasgupta is more patient about details, and gives one additional chapter of great interest on the conceptions of the Indian medical schools. The extensive bibliography in Prof. Dasgupta's two volumes adds to their scientific value.

One must go back to the sacred Vedas for the early sources of Indian philosophy. The Vedic gods, with their cosmogonic implications, must have been the first objects of independent thinking. Behind them, however, the concept of Brahman came to acquire a great significance as the supreme principle of everything. Yet the monotheistic tendencies thus developed, never displaced the ritualistic inclinations of the early Hindus, who cultivated diligently their polytheistic sacrifices. On the other hand, the law of Karma, which identifies sacrifice with action, implies a most effective causally related universe; so that the natural virtues attributed to the sacrifices lessened gradually the importance of deities as the supreme masters of the world and our fate. The ultimate unity of the universe soon gave rise to the idea of a world-soul (Atman), the highest essence in man as well as in the universe, which was to take such a great importance in the Upanishads. So far, it may be observed, the development of the early Vedic philosophy has a striking parallel in that of Greek philosophy, in which the gods of Homer had ultimately to give way before the urgent rational quests for the ultimate

nature of things and for order in the universe, culminating in the recognition of a νοῦς by Anaxagoras.

The parallel develops further when we pass from the Vedas to the Upanishads. Just as it was the case when the centre of interest was displaced by Socrates from the outside world to the self, so, with the Upanishads, the attention of the thinkers is decisively focused on the self, instead of being directed to the Creator outside. This is a considerable change, though the Upanishads or Vedantas are believed to be the last portion of the Vedas. The fundamental idea which runs through the early Upanishads is that, underlying the external world of change, there is an unchangeable reality which is identical with that underlying the essence of man. The quest after Atman, with its many variations and implications, becomes the main concern of the philosopher. The post-Vedic writers have thus a good deal to say about the world, causation, the evolution of the soul and transmigration, and the final state of transcendental bliss which should be that of the soul when at the end of its inexorable cycle, conditioned by the all-pervading law of Karma. In spite of their unity of endeavour, all the Indian schools do not see eye to eye the possible answers to these problems. One of the reasons of the diversity of opinions is that the sutras of the sacred Brahmanic texts are mostly unfinished sentences the meaning of which has to be guessed rather than obviously stated.

These complications increased with the growth of Buddhism and Jainism, both schools outside the pale of orthodox Brahmanism. Though it is said that Buddhism derived much of its inspiration from the oral Samkhya and Yoga traditions of the Vedas, there is no doubt that it introduced entirely new conceptions into Indian philosophy. By denying the substantial and eternal Atman, Buddhism could not teach the conscious transcendental bliss which was the final state admitted by the Vedas. As our experience never apprehends the essence of things, but only our own perceptions, consciousness is nothing but a group of bodily and psychical states which, at death, disintegrate and merge into an unconscious nirvana. The main concern of Buddhism was the answer to the four 'noble truths' : What is sorrow ? What is the cause of sorrow ? What is cessation of sorrow ? What can lead to the cessation of sorrow ? The whole of Buddhist doctrine is the development of the answers to these questions. The denial of a permanent external world and of a permanent soul leads to a complete upsetting of the major tenets of the Brahmanists about the unity, causality and purpose of the world and of life. It is interesting to note, however, that Buddhism had to develop a certain logic for its dialectic purposes. Thus we find in the Sautrantika theory of inference, that the Buddhist knew actually the doctrine of distribution of terms, of conversion, and of the hypothetical syllogism, during the third century before our era.

Jainism, on the other hand, took the opposite view about the world, admitting the permanence of the substance under the changing accidents, and identifying being as the union of permanence and change. This relative pluralism, as opposed to the extreme absolutism of the Upanishads and the extreme pluralism of Buddhism, was further emphasised by the Jainist doctrine of the 'nayas' or points of view in a judgment, which held that no truth is absolute but only conditional, and that the test of knowledge is that it helps us to attain our purpose—a striking anticipation of pragmatism.

These cross-currents in Indian philosophy influenced considerably the age of the systematic doctrines, as may be gathered from the conflicting opinions about the world, causation, perception, inference, the origin of knowledge and the rules of right conduct, put forward by the Samkhya and Yoga schools, the materialist conceptions of Carvaka-darsana, the Nyaya-Vaisesika philosophy, the Purva-Mimansa teaching, and the various Vedanta schools, such as the Sankara, Advaita and Visistadvaita traditions. In spite of their differences, these systems are remarkable products of rational thinking. Fine distinctions on logical problems, ontological and psychological theories, and ethical experiences and rules of conduct, illustrate the amazing versatility of the Indian mind and the sensibility of the Hindus. Translated into occidental language, these distinctions would no doubt prove quite capable of enriching the vast syntheses of our great thinkers. The qualified indications contained in the two works under review are already by themselves an ample mine of material for immediate use.

Before closing our remarks on the development of Indian thought, we wish to direct attention to the learned chapter on the "Speculations in Medical Schools" in the second volume of Prof. Dasgupta's work. Medicine was the most important of all

the physical sciences in ancient India; and its conceptions are closely connected with such doctrines as the Samkhya and Vaisesika physics and the ethical teaching of the Vedic tradition. The earliest texts on medicine, which formed the basis of later commentaries, are those of the Atharva-Veda, which may have been composed by Brahma himself. In them, one finds a mass of information about the organs of the body, embryology, symptoms and observations of diseases, the use of medicines and charms, and, of course, a store of prayers, imprecations and hymns for the cure of certain diseases. Observations about the head, the heart, the circulatory and nervous systems are very important too, in so far as they have been taken as the basis of rival medical and psychological theories, such as the Tantras and the Caraka and Susruta schools, which give the spinal column and the heart, respectively, as the fundamental organs. There are also detailed speculations about the elements of the world and the elements of the body which, at times, bear a striking resemblance to the Hippocratic teaching and to that of the medical school of Crotona.

In conclusion, we can do no better than quote Prof. Hiriyanna's estimate of Indian philosophy (p. 24):

"The two elements common to all Indian thought, are the pursuit of liberation as the final ideal and the ascetic spirit of the discipline recommended for its attainment. They signify that philosophy as understood in India, is neither mere intellectualism nor mere moralism, but includes and transcends them both. They have been represented as the two wings that help the soul in its spiritual flight. The goal that is reached through their aid is characterized on the one hand by illumination which is intellectual conviction that has ripened into an immediate experience, and, on the other hand, by self-renunciation which is secure by reason of the discovery of the metaphysical ground for it. It is pre-eminently an attitude of peace which does not necessarily imply passivity. But the emphasis is on the attitude itself or on the inward experience that gives rise to it, rather than on the outward behaviour which is looked upon as its expression and therefore more or less secondary. The value of philosophic training lies as little in inducing a person to do what otherwise he would not have done, as in instructing him in what otherwise he would not have known; it consists essentially in making him what he was not before. Heaven, it has been remarked, is first a temperament, and then anything else."

THOMAS GREENWOOD.

Research on Vitamins

Medical Research Council. Special Report Series, No. 167: *Vitamins; a Survey of Present Knowledge*. Compiled by a Committee appointed jointly by the Lister Institute and Medical Research Council. Pp. 332+12 plates. (London: H.M. Stationery Office, 1932.) 6*s*. 6*d*.

THIS book is both the most comprehensive and the most official of all publications so far available on its subject. It is the most comprehensive because it surveys all work up to the end of 1931, thus beating Sherman and Smith's monograph and Dr. Ethel Browning's vast compendium by several months; it is the most official because it is the only work on the subject, apart from its own earlier editions, that has been produced under the auspices of a government department.

To describe it, however, as a new edition of the earlier volumes is somewhat misleading; the revisions have been so exhaustive and the rearrangement in certain cases so fundamental as to make it a new work altogether. It is interesting to learn from the foreword that it is not proposed to revise it again or to publish any further editions. The reasons for this decision can best be given in the words of the Medical Research Council, which itself is responsible for issuing the report.

"It can hardly be contemplated that the rapid and accelerating growth of the subject can be conveniently followed further by fresh revisions of such a monograph as this. The labour entailed and the sacrifices of time made by research workers in successive revisions of such a monograph are not likely to be justifiable again. The Council have joined with the Reid Library of the Rowett Institute, Aberdeen, and the Imperial Agricultural Bureaux Council, in giving financial support to a new periodical journal, "Nutrition Abstracts and Reviews", of which the first number appeared in October last [1931]. The Council hope that this will provide for the future a regular means of bringing together and making more readily available the results of research work as they accumulate in the now widely distributed and often disconnected fields of work, medical, agricultural, dietetic, and commercial, in which the subject of nutrition is being so rapidly developed."

Both the decision, and the reasons given for it, are symptomatic of the present condition of vitamin research. Not only has the subject become a recognised branch of biochemistry with repercussions in the extreme directions of pure chemistry and of applied medicine, but it is also just now at a stage when so many growing researches are

about to blossom that it would be almost impossible to lay adequate plans for similar publications in the future. Indeed, the history of vitamin research since this book was published, and still more since the date of the latest publications included in the survey, give ample evidence on the matter.

During 1932 pure crystalline vitamin D became a commercial commodity: further advances have been made in investigating the nature of crystalline vitamin B_1, and the purity of the most concentrated specimens is probably little short of 95 per cent: highly concentrated preparations of vitamin A have now been made (see Carr and Jewell, NATURE, January 21, 1933, p. 92) of probably the same degree of purity as crystalline B_1, but unfortunately not themselves crystalline: Reader and her colleagues (*Biochem. J.*, 26, 2035; 1932) have announced the preparation of what may prove to be crystalline vitamin B_4: the identification of vitamin C with ascorbic (hexuronic) acid is now accepted by nearly all workers in the field.

It is clear that, as these researches reach fruition, investigation of the structure of each particular vitamin will cease to be a biochemical problem and will pass into the hands of the pure chemist. As soon as a vitamin becomes a definite, recognisable, and determinable entity—in the sense that accurate chemical measurement constitutes a determination while biological assay only constitutes an estimation—the hands of the physiologist and clinician will be immensely strengthened in their attempts to work out its precise metabolic function.

How much has already been achieved in this direction, in spite of the difficulties invariably confronting those who work with substances that can only be assayed biologically, is admirably told in this indispensable summary. Although in one or two places it may be possible to detect the individual views of well-known authorities, the objectivity of the volume as a whole is beyond reproach. Considering the fact that the actual text only occupies some 270 pages, its comprehensiveness is quite astonishing. It is, indeed, amusing to notice how often, on turning to the index to find a reference to some aspect of the problem that one thinks has been overlooked, one does indeed find a reference, or more than one, to that very aspect.

On certain matters the authors of particular sections have expressed themselves with refreshing definiteness. On page 69 we find it said that "There is no reason to believe that any of the toxic actions ascribed to cod-liver oil are due to its vitamin content". On page 122 it is stated that "The rat . . . requires for satisfactory nutrition four vitamins of this group, B_1, B_2, B_4, and factor Y: the pigeon at least three vitamins, B_1, B_3, and B_5". This is, incidentally, not a view that would be accepted by all those who have worked with the B complex; it is certainly held by some that the pigeon needs vitamin B_2. On page 227 it is interesting to read "About 500–1,000 c.c. (1–2 pints) of raw cow's milk provides enough or nearly enough of the vitamins A and C and of the B-vitamins of the yeast complex, but not enough of vitamin D. Cow's milk, however, is so variable in composition that this statement may need qualifying, and does not provide more than a slender basis for calculation".

It is perhaps legitimate to observe that cow's milk may here be suffering rather more from the amount of attention that has been given to it than from any fluctuation in the vitamin content of milk, as distinct from other foods. Probably far more samples of cow's milk have been assayed for vitamin content than any other single food-stuff, and it is not surprising to find very different results reported by different workers. It is at least conceivable that any other food substance that had been examined so often and in so many different parts of the world would show similar irregularities. The practice of arguing from the study of a particular sample of a particular substance that all other samples of the substance, wherever produced and under whatever conditions, will contain much the same amount of the vitamin as the sample examined, is all too prevalent in vitamin literature, and has led to generalisations as glib as they are fundamentally unsound and unconvincing. Nevertheless, it is gratifying to note the immense amount of information that is already available and only awaits co-ordination and extension to be made the basis of a really scientific consideration of world dietary problems.

The compilers of this report, owing perhaps to a modesty that we hope is characteristic of scientific workers in Great Britain, have a freedom from scientific chauvinism which is both rare and gratifying. The specialist in vitamin work has been irritated, at least as often as the specialist in other fields, by the production of books purporting to be objective studies of a subject, but found on inspection to be little more than a summary of their authors' own work and views. He has also been exasperated by books issued under titles promising comprehensive surveys of a whole subject, only

to find that scientific workers of the author's own nationality must have been seriously under-rated by all the rest of the world, if the author's assessment of their work is to be regarded as correct. This volume is devoid of such faults. Naturally, American and British workers, who have indeed been first in many vitamin fields, receive most attention, but that this fact is not due to accidents of birth and language, is fully attested by the 26 pages of references at the end of the book. If English and American names, indeed, predominate here and in the text, German, Scandinavian and French names are to be found in plenty, supplemented occasionally by those of workers in many other countries.

It is, indeed, doubtful whether the book could have been made more comprehensive or freer from any suspicion of personal views and prejudices had it been produced by, say, the Health Organisation of the League of Nations. As it is, it carries just sufficient impress of the personalities compiling it to make it something very much more than an occasional reference book. For all those in any way interested in the development of the subject, it is a volume that not only must be read but will also be found to be very readable.

A. L. BACHARACH.

Membrane Equilibria

The Donnan Equilibria: and their Application to Chemical, Physiological and Technical Processes. By Dr. T. R. Bolam. (Monographs on Modern Chemistry.) Pp. vii+154. (London: G. Bell and Sons, Ltd., 1932.) 9*s*. net.

THE conditions of equilibrium in a system in which one component is unable to escape from the phase in which it is found, but is able to combine with another substance which can escape from the phase, were worked out by Willard Gibbs. The importance of equilibria of this type was not realised, however, until Donnan and Harris in 1911 described the behaviour of common salt when added to a system in which an aqueous solution of Congo red (the sodium salt of a complex sulphonic acid) was separated from pure water by a membrane through which the anion of the colloidal electrolyte could not pass. The concentration of sodium chloride was found to be greater in the solution which did not contain the colloidal electrolyte. Finally, a condition of equilibrium was reached when the product of the concentration of the sodium and chlorine ions, $[Na^+] \times [Cl^-]$, was the same on both sides of the membrane.

This type of 'membrane equilibrium' is of special importance in physiology, and was in fact described before the London Physiological Society in December, 1910. It is not necessary, however, that a membrane should be present, since similar conditions of equilibrium prevail whenever one ionic component of a pair of salts is prevented from diffusing freely. This non-diffusibility may be realised, for example, in a jelly, or it may be caused by adsorption at a surface.

The present volume describes, in a series of four chapters, the theory of the equilibrium, and its applications in chemistry, physical chemistry and biology. In addition to name and subject indexes, it contains a bibliography containing 143 entries. These include a few references to standard works on thermodynamics, etc., but are mainly citations from physico-chemical and physiological journals in which illustrations are given of the influence of the tethered ion on equilibrium in living and non-living systems.

Short Reviews

The Calendar and its Reform. By F. A. Black. Pp. viii+80+3 plates. (London and Edinburgh: Gall and Inglis, 1932.) 2*s*. 6*d*. net.

THIS book describes in detail the various stages which led to the adoption of our present calendar; it begins with the half legendary calendars of Romulus and Numa Pompilius, goes on to the reform of Julius Cæsar, and the alterations (for the worse) introduced by Augustus. There is a chapter on the origin of the names of the months and weekdays, followed by one on the introduction of the use of the Christian era for reckoning years. Then we have the Gregorian reform, and a discussion of the small errors that it involves. Incidentally, it is mentioned that the beginning of the financial year on April 5 is a relic of old style, when the year began on March 25; that day became April 5 after the change. The author is under a misconception in asserting on p. 37 that the slight shortening of the year since the days of Hipparchus depends on the observations made by the latter; it depends on modern observations and calculations.

Mr. Black then comes to the vexed question of calendar reform; he wisely notes that the proposal of many calendar reformers to put five days

in four years outside the regular sequence of weekdays excites such strong opposition that there is little chance of carrying it; in fact it blocks the way of reform. The author proposes as an alternative that ordinary years should have exactly 52 weeks and leap years exactly 53 weeks. A simple rule for the fixing of the leap years is given; there are in general two of them in eleven years, but the number is adjusted to give exactly the same number of days in 400 years as in the Gregorian calendar. Under this system the weekdays would recur every year on the same days of the month, which is the principal aim of the reformers; but there would be no tampering with the sequence of weekdays. A full calendar for the next 400 years is given under the proposed system; the greatest divergence from the present calendar is one week.

Suggestions are also given as to the lengths of the months; the author would make them 35, 28, 28 days in each quarter: in leap year one quarter would be 35, 28, 35 days. The lengths of the months are, however, subsidiary to his main proposal.

The Analysis of Fuel, Gas, Water and Lubricants. By Prof. S. W. Parr. (International Chemical Series.) Fourth edition. Pp. xv+371. (New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd., 1932.) 18*s.* net.

THE book is divided into two parts, the former covering a wide range of subjects, with coal as their common basis, the latter dealing with laboratory methods. Such a work as compiled by the late Prof. Parr should have a wide public, if only some means could be devised of gaining its interest. The individual chapters are based on lectures and are most readable, since their writer had the gift of simple and direct expression. An attractive feature for the reader is the emphasis laid on the historical side of the subject, so far as America is concerned: copies of Joliet's map of the Mississippi valley made in 1674 and of La Salle's colony on the Illinois in 1684 show the beginnings of an industry which from a production in 1830 of 320,000 tons, representing a little more than one-fiftieth of a ton per capita, advanced to a total of 550,000,000 tons in 1930, almost 5 tons per head.

The scope of this book is best indicated by the chapter headings; they include the distribution and production of coal, the development of research and the science of calorimetry from the days of Count Rumford onward, in which the work of Parr has played a useful part. Then follow sections on the constitution and classification of coal, the absorption of oxygen, and ignition temperature in relation to the storage of coal. The question of impurities and coal contracts receives attention, also the smoke evil. Combustion and carbonisation are discussed, likewise coke and gas. Sections are devoted to wood, liquid fuels, lubricants and boiler waters.

The book is well illustrated and clearly printed. It is primarily intended for American readers, who are favoured in having available such an adequate summary of the whole subject of fuel.

Bell's Popular Science Series. *Old Trades and New Knowledge: Six Lectures delivered at the Royal Institution.* By Sir William Bragg. Pp. xii+266+42 plates. *The World of Sound: Six Lectures delivered at the Royal Institution.* By Sir William Bragg. Pp. viii+196. *Living Machinery: Six Lectures delivered at the Royal Institution.* By Prof. A. V. Hill. Pp. xiv+256+24 plates. (London: G. Bell and Sons, Ltd., 1933.) 4*s.* 6*d.* net each.

REFERENCE was made in our issue of December 10, 1932 (p. 878) to the first four volumes in this attractive series. Three more have now appeared, all of them emanating from the Royal Institution. Sir William Bragg is a master of the art of popularisation and his lectures on the applications of physics in commercial processes and on sound are models of their kind. Prof. A. V. Hill's Christmas lectures on the machinery of the human body will probably be remembered for the experimental illustrations he gave, using his own children as subjects—to their delight and to the concern of the uninitiated. Messrs. Bell are to be congratulated on the production in cheaper form of these fascinating courses of lectures.

Wave Mechanics: Elementary Theory. By Prof. J. Frenkel. Pp. viii+278. (The International Series of Monographs on Physics.) (Oxford: Clarendon Press; London: Oxford University Press, 1932.) 20*s.* net.

ALTHOUGH complete in itself, this is intended to be the first of three volumes and gives a general survey of the whole subject of wave mechanics. The word 'elementary' in the title should not mislead the reader. The book is not a mere description or attempt to evade mathematics, but is introductory to the more detailed volumes to follow. First comes the derivation of the photon from Einstein's relativity mechanics and its extension to the wave packets of Schrödinger and the uncertainty relation of Heisenberg. The wave mechanics of a particle, system of particles, statistical mechanics and applications of quantum statistics to the electron theory of metals follow.

Photocells and their Application. By Dr. V. K. Zworykin and Dr. E. D. Wilson. Second edition. Pp. xxv+331. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1932.) 18*s.* 6*d.* net.

THE second edition is a considerable enlargement of the first. It constitutes a valuable account of photoelectric cells of all kinds, but more particularly of the photo-emissive type. The history of the photoelectric effect is given and is followed by an account of the production of alkali metal films and composite films and of the various processes of manufacture of cells. Circuits suitable for detection are described for all types of cells, photoconductive and photovoltaic as well as emissive, and sufficient theory is given to make the account of value. Applications to photometry, facsimile transmission and television are also included.

Scientific Professionalism

IN contrast to the trade union movement, which has received much attention both in its historical aspects and in relation to the social and economic problems it presents, professional associations have been almost entirely neglected. There has been no study of the historical development of professional association or of the social, economic and ethical problems involved. In view of the growing importance of the expert in public life, the position and influence of professional associations possess a wide interest.

We may perhaps begin with the medical profession. Its present organisation is based upon the Medical Act of 1858, which created the General Council of Medical Education and Registration of the United Kingdom, usually known as the General Medical Council. This Council, which is subject to the Privy Council, has two main duties, to ensure that the unfit do not get on to the register and to expunge the unworthy from it. While the General Medical Council has no option but to register those who produce a licence from a duly accredited authority and tender the prescribed fee, it is empowered to erase a name from the register in certain circumstances ; although neither teaching nor examining, it can enforce such minimum standards of education and examination as it pleases. The topics which the General Medical Council is competent to discuss are, however, limited, and exclude, for example, all questions relating to remuneration. These questions, particularly the pay and status of medical officers in the Services and under local authorities, and of practitioners under the National Health Insurance scheme, are main fields of activity of the British Medical Association, though it would be difficult to overestimate the contribution of the latter also to medical science and practice.

The British Medical Association was founded at Worcester in 1832, although it did not assume its present title until 1856. Its membership embraces 35,000 of the 55,000 names on the medical register and probably includes three-quarters of the medical men in practice in Great Britain. Its constitution in its present form dates from 1902 and the effective control of the Association lies with the Representative Body, consisting chiefly of delegates elected by the divisions. The Representative Body is the parliament of the Association and debates at its meetings are keen. Persistent skilful leadership has played a large part in raising the status and remuneration of doctors and although there is little evidence regarding the average income of the general practitioner, it is significant that the Association is able to obtain a minimum commencing salary of £600 a year for a whole-time medical officer of the lowest grade. At the arbitration inquiry in 1926 it was stated that £1,200 might be the average income from a successful practice "not at the top". Evidence was given before the Royal Commission on the Civil Service in 1930 that a fully employed panel doctor in a populous area, using half his time for panel and half for private practice, could make £1,400 net per annum. The salaries offered to medical men are considerably higher than those for dentists or for veterinary surgeons.

The position of the veterinary surgeons presents analogies with the position of the medical profession but is weaker mainly through the neglect of veterinary science in Great Britain. The Veterinary Surgeons Act of 1881 laid upon the Royal College of Veterinary Surgeons the duty of keeping a register but, unlike the General Medical Council, also of examining the students of recognised veterinary colleges. It possesses disciplinary powers and its members have certain privileges similar to those granted to doctors. The numerical weakness of the profession—the register contains 3,473 names for the British Isles—and prevailing indifference to veterinary science largely account for the comparative impotence of the National Veterinary Medical Association.

The engineering profession offers strong contrasts to the conditions of the medical profession, particularly in the absence of any legal register and in the number of specialist organisations which have developed as the range of engineering grows. The parent society is the Institution of Civil Engineers, founded in 1818, the activities of which for the first fifty years were confined to study. For long enough membership, however, did not imply scientific training and only in 1897 did the Institution establish its own examinations. There are grades of membership, corresponding to different degrees of attainment and experience. Associates must be more than twenty-five years of age and have passed either the examinations of the Institution or an approved examination and have undergone a specified period of practical training. Members must be more than thirty-three years of age and have been associates with five years' experience in a position of responsibility, or have had "suitable education and training as a civil engineer" and fifteen years employment in a position of responsibility and have acquired "a considerable degree of eminence in the profession". Rules governing the professional conduct of members were not formed until 1910 and their general purport is to ensure that the engineer's utmost skill shall be placed at the disposal of those who employ him, and that the method of remuneration shall not involve any conflict between his personal interests and those of the clients whom he advises.

Round the Institution of Civil Engineers have sprung up the Institution of Mechanical Engineers, the Institution of Naval Architects, and the Institution of Electrical Engineers, as well as other junior institutions such as the Institution of Mining Engineers, the Institution of Structural Engineers, the Institution of Automobile Engineers,

the Institution of Gas Engineers and the Institution of Chemical Engineers. These are not rival associations though they are modelled on the parent society and the membership overlaps considerably. The civil and mechanical engineers have memberships of about 10,000, the 'electricals' about 11,500, the naval architects about 3,000 and the mining engineers 3,800. The number of qualified engineers in Great Britain is estimated at 26,659.

The professional organisation of chemists in Great Britain has been handicapped by the assumption of the title of "chemist" under the Pharmacy Act of 1868 by members of another vocation possessing one or more alternative titles. The growth of the profession is frequently referred to the formation of the Chemical Society in 1841, which, however, has remained a study society and never demanded scientific or practical qualifications of its members. The first steps at professional organisation were taken in consequence of the passing of the Sale of Food and Drugs Act in 1875, and led directly to the founding of the Institute of Chemistry in 1877. Although its interests were originally mainly limited to those of analytical and consulting chemists, since 1918 it has included a large number of those practising in industry. Its present membership of nearly 6,000 probably represents from one half to three quarters of the fully trained chemists in Great Britain.

The Institute of Chemistry has done much to raise the status of the public analyst, but it has been able to do relatively little to raise the status or remuneration of the chemist in general, and the prestige and value of its membership have not become such that all qualified to obtain it do in fact apply. More effective professional defensive work for chemists generally is being done by the British Association of Chemists, in spite of a much smaller membership—a little over 1,000—largely on account of the greater freedom permitted by its constitution and by its registration under the trade union acts. The Institute of Chemistry is an examining body but the fellowship and associateship can be obtained with partial or complete exemption from examination by those holding recognised degrees or diplomas with first or second class honours in chemistry. The British Association of Chemists also admits those with a sufficient general education and scientific training who have had at least seven years' practice in pure or applied chemistry. The estimated number of chemists is about 10,000 of whom not more than 350 are in private practice. Inquiries conducted by the Institute of Chemistry in 1930 indicated that 15 per cent of fellows at home were receiving between £1,000 and £1,500 and nearly 50 per cent between £500 and £1,000; of associates at home 25 per cent were receiving £500 to £1,000 and 62 per cent from £250 to £500. Members abroad were getting considerably higher salaries.

Reference has been made to the pharmacists, whose early history is closely related to that of the medical professions through the apothecaries and "chemists" and "druggists". The Pharmacy Act of 1868 prohibits any person from selling or keeping open shop for retailing, dispensing or compounding specified poisons or from using the title "chemist and druggist", or "chemist", or "druggist", or "pharmacist", or "dispensing chemist", or "druggist", unless registered by the Pharmaceutical Society. Up to 1919 the latter society not only fulfilled its statutory obligations of examining and registering but it also looked after both the professional and trading interests of pharmacists. In consequence of the judgment in a test case in 1920 the Retail Pharmacists' Union was established, to which were transferred all employers' functions and those of negotiating with the Government regarding the National Health Insurance Act.

Up to the formation of the Institute of Physics in 1920 the physicist had scarcely been recognised as one of the professions, being mainly confined to the universities. The increasing demand for physicists in industry led to the formation of the Institute, which differs considerably in constitution from the Institute of Chemistry. Members of any of five participating societies, which are study associations, can become ordinary members, but the corporate members in whom authority is vested consist of fellows and associates who must have passed either the examination of the Institute or an equivalent examination. Fellows in addition must have had five years' experience. There are 600–700 corporate members and the Institute of Physics has a much more effective command of the profession than has the Institute of Chemistry.

The emergence of the true patent agent possessing a skill partly legal and partly scientific is of comparatively recent date, and the number of qualified patent agents in Great Britain and Ireland is only 343. Since, however, salaried employees in a patent agency are not required to register, there are many qualified persons who have fulfilled all the requirements but have not proceeded to registration. A register of patent agents was established by the Act of 1888, but effective protection was only conferred by the subsequent Patent and Designs Act of 1919, which lays it down categorically that "no person shall practice . . . as a patent agent, unless . . . he is registered". The register is kept by the Institute of Patent Agents and admission is confined to those who have passed a preliminary, an intermediate and a final examination conducted by the Institute. Candidates for the final examination must have served for five years in the office of a registered patent agent, although articles are not obligatory and some exception is granted to those who have graduated at a university or spent a specified time at an approved technical college, or an approved profession or industry or on the examining staff of the Patent Office. In spite of its important educational duties, the Chartered Institute of Patent Agents is a voluntary associa-

tion and only about two-thirds of the registered patent agents are members.

The recently published work by Prof. A. M. Carr-Saunders and Mr. P. A. Wilson* on the growth and position of the professions, on which the above remarks have been based, is a welcome and valuable attempt to fill a serious gap. The first part gives a survey of the present position of the recognised professions and of other occupations with more or less definite claims to be recognised as professions, and forms an invaluable reference work with regard to qualifications, numbers of practitioners, salaries or positions obtainable in a wide range of professions.

Special interest is attached to the sections dealing with architects and with teachers, one on account of the recent efforts to obtain a registration which issued in the Architects (Registration) Act of 1931, the other on account of the growth of unity in a profession formerly separated by deep-seated jealousies and also on account of the influence of widespread State employment leading to what is in effect a State register of teachers. So, too, the analysis of the conditions which led to public accordance of professional status to the civil service and to local government service, and of those again which prevail in the mercantile marine or among mine managers, are invaluable to all scientific workers who seek to understand the place and functions of professionalism in modern society and to assess the contribution which registration can offer alike to the advance of the professions or of the State they serve.

* "The Professions". By A. M. Carr-Saunders and P. A. Wilson. Pp. viii+536. (Oxford: Clarendon Press; London: Oxford University Press, 1933.) 25*s*. net.

Taxonomy and Evolution

By DR. W. H. LONGLEY, Marine Biological Laboratory, Tortugas, Florida.

TEN years ago Dr. J. C. Willis developed in his work "Age and Area" his discovery of the existence of an unexpected order in Nature revealed by statistical analysis of selected data of taxonomy. Prof. Bateson expressed keen appreciation of this discovery in a review of the work in NATURE[1]. The sign of order represented was, in Bateson's judgment, highly significant and is the central fact to which the present contribution is related.

In the great natural groups of organisms—the larger families and orders—the statistical distribution of genera by size is approximately the same in all cases; or, to put it in other words, the curve of genera plotted against the number of their species is always of the same general form. This suggests at once that the process of evolution occurs according to law. Indeed, only if the naturalist's conception of genera and species is without justification in the order of Nature itself, or if his classification of material given by Nature is grossly inadequate, may the direct inference be avoided. But, letting the necessary inquiry this suggests rest for the moment, is there independent reason for supposing the process of differentiation of genera and species of organisms may occur according to law?

Manifestly such law as is suggested by Dr. Willis's discovery is one of a statistical sort, a description of the outcome of the evolutionary process as a whole and without regard to detail—a law, indeed, of the general order of the gas laws of physics, where the individual is quite lost to sight. If it be urged that such laws do not deal with underlying truths, it may be admitted at once that they are not exhaustive accounts of the events in systems of which they treat: but they are still laws, and laws, too, of a high order of importance.

The laws of gases (with similar statistical laws) have, in fact, served as the foundation, from one point of view, of our modern industrial civilisation, with all that it entails. If to know how things go, on the whole, with molecules in the gaseous systems they compose, has shown itself so significant a matter, we may believe that the like knowledge of what is involved in the making of genera and species will justify itself. It requires no lively imagination to foresee some of its effects upon our thought, where its important application will chiefly lie.

To consider the gas laws further: these are generalisations empirically established and the basis upon which the kinetic theory of gases rests. It is from them that we derive our idea that the normal gas is a system of ultra-microscopic particles, active and acting at random, incapable of reproduction and variation, capable of exerting an influence upon one another measurable at last as pressure against the weight of a column of supported fluid.

Now clearly there is no theoretical reason why there might not be systems of units differing from molecules in few or many respects, but still active and acting on one another at random, and on that account having among their laws some of the form of the gas laws. Such systems might be composed of macroscopic, as well as of ultra-microscopic units, units capable of exercising some other influence upon one another than that measurable after the precise fashion of gas pressures, units capable of varying or of increasing their number by some sort of reproductive process, or of at once reproducing and varying.

To express such ideas is only to suggest that the kinetic theory of gases is capable of generalisation, and of being applied, *mutatis mutandis*, to a variety of systems, real or imaginary: call them 'kinetic systems', systems the units of which, whatever they may be, are active and act upon others of their kind at random.

Such systems as are proposed do, in fact, exist. 'Glowing gases' are an example. These obey the gas laws but their units are variable. Defective as it may be in detail, Bohr's schematic representation of the structure of the atom and of what is involved in the absorption and release of more or fewer quanta of energy has made this a matter of common knowledge. More still, if the atom's power to vary is exercised, so to speak, under the control of pressure in the glowing gas, the law of distribution of energy in the line spectrum will —when it is made out—prove to be one from which, if it had been first formulated of gas laws, Boyle's, Avogadro's and others might have been derived by inspection. It will be the master-law of the system.

Populations of a single sort of organism, growing under such conditions as are maintained for determining their law of increase, are also kinetic systems in the sense defined. Their law of growth is a master law from which laws of the form of the gas laws may be derived by inspection[2]. They are clearly systems of units, active and acting at random upon one another, but macroscopic; for practical purposes incapable of effective variation within the life of the experiments; capable of reproduction, and exerting an influence upon one another measurable as an effect upon their proportional rate of increase as they grow.

To avoid the inference, it is necessary to disprove the premises from which it is deduced by logical process. In an attempt to invalidate the law of growth of populations, it is as little to the point to refer to unanalysed experience in the field as it would be to cite the wavering course of a mote in the sunbeam in contravention of the laws derived for bodies falling *in vacuo* under the influence of gravity. In each case advanced as exceptional, the fundamental law is undoubtedly momentarily obeyed.

Evolution is the process of differentiation of a compound population, a population composed of more than one sort of thing, one in which the unit is not the individual but a natural group of individuals related by descent. So Dr. Willis's discovery suggests only that besides the three sorts of kinetic system definitely recognised—and with recognised laws—there is a fourth, the compound population, of which the characteristic process of differentiation also occurs according to law, the master law of this kind of system.

To reach a final decision regarding the soundness of these suggestions, one may first validate the taxonomist's conception of genera and species as groups objectively existing[3]. The empirical curves of genera plotted by size may then be determined as accurately as possible. In course of this work, it appears that in no great group of organisms are known species a representative sample of the world population[4]. The curves therefore change as knowledge grows respecting the groups to which they individually refer. But as they change, they tend to assume the same limiting form, which is a function of the curve of normal frequency.

Space does not permit the argument to be carried here to its logical conclusion. This requires that it be shown that the curve derived from analysis of the data of taxonomy is what theoretical considerations indicate it should be. But even if it be left for the moment an open question whether the law of evolution is the law of differentiation of a particular sort of kinetic system, the existence of the law as such justifies the confidence expressed in the validity of the species conception one finds so commonly in some sense in the writings of systematists, and nowhere more plainly than in contributions by the scientific staff of the British Museum (Natural History).

The light it throws upon existing order in Nature—specifically in the matter of evolution—establishes taxonomy as a science, its place among the biological sciences being comparable to that of astronomy among the physical sciences. It deals with the products of a process as nearly cosmic, as nearly transcending the resources of the experimental method, as anything biology knows.

[1] NATURE, **111**, 39, Jan. 13, 1923.
[2] *Science*, **75**, 248–250, Feb. 26, 1932.
[3] *Proc. Linn. Soc. Lond.*, April 6, 1933.
[4] *Science*, **73**, 700–702; **72**, 141. Proc. Sixth Int. Congress Genetics, **2**, 120–123; 1932.

Iraq Petroleum and Pipe-Line

AS M. Victor Forbin so graphically explains in a recent article on "Le Pétrole de Mésopotamie et son Pipe-Line" (*La Nature*, No. 290, pp. 253–262, March 15, 1933), the petroleum industry of Iraq is historically the oldest and commercially the youngest in the world. In spite, however, of sundry biblical and legendary references to natural resources, negotiations for the acquisition of oil land were not opened until the beginning of this century, and no definite concessions were granted until 1928, when the Iraq Petroleum Co. was founded. Even at this stage, further development of the petroleum industry in Iraq was not assured, for it had yet to be discovered whether the seepages were in fact indicative of untapped resources or merely the dregs of ancient pools.

In 1925, twelve enterprising geologists of various nationalities set out on an expedition to Iraq. Undaunted by extremes of temperature, hostile attacks from nomadic tribes and the numerous problems of structure peculiar to that country, they selected ten sites for testing purposes. The first well drilled in one of these sites, Baba Gurgur, near Kirkuk, was the scene of a great disaster. The boring unexpectedly pierced a dome, of which there had been no surface indication, and liberated a gusher of oil which had finally to be diverted into channels and set on fire in order to prevent further catastrophe. Additional precau-

tions were necessarily taken in drilling subsequent wells on this site, with the result that a prolific production was obtained. In fact, so prolific is the production that to fulfil an annual contract of 4 million tons, only fifteen of the thirty wells drilled need be tapped. Moreover, as Kirkuk is the only one of the ten selected sites which has been developed, the future supply of Iraq oil is potentially enormous.

The pipe-lines which run from the oilfield to the Mediterranean sea are among the most remarkable of their kind. There are longer lines in the United States, but none required greater engineering skill and endurance. Practically the whole line is laid through barren inaccessible territory and the workers are obliged to make roads, huts and means of communication before they can begin on actual construction. Moreover, they have frequently suffered from shortage of drinking water and have had little or no protection against extremes of heat and cold.

The proposed pipe-line course was modified several times in the early stages of the project, but the final form is that of the letter Y. The pipes run in a double track from Kirkuk, across the Tigris to the Euphrates where they fork, one line northward and the other southward. The former is the shorter and easier route and terminates at El Mina, near Tripolis. The southern line, which has proved much more difficult to lay, is not yet completed, but will eventually be carried to the Bay of Acre near Haifa. Two thousand kilometres of steel tubes, representing a weight of 116,000 tons, have been laid at depths varying from one to several metres, through the most difficult territory in the world, in order to accomplish this engineering feat. Moreover, 500 Europeans and Americans and 6,000 natives have been employed in the construction. The cost of laying the lines is naturally considerable, having regard to the peculiar difficulties which had to be overcome, and the question arises as to whether the construction is, and will be, in the future, economically worth while.

In the first instance, Tripolis and Haifa are geographically better situated for the exportation of petroleum than the ports of Russia and Roumania, or even of the New World, for they are considerably nearer the chief centres of importation. Cost of transport will therefore be low in comparison with that paid by rival countries. Cost of production is likewise low owing to the large quantity of oil procurable from each well, the vast dimensions of the oilfields, and the ease with which drilling operations are effected. It is therefore conceivable that the oil of Iraq will in the future be the cheapest and most accessible in the world, although it originates in, and has to flow through, such apparently impossible territory.

Obituary

Harriet Brooks (Mrs. Frank Pitcher)

HARRIET BROOKS (Mrs. Frank Pitcher), who died in Montreal on April 17, was well-known in the years 1901–5 for her original contributions to the then youthful science of radioactivity. A distinguished graduate of McGill University, she was one of the first research workers with Prof. (now Lord) Rutherford in Montreal. She observed that the decay of the active deposit of radium and actinium depended in a marked way on the time of exposure to the respective emanations and determined the curve of decay for very short exposures. This work, which was done before the transformation theory of radioactive substances was put forward, assisted in unravelling the complex transformations which occur in these deposits. With Rutherford she determined the rate of diffusion of the radium emanation into air and other gases. These experiments were at the time of much significance, for they showed that the radium emanation diffused like a gas of heavy molecular weight—estimated to be at least 100.

Miss Brooks entered the Cavendish Laboratory, Cambridge, in 1903 and continued her radioactive investigations. In a letter to Nature of July 21, 1904 (vol. 70, p. 270) she directed attention to a peculiar type of volatility shown by the active deposit of radium immediately after its removal from the emanation. In the light of later results of Hahn and Russ and Makower in 1909, it is clear that the effect was due to the recoil of radium B from the active surface accompanying the expulsion of an α-particle from radium A. This method of separation of elements by recoil ultimately proved of much importance in disentangling the complicated series of changes occurring in the radioactive bodies.

After her marriage to Mr. Frank Pitcher of Montreal, she gave up her research work but took a strong interest in university affairs. In this she was aided by her family ties, for one sister is the wife of Sir Charles Gordon, a prominent supporter of McGill University, and another the wife of Prof. A. S. Eve, professor of physics in McGill University. A woman of much charm and ability, she was a welcome addition to any research laboratory and left in all who met her a vivid impression of a fine personality and character. R.

Dr. H. Basedow

THE recent death of Dr. Herbert Basedow at the age of fifty-two years, which is announced in a dispatch by Reuter from Adelaide, will be deeply regretted by anthropologists in Great Britain, where his persistent and courageous efforts on behalf of the Australian aborigines, which brought about the allotment of an extensive

reservation for those of the central area, were widely appreciated and received influential support. Since the death of Sir Baldwin Spencer, Dr. Basedow had been generally recognised as the first authority on the aborigines of Australia.

Dr. Basedow was born in Adelaide on October 27, 1881, the son of a former minister of education, and was educated at Prince Alfred College and the University of Adelaide, studying later at the Universities of Göttingen, Heidelberg, Breslau and Zurich. He entered the South Australian Geological Service; but in the course of a number of expeditions to the interior of Australia, he became interested in the Australian aborigines, both scientifically and from the practical point of view of their protection from the deleterious influences of contact with civilisation. On several occasions he lived among them for considerable periods for purposes of study. In 1911 Dr. Basedow was appointed Chief Protector of the Aborigines for the Federal Government in the Northern Territory and he was also Medical Commissioner of Aborigines under the South Australian Government.

Basedow had achieved a considerable reputation by his contributions to scientific periodicals, including the publications of the Royal Anthropological Institute of Great Britain. This he consolidated by his chief work "The Australian Aboriginal" published in 1925, a record of careful observation, which also showed considerable originality in interpretation. He showed himself a vigorous controversialist in the local press on behalf of the aboriginal. In 1928 he undertook his most important piece of zoological and anthropological research when he led an expedition to Arnhem land. On his retirement from his official position, he entered business and politics and was elected a member of the Adelaide legislature in 1927.

WE regret to announce the following deaths:

Major W. C. Ball, O.B.E., superintendent of the Chemical Department, Porton, on June 9.

Mr. William B. Bannerman, known for his work on local archæology especially of Kent, Surrey and Sussex, on June 6.

Prof. W. L. Elkin, emeritus professor of astronomy in Yale University and director of the Yale Observatory from 1896 until 1910, on May 29, aged seventy-eight years.

Sir Walter Morley Fletcher, K.B.E., C.B., F.R.S., secretary of the Medical Research Council, on June 7, aged fifty-nine years.

Dr. J. G. Hibben, formerly president of Princeton University, who has published several textbooks on logic and psychology, on May 16, aged seventy-two years.

News and Views

The World Economic Conference

HIS MAJESTY THE KING in opening the World Economic Congress on June 12 proclaimed his satisfaction that such a gathering had been possible and expressed his confidence that this common endeavour would lead to beneficial results. Unlike that of 1927, the Conference is a Conference not of officials but of Governments, in fact of all the Governments of the world, since it includes the representatives of some sixty-six nations. The magnitude of the task confronting the Conference and the difficulties involved are great but, as His Majesty stated, there is evidence of a real desire to reach agreement. All nations are suffering from a common ill as is shown only too clearly by the rise in the figure of unemployment. In appealing to all the representatives to co-operate for the sake of the ultimate good of the whole world, in the face of a crisis which all realise and acknowledge, the King stated that it cannot be beyond the power of man so to use the vast resources of the world as to ensure the material progress of civilisation. No diminution in these resources has taken place. On the contrary, discovery, invention and organisation have multiplied their possibilities to such an extent that abundance of production has itself created new problems. There has come also a new recognition of the interdependence of nations and of the value of collaboration between them. Therefore, as His Majesty stated, there is now an opportunity of harnessing this new consciousness of common interests to the service of mankind. His Majesty's speech and also that of Mr. Ramsay MacDonald, who followed the King, were broadcast by the British Broadcasting Corporation, and a record of the King's speech was made by His Master's Voice Company.

Sir Prafulla Chandra Rây, C.I.E.

SIR P. C. RÂY stands alone amongst Indian men of science not only on account of his scientific attainments but also for his public activities. In December last his colleagues and former students took advantage of his seventieth birthday to show their appreciation and esteem by presenting him with a congratulatory address in which they announced that a considerable sum had been subscribed which would be applied to assist indigent students. The Indian Chemical Society has dedicated a handsome commemoration volume to its first president and it has thus enabled Sir Prafulla's friends in other countries to show their appreciation of his services to science ("Sir Prafulla Chandra Rây". Seventieth Birthday Commemoration Volume. *Journal of the Indian Chemical Society*, Special number. Pp. vi+363. Calcutta: Indian Chemical Society, 1933.) This volume of more than 300 pages contains 36 papers and, although the majority of these are naturally by Indians, chemists from Great Britain, America, Germany, Austria and Switzerland have also contributed. Pride of place is fittingly given to a paper by the president of the Chemical Society, Prof. G. T. Morgan, who,

with Dr. F. H. Burstall, gives an interesting account of recent high-pressure work which has been carried out at the Chemical Laboratory, Teddington, on the dehydrogenation of pyridine with anhydrous metallic chlorides. One of the products of the reaction, 2 : 2′-dipyridyl, yields particularly important co-ordination compounds (NATURE, 128, 31, July 4, 1931).

THE two other contributions from Great Britain are by Prof. M. W. Travers and Prof. F. G. Donnan, the former discussing the pyrolytic condensation and decomposition of ethane in the presence of hydrogen, whilst the latter presents a short but stimulating note on the thermodynamic functions of radiation. Students of the chemistry of the polysaccharides will welcome a valuable résumé of recent investigations in this field from the pen of Prof. H. Pringsheim. Another paper of great interest by Prof. Franz Fischer summarises the valuable work on the utilisation of coal gas which he has carried out during the past few years. As would be anticipated by those who have followed the trend of chemical research in India, the majority of the papers by Sir Prafulla's former students are on physico-chemical themes and are of interest mainly to the specialist. Prof. M. N. Saha has, however, written a remarkably able review entitled "Spectroscopy in the Service of the Chemist". The contributions to this commemoration volume reach a high standard and augur well for the future of the schools of chemistry in India of which Sir Prafulla may with justice regard himself as the founder.

Mr. Pierre Chevenard

THE "Société d'Encouragement pour l'Industrie Nationale" awards annually a special medal with the effigy of an eminent person in science or arts to a French or foreign author whose work has had the most effect on the progress of French industry. The medal for 1932 bears the effigy of Prony and has been awarded by the Committee of the Society dealing with mechanical arts to M. Pierre Chevenard, a mining engineer of the Mining School at Saint Étienne. Born in 1888, M. Chevenard has, since 1910, worked in the research laboratory at Imphy of the metallurgical works of Commentry, Fourchambault et Décazeville. One of his most important papers deals with an experimental research on iron, nickel and chromium alloys, but he is especially known for elaborating devices for the examination of very small quantities of alloys. With small samples a homogeneous temperature is secured throughout the piece, this being important for quick and reliable measurements, and M. Chevenard was able to examine the physical properties of alloys over a wide range of temperature. His differential dilatometer, galvanopyrometer, and apparatus for the examination of the mechanical properties of alloys, are widely used all over the world. Besides purely scientific research, M. Chevenard has contributed a great deal to the production of special alloys at Imphy, such as M. Ch. Guillaume's invar, elinvar and the A.T.V. ferro-nickel alloy.

Concealing Coloration of the Tapir

THE birth at the Gardens of the Zoological Society of London, last week, of a Brazilian tapir is worth recording, since it will afford visitors to the Gardens an opportunity of examining one of the most striking types of 'protective', or 'concealing coloration' in young mammals to be found anywhere. It takes the form of numerous longitudinal white stripes on a black background. The stripes tend to break up into short bars and spots on the flanks, while the legs are obliquely striped. The face is spotted. This coloration is the more interesting because the young of the Malayan tapir is coloured after a closely similar fashion; while the adults of the two species are as unlike as could well be. In the young Malayan species the spots on the face are more numerous and distinct, while the stripes down the sides are rather more sharply defined and less broken up on the lower flanks. As the animal approaches maturity these markings fade out in a very curious way. As the great white area of the body behind the withers gradually shows up, the stripes fade out; but they persist far longer on the black fore-quarters and the face. The strange coloration of the adult Malayan tapir affords another striking example of 'concealing coloration', since when asleep in dry boulder-strewn water courses these animals look themselves like boulders, the white area forming the summit while the black fore-quarters and legs simulate the deep shadows cast by such boulders in the intense sunlight.

Theory in Modern Physics

THE leading idea of Prof. A. Einstein's Herbert Spencer lecture, entitled, "The Method of Theoretical Physics", delivered at Oxford on June 10 was the relation between experience and reason in the domain of physics. The Greeks, he said, perfected a logical system in which, considered as such, no flaw could be found. But it was a closed system; and its concepts and laws, though for long believed to be derivable from the data of experience, were entirely a creation in the mind of the theorist. The practical success of theory in the hands of Newton obscured during the eighteenth and nineteenth centuries the want of correspondence, now evident, of pure theory with the results of experience. But though the view that prevailed for so long must be discarded, Prof. Einstein believes it to be possible for the theorist to construct a system that will be a true model of reality. Experience cannot give the answer to the problem of Nature, but it can suggest the methods which will enable the theorist to arrive at a solution.

Inadequacy of Economic Sanctions

IN a recent issue of the *New Commonwealth*—a journal devoted to the promotion of international law and order—Dr. J. J. van der Leeuw discusses the inadequacy of economic sanctions. The greater the measure of disarmament, he writes, the greater the need for sanctions. Complete disarmament, though this is the only safe basis for a lasting peace, is unthinkable without safeguards against aggression by an improvised attacking force. Such safeguards,

however, must not merely consist of coercive measures against an aggressor nation; they must be a protection against aggression. It is in this respect that economic sanctions fail whether they take the form of an economic and financial boycott of the aggressor or that of a regular blockade. (1) They come too late; they can only be applied as a corrective; they do not protect against aggression. (2) Economic sanctions are notoriously slow in their application. (3) They are a double-edged weapon, striking at international trade and punishing the innocent with the guilty. (4) Economic sanctions are powerless against nations which can, if need be, form self-sufficient economic units, such as the United States to-day and the U.S.S.R. to-morrow. Dr. van der Leeuw contends that an international police force alone would make complete disarmament possible, since it would provide security against aggression, not merely coercion afterwards. Each nation would contribute its quota to the world police and, having done so, would not be further involved.

Old Gaza

SIR FLINDERS PETRIE'S letter to the *Times* of June 2, announcing that it would not be possible this year to hold the usual exhibition of material from the Palestinian excavations of the British School of Archæology in Egypt, will give rise to much regret. The members of the school, Sir Flinders reports, this year have been engaged for the third season in succession in the excavation of Old Gaza (Tell el Ajjul), where the earliest palace, dated at about 3200 B.C., discovered last year, awaited clearance. It now appears that the foundations were laid in a rectangular block about 127 ft. from north to south and about 166 ft. in length. The buildings enclosed a large square courtyard with chambers on three sides, but with an enclosing wall only on the fourth, or south, side. Egyptian influence is strongly marked in a number of small objects and a finely carved stone head from a funerary jar, which is earlier than any from Egypt. Greater interest, perhaps, is attached to several objects which may point to the place of origin of the Syrian invaders. These were a bronze dagger with raised veins, very similar to one found last year, which is a Caucasus type, and two forms of toggle which belong to the same area. The burial was early, while from a superimposed burial came a scarab which cannot be later than the xith dynasty. South of the palace area massive buildings were uncovered in a sand dune which yielded fragments of painted pottery, similar to that found last year, of which the origin is still obscure, although northern Syria, Armenia or Cappadocia are indicated. The buildings with which this pottery was associated were of the age of the first and second palaces—viith and xiith dynasties. Other parts of the Tell have been excavated, yielding nearly two hundred types of pottery, and the family tomb of an Egyptian governor, which indicates a continued Egyptian occupation from the time of Akhen-aten to Rameses II. A second gold torque ear-ring of Irish pattern occurred in an xviiith dynasty level.

Local Archæological Observation in the United States

USEFUL information relating to local archæological sites and discoveries, which might otherwise be disregarded as unimportant and lost to sight, is being recorded through a system of local correspondents and investigators inaugurated by Science Service (Washington, D.C.). Naturally the information varies considerably in value and interest; but as time goes on, the organisation should serve a useful purpose in preserving data which will assist in determining the character, distribution and relation of the Indian cultures which had become extinct before the days for which records of the tribes are available. An instance in point is afforded by a communication recently received by Science Service from Mr. William E. Baker of Boise City, Oklahoma, who describes Indian ruins on the south bank of the Beaver River, four miles south of Optima, Oklahoma. The ruins are of the type known as 'slab house', being constructed of stone slabs, set on edge. Before the depredations of neighbouring builders, they covered a site of several acres. Their artefacts, flint arrow points, drills, snub-nosed scrapers, and bone implements, are such as have a wide distribution in the Plains, being found in the western half of Kansas, the panhandle of Oklahoma and of Texas. They have also been found at Pecos Pueblo. Mr. Baker differentiates two cultures, partly on stratigraphical grounds. The earlier is characterised by a small arrow point with right-angled notches, which is associated with pottery of the Plains type. In the later the arrow point is large and has diagonal notches, but pottery is absent. The former was probably partly agricultural—a view supported by a suggestion of irrigation and the discovery of kernels of corn—the latter nomadic. This order and association has been found by Mr. Baker over a wide local area while the cultures are related to types described by Dr. W. K. Moorehead on the Arkansas River and Dr. A. W. Kidder at Pecos Pueblo. Mr. Baker suggests that there was a widely distributed semi-agricultural population spread over the Plains before the coming of the Spaniards, when the introduction of the horse made possible a nomadic life dependent on the buffalo.

Oil Reserves and Production

SOME interesting figures of oil reserves and past production to date were given by Mr. V. R. Garfias to the American Institute of Mining and Metallurgical Engineers recently. According to this authority, the proved oil reserves are estimated at more than 24 billion barrels and the world production of oil to date aggregates nearly 23 billions. Of the realised reserves, 61 per cent are located in the American continent, while Russia, Iraq and Persia account for 33 per cent. Science Service of Washington, D.C., states that the American reserves, when compared to the probable future consumption in the United States, will prove inadequate to meet demands for more than a few years, unless there should be a pronounced falling off in demand. It is considered that the Venezuelan, Iraq and Rumanian fields will

in the future become, in varying degrees, potential sources of instability in the world's oil trade, but in this connexion it would seem that the growing importance of an ever-increasing Russian production has not been assessed at its true significance. Further, Mr. Garfias's figures do not consider estimates of potential oil reserves but cover only the world's oil supplies estimated to remain underground in the present-known producing fields and their anticipated extensions.

Electric Trolley Omnibuses

ABOUT twenty years ago, electric tramways had no serious rivals for street passenger traffic. As they are doing to-day, they were then carrying a very large number of passengers. The advent of petrol and electric omnibuses was not considered as a serious menace to their prosperity. They would doubtless be useful in those districts where the cost of installing tramway track was prohibitive. In a paper read to a joint meeting of the Institution of Electrical Engineers and the Institute of Transport on April 10, C. J. Spencer described the progress made in developing electric trolley omnibuses during the last twenty years and discusses the general problem of street passenger traffic. The great advantage of a trolley omnibus is that it can use a series electric motor—the most perfect of all traction motors. It gives its maximum torque when starting and can carry an overload of a hundred per cent for several minutes without damage.

THE War hindered the development of the trolley bus. Ten years ago, only 47 route miles were operated in Great Britain. Last year the number had increased to 256 miles and numerous extensions are being planned. The modern electric bus is little more than an adapted petrol bus; the engine and gear box have been removed, an electric motor substituted and a trolley collecting gear bolted on the roof. The weight of the motor used for trolley bus operation is only 12 lb. per horse power. This compares with 70 lb. per horse power in pre-War days. In the early buses, two motors of 20 h.p. were used in each bus but now a single 80 h.p. motor is used. This is capable of withstanding the roughest usage. The London United Tramways Co. recently converted 17 miles of route between Twickenham and Wimbledon into trolley bus operation. At the start, many complaints were made by possessors of radio sets of extraneous noises in their apparatus due to 'interference' by the buses. Thanks to the help of the General Post Office and the British Broadcasting Corporation this trouble has been practically overcome. On busy routes, evolution of design has led to a continual increase in the size of the vehicles.

National Research Council of Canada

THE fifteenth annual report of the National Research Council of Canada (Ottawa) surveys the activities of the Council in the period 1931–32. The demand for scientific assistance from industrial groups was greatly increased and, during the year, the Council considerably extended its direct relations with industry, a number of associate committees having been formed as a result of the Council's effort to relate itself with industrial development. The Council is largely echoing the views of the Advisory Council for Scientific and Industrial Research in Great Britain in asserting, and demonstrating from its own experience, that science will not occupy its proper place until the industrialist is ready, not merely to admit the possibilities of research and accept its assistance, but also to co-operate fully and on a confidential basis with workers in the scientific field. The report summarises the activities of the laboratory divisions as well as the activities of associated committees and the reports of assisted researches. From this wealth of information it is impossible to select more than a few points illustrating the scope of the investigations covered. Both in the Division of Chemistry and in that of Biology and Agriculture, considerable attention has been devoted to chemicals and herbicides as well as to the fire hazards attached to their use. Synthetic rubber and resins and the efficiency of detergents are other questions investigated by the Division of Chemistry, while the Division of Physics and Engineering has been concerned with aeronautics, locomotive research, and fire hazards of oil burners. Associate committees have dealt with a wide range of problems of animal diseases, field crop diseases, coal classification and analysis, engineering standards, gas research, grain research, leather, magnesian products, oceanography, radio research, tuberculosis, weed control, and wool.

Agricultural Societies

THE gain to agriculture from the activities of the various agricultural societies which have flourished during the last two centuries must be enormous. These associations, supported by landlord enthusiasts bent on improving their estates and raising the standard of farming, have spread agricultural knowledge by their publications, by the offer of prizes for information or practical achievement, and by their shows of implements and live-stock. They have continually fostered scientific inquiry into the technical problems of farming, and in their journals are to be found the successive landmarks of agricultural progress. On June 8, 1723, was founded the earliest association of this kind in Scotland under the title "The Honourable the Society of Improvers in the Knowledge of Agriculture in Scotland". Its members were certain noblemen and gentlemen who were impressed by the backward state of farming at this period. The Society was concerned with the collection and dissemination of the best agricultural information. It advised members on their farming problems; on cultivations, including the new horsehoeing husbandry of Jethro Tull, on sheep folding and on cattle feeding. Under the last heading the recommendation that the cattle be "not less than seven years old" before feeding commences, reads rather strangely in these days of 'baby beef' and rapid turnover. On the other hand, few stockmen will find fault with this:—"Be sure

to prepare a careful hand to attend the feeding of them, for upon this depends the whole success of the attempt". The Society concerned itself with fisheries and manufactures in addition to its main objective. It did not survive the upheaval of 1745, but for twenty years supplied a need which more permanent societies were later to satisfy.

Research in Germany

THE issue of *Die Naturwissenschaften* for May 26 is devoted to the work of the Kaiser Wilhelm Gesellschaft zur Förderung der Wissenschaften and extends to more than eighty pages. The year ending March 1933 has been a difficult one for the society, and the hope is expressed that the Government will in the future be able to afford it more financial support. Its membership is now 786, a fall of more than 40 on the year. Its headquarters—Harnack House—provides accommodation for the meetings of more than thirty societies in addition to those of its own sections, daily meals for 160 scientific workers, and has put up for short stays 230 visitors during the year. Evening lectures, by distinguished members of the staff, have been given both at headquarters and in other towns of Germany as in previous years. In addition to outline reports of the work of each Institute, lists of papers published by the staffs are given, and both show how much the society is doing by scientific research to increase the welfare of Germany and to maintain its position amongst those bent on "improving natural knowledge".

Annual Meeting of the French Chemical Society

THE French Chemical Society is holding its annual general meeting in Paris on June 15–17; at the same time it is commemorating the bicentenary of the birth of Priestley. Among the distinguished foreign visitors at the meeting are Sir William Pope, professor of chemistry in the University of Cambridge, who has been asked to preside over the opening meeting; Prof. Morgan, president of the Chemical Society; Prof. H. E. Armstrong; Prof. J. Böeseken, professor of organic chemistry in the Technical High School at Delft, who is speaking on the configuration of the polyalcohols; and Prof. E. Späth, professor of chemistry in the University of Vienna, who is discussing recent syntheses of alkaloids. An address on "Priestley and his scientific Work" was to be given on June 15 by Prof. C. Matignon, professor of inorganic chemistry in the Collège de France, and president of the Society. Priestley, by a decision of the National Council, was made a French citizen and was a member of the Academy of Sciences.

"Empire Forestry Handbook"

THE Empire Forestry Association has recently published a new edition of the "Empire Forestry Handbook" (Empire Forestry Association, Grand Buildings, Trafalgar Square, London. 5*s*.). The handbook contains much useful information, including a list of the officers and members of the Empire Forestry Association, and forestry officers serving in different parts of the British Empire. This is followed by a digest of education and research in forestry throughout the Empire, including lists of the universities and research institutes which contain forestry departments, together with the heads of departments and research workers. A list of forest periodicals is appended. The section on forest resources of the Empire contains a wealth of useful statistics concerning forest areas, and production, exports, etc., of conifers and hardwoods. The "Handbook" concludes with a list of the trade and botanical names of Empire timbers.

Lister Institute of Preventive Medicine

THE report of the governing body, presented at the annual general meeting of the Lister Institute of Preventive Medicine on May 24, gives a survey of the scientific work carried out during the year in the various departments. This includes studies on the viruses of variola, vaccinia, and varicella by Drs. Ledingham and Amies, on the typhus group of diseases by Dr. Felix, and researches on nutrition and vitamins in the Division of Nutrition under Dr. Harriette Chick. The nature and function of phosphoric esters formed during alcoholic fermentation have been studied by Prof. Robison and his collaborators. The National Collection of Type Cultures is housed in the Institute, and more than 5,000 strains of bacteria and fungi have been distributed to workers at home and abroad, and some 200 types have been added to the collection. The total expenditure for the year was £43,258, and the excess of income over expenditure £10,362.

National Institute for Research in Dairying

THE annual report for the year ending July 31, 1932, of the National Institute for Research in Dairying, University of Reading, which has only recently been issued, gives a summary of the research work carried out in the various departments. This includes a study of typical English milk, experiments on the feeding of young dairy cattle, and details of schemes for controlling the cleanliness of milk delivered by producers to retailers. Dr. H. Davenport Kay has been appointed to succeed the late Dr. Stenhouse Williams as director of the Institute. The financial position remains substantially the same as in the previous year, and additional income is still needed to stabilise the present position, and without reference to the ultimate needs of the Institute.

Franklin Institute Medals

AMONG the medal awards recently made by the Franklin Institute, Pennsylvania, are the following: Franklin medal, founded in 1914 by Mr. Samuel Insull, of Chicago, and awarded to those workers in physical science or technology whose efforts have done most to advance a knowledge of physical science or its application, to Dr. Orville Wright, of Dayton, Ohio, in recognition of the valuable investigations carried out by him and his brother, Wilbur, from which they obtained the first reliable scientific data

concerning the principles of flight and the design of aeroplanes; and also to Dr. Paul Sabatier, dean of the Faculty of Science of the University of Toulouse, in recognition of his contributions to the general field of chemistry and especially to organic chemistry, in which he discovered the catalytic activity of finely divided common metals and devised methods for their use in science and industry; Elliott Cresson medal, founded in 1848 by Mr. Elliott Cresson, to Señor Juan de la Cierva, of London, in consideration of the original conceptions and inventive ability which have resulted in the creation and development of the autogiro.

Announcements

PROF. F. G. DONNAN, professor of general chemistry in the University of London, was elected an honorary member of the Bunsen Society at its thirty-eighth annual meeting held at Carlsruhe on May 26–28.

PROF. E. W. MACBRIDE, professor of zoology in the Imperial College of Science and Technology, has been appointed by the Development Commissioners to be chairman of their Advisory Committee on Fishery Research in succession to the late Prof. G. C. Bourne.

THE following appointments in the Colonial Agricultural Service have recently been made by the Secretary of State for the Colonies:—Mr. A. M. Gwynn, to be entomologist in the Department of Agriculture, Nigeria; Mr. C. L. Willding-Jones, to be assistant superintendent of agriculture, Gold Coast.

IT is announced in *Science* of May 19 that the Rumford medal of the American Academy of Arts and Sciences has been awarded to Dr. Harlow Shapley, director of the Harvard College Observatory and Paine professor of astronomy in Harvard University, for "researches on the luminosity of stars and galaxies".

IT is announced by Science Service that Commdr. Jerome Clarke Hunsaker, now vice-president of the Goodyear-Zeppelin Corporation, Akron, who designed the first modern airships produced in the United States, has been awarded the 1933 Daniel Guggenheim medal. Commdr. Hunsaker introduced aerodynamic research into American aircraft design by translating Eiffel's pioneer work and building the first wind tunnel at the Massachusetts Institute of Technology. He designed the *Shenandoah* airship and the first modern non-rigid airships in the United States. Since resigning from the Navy in 1927, he has played an important part in the production of the *Akron* and the *Macon*.

A DISCUSSION on "The Ionosphere", to be opened by Prof. E. V. Appleton, will take place at the Royal Society on June 22 at 4.30 p.m.

THE Masters' memorial lectures of the Royal Horticultural Society will be delivered in the lecture room of the Society's new hall in Greycoat Street, Westminster, on July 18 and 19, at 3.30 p.m., by Prof. V. H. Blackman, on "Plants in Relation to Light and Temperature".

IN 1920, Miss L. Jones-Bateman of Cae Glass, Abergele, presented to the Royal Horticultural Society a valuable silver-gilt replica of the Warwick Vase to be used for the encouragement of fruit production. It is accordingly decided to offer it triennially for researches in the growing of hardy fruits, figs, grapes and peaches in the open or under glass, and it is available for award in 1933. Candidates should submit accounts of their work by October 31 to the Secretary, Royal Horticultural Society, Vincent Square, Westminster, London, S.W.1.

THE life story of William and Caroline Herschel has been compiled from their journals and letters by Lady Lubbock, the granddaughter of Sir William Hershal, and will be published in July under the title "The Herschel Chronicle", by the Cambridge University Press. The book presents so far as possible in their own words, the astronomical discoveries of the Herschels.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—An organiser of further education and a principal of the Stratford-on-Avon Technical and Art School—The Director of Education, 22, Northgate Street, Warwick (June 19). A chief sanitary inspector for the Municipal Commissioners, Penang—Messrs. Peirce and Williams, 1, Victoria Street, Westminster, S.W.1 (June 21). A University professor of pathology at the London (Royal Free Hospital) School of Medicine for Women—The Academic Registrar, University of London (June 23). A probationary forest officer for H.M. Forestry Commissioners—The Secretary, Forestry Commission, 9, Savile Row, London, W.1 (June 24). A lecturer in experimental psychology at the University of St. Andrews—The Secretary (June 24). A demonstrator in botany, interested in mycology, at King's College, Strand, London, W.C.2—The Secretary (June 27). A head of the Mathematics and Physics Department of the Liverpool Central Municipal Technical School—The Director of Education, 14, Sir Thomas Street, Liverpool, 1 (July 3). A junior assistant in the Electrical Engineering Department of the Royal Technical College, Glasgow—The Professor of Electrical Engineering (July 10). Examiners in various scientific subjects in the General and Higher School Examinations of the University of London—The Secretary to the Matriculation and School Examinations Council, University of London, South Kensington, S.W.7 (July 21). A professor of economics and commerce, and a professor of education at University College, Hull—The Registrar. A teacher of cookery at the Gloucestershire Training College of Domestic Science, Barrack Square, Gloucester—The Principal. A mechanical engineer for water works for the Government of the United Provinces, India—The High Commissioner for India, General Department, India House, Aldwych, W.C.2. A lecturer in botany at the Midland Agricultural College, Sutton Bonington, Loughborough.

Letters to the Editor

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

Fine-Structure of the Ionosphere

I WAS much interested in the letter by Messrs. Schafer and Goodall in NATURE of June 3 dealing with the results of their experiments on the radio exploration of the ionosphere in the United States,

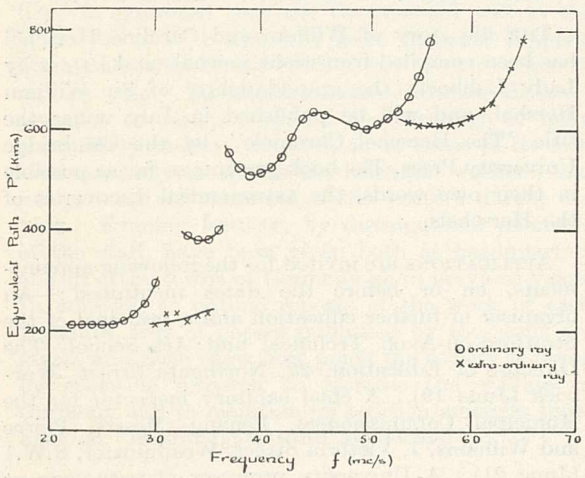


FIG. 1. (P^1, f) curve at 1200, April 8, 1933.

since an independent set of observations in Great Britain, which are dealt with at length in a paper now awaiting publication, have led to very similar conclusions.

The method[1] used in the British series of observations has been to measure the maximum ionisation content of the various upper atmospheric regions by finding the critical penetration frequencies. Attention has been concentrated on the case of the ordinary ray of the two magneto-ionic components into which the incident wireless beam is resolved due to the influence of the earth's magnetic field. Such penetration frequencies are found from the inspection of a curve illustrating the relation between the equivalent path P^1 of the atmospheric waves and the frequency f. The maximum ionisation content N is then calculated from the formula

$$N = \frac{3}{2}\frac{\pi m}{e^2} f^2$$

where e and m are respectively the charge and mass of an electron and f is the critical penetration frequency.

The following results have been obtained from such determinations made at the Radio Research Station, Slough, in experiments carried out as part of the programme of the Radio Research Board of the Department of Scientific and Industrial Research.

(1) Evidence has been found of the existence of a region of electrification intermediate between the two main regions E and F. (This has already been pointed out by my collaborator Mr. Naismith.[2]) The ionisation in this 'intermediate' region, as it may be called, is usually less than that in region E at noon but, in the early morning hours, as the solar rays begin to ionise successively lower strata of the atmosphere, it is noted more frequently. Our experience in this connexion is therefore different from that of Messrs. Schafer and Goodall.

(2) Evidence of the existence of a protuberance or ledge on region F has also been found, the maximum ionisation of which increases with solar altitude. Region F must therefore be regarded as composite.

A rather unusual (P^1, f) curve illustrating both phenomena is shown in Fig. 1 from which may be deduced the maximum ionisation contents (in electrons per cubic centimetre) as follows: region E, $1{\cdot}8\times10^5$; intermediate region, $2{\cdot}5\times10^5$; region F ledge, $3{\cdot}8\times10^5$; and region F main, $6{\cdot}1\times10^5$.

As previously stated, it is not usual in England for the intermediate region to be as strongly ionised as region E, so that the original division of the ionosphere into two main reflecting regions must still be retained. The most frequent daytime variation of ionisation with height appears to be that shown in Fig. 2. The British measurements do not, as do the American series, give the actual heights of the ionisation maxima, but they give the values of the maximum ionisation contents. The relative values of the ordinates of Fig. 2 are therefore approximately correct but not the relative values of the abscissæ.

The British series of observations suggests therefore that there are four main components in the ionosphere caused by the influence of ultra-violet light from the sun. Such a composite structure is not considered unlikely when it is remembered that Pannekoek[3] has shown that the level of maximum ionisation caused by ultra-violet radiation depends on the ionisation potential of the gaseous constituent. It is tempting to associate the four components with the four ionisation potentials of oxygen and nitrogen atoms and molecules, and the suggestion that F^{II} is due in this way to oxygen

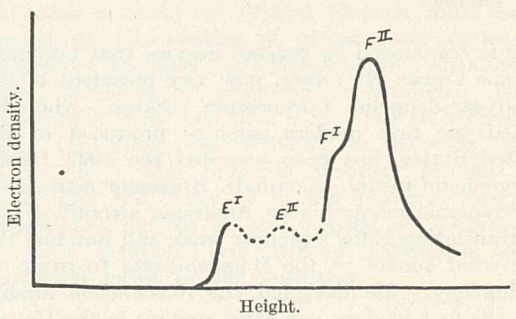


FIG. 2.

molecules has, indeed, already been made by T. L. Eckersley[4], who independently obtained evidence indicating a dual structure for region F.

Concerning the subject of nomenclature, reasons are given in my paper for adopting the one indicated in the diagram. The suggestion of Messrs. Schafer and Goodall that the intermediate region should be called the M region, while acceptable in other ways, may perhaps lead to confusion in one respect; since an M region reflection might be mistaken for what Ratcliffe and White have, very appropriately, called

M reflections (that is, tracks of waves which have been reflected in succession from region *F*, the upper part of region *E*, and region *F* again before coming back to the ground). For that reason the term 'intermediate region' seems preferable.

E. V. APPLETON.

Halley Stewart Laboratory,
King's College,
London.
June 3.

[1] NATURE, **127**, 197, Feb. 7, 1931; see also *Proc. Roy. Soc.*, A, **137**, 36; 1932.
[2] *J. Inst. Elec. Eng.*, **72**, No. 435, 246; 1933.
[3] Pannekoek, *Amst. Acad. Proc.*, **29**, 1165; 1926.
[4] Eckersley, *J. Inst. Elect. Eng.*, **71**, No. 429, 423; 1932.

WE were much interested in the letter of Messrs. Schafer and Goodall in NATURE of June 3, p. 804, under the title "Characteristics of the Ionosphere", and in particular in their remarks about the presence of an ionospheric reflecting region between the *E* region and the *F* region of Appleton. While making automatic records of ionospheric reflections[1] we have recently found indications of this region on several occasions.

One of our records, for the morning of January 29, 1933, taken on a wave-length of 150 m., is reproduced in Fig. 1. On this occasion a "circularly polarised receiver"[2] was used, and was arranged so

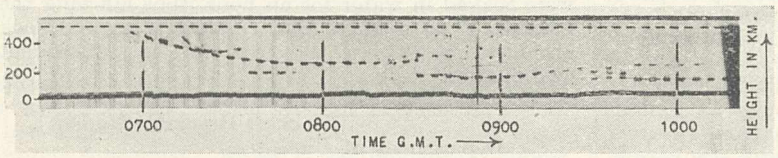


FIG. 1.

as to receive left- and right-handed circularly polarised waves alternately; a black line at the upper edge of the record corresponds to the reception of right-handed polarisation. At 0655 G.M.T., reflection of the right-handed component at the *F* region begins, at 0712 G.M.T. the left-handed component appears, at 0735 G.M.T. the right-handed component 'jumps' to the intermediate region at a height of 175 km. and at 0750 G.M.T. it disappears due to absorption. At 0835 G.M.T. the left-handed component 'jumps' to the intermediate region and a double reflection from the intermediate region is recorded. At 0930 G.M.T. a discontinuous 'jump' from the intermediate to the *E* region is seen, and for a few minutes reflections from the two regions occur simultaneously. A little later double reflections from the *E* region appear.

The sudden jumps from *F* to the intermediate region, and from the intermediate to the *E* region, indicate clearly that the three regions are distinct, while the fact that the jump from the *F* to the intermediate region takes place at different times for the right- and the left-handed components shows that the intermediate region is mainly composed of electrons.

J. A. RATCLIFFE.
E. L. C. WHITE.

Cavendish Laboratory,
Cambridge.
June 7.

[1] Ratcliffe and White, *Proc. Phys. Soc.*, **45**, 399; 1933.
[2] Appleton and Ratcliffe, NATURE, **130**, 472, Sept. 24, 1932.

The Hydroxyl Group and Soap Film Structure

IN view of the well-known 'stabilising' effect of glycerin on soap solutions, it is not surprising to find that the elastic recoil of aqueous ammonium oleate—demonstrated by Hatschek at a Royal Institution discourse in 1927[1]—is destroyed by a small addition of glycerin: the resulting solution having no obvious anomalous viscosity. (Hatschek supported a hollow glass cylinder on vertical pivots in a quarter per cent solution of ammonium oleate: when this cylinder was spun by the finger and thumb, it rotated for a few seconds, but then, after stopping, slowly returned in the opposite direction, as if by a coiled-up spring.)

Besides glycerin, many other alcohols, however, have an even more striking effect on aqueous ammonium oleate, sufficiently interesting to place on record. The mucilage-like consistency of 9 per cent ammonium oleate is changed by small additions of glycol, propylene alcohol, cyclohexanol, and ordinary ethyl alcohol, among other substances, first to a thick but perfectly clear gel, transforming in a short time, or on further small addition of the alcohol, to a limpid, free-flowing, normal, clear liquid. The actual amounts that produced this result, when added to 20 c.c. of 9 per cent aqueous ammonium oleate, were 4·5 c.c. glycerin, 2·8 c.c. glycol, 1·1 c.c. propylene alcohol, 0·5 c.c. cyclohexanol, and 1·2 c.c. ethyl alcohol. The resulting solutions, especially when diluted, give lasting thin films which have in most cases the interesting property of thinning to the 'black' state through several grades, so that ordinary photographs of three or four well-defined black grades can often be obtained present at the same time, though aggregating at different rates.

This reaction would also suggest that soap molecule aggregates are formed by means of hydroxyl groups rather than as ordinary hydrates; and seems to indicate a mechanism by which sheets of such molecules are rooted in a water surface, or linked in a stable soap film. In any event, the addition of alcohols as described here has evidently resolved some of the complications of the colloidal structure of the aqueous oleate.

W. J. GREEN.

Royal Institution, W.1.
May 18.

[1] *Proc. Roy. Inst.*, **25**, 245; 1926-28.

Interaction between Soot Films and Oil

THE effect described by Mr. J. H. Coste in NATURE of May 13, p. 691, is a manipulation variation of the interaction reported by me in NATURE of March 12, 1932, p. 401, as a new observation.

The drop *falling* on the film, the result is a record of impact rather than the effect of an undisturbed interaction. The drop being carefully *posed*, the central dark zone, varying from 0·25 cm. to 0·5 cm. in diameter, is a beautiful self-contained ring system, of so small diametrical variation that microscopic examination is necessary. A minute clear-dot puncture circle—probably through faulty posing—sometimes occurs, like a planet on the zone centre with perhaps a dozen surrounding satellites. This puncture circle increases with increased distance of fall, and at 3 mm. is quite large, whilst at 3 cm.

the dark zone is completely split into the striking spectacular visible effect noticed by Mr. Coste. This is an impact effect, the beautiful microscopic ring system obtained by the orderly reaction when the drop is posed being totally destroyed. Excepting possible central punctures, there is continuity throughout the system, and no film displacement forming 'clots' of carbon if the drop be posed, but a pleasing gradation of visible light and dark zones without suggestion of strain. A striking visible pattern persists outside the central dark zone, revealing microscopically orientated strings of carbon particles (or agglomerates) of denser or rarer conformation, with gradient transition between rings.

The striking periodic motive throughout a diameter of 2–3 cm. when the drop is posed, contrasts with the destroyed periodicity in the dark zone—only irregularly propagated outside—produced by falling impact.

The viscosity, vapour pressure, manner of introduction, and 'setting' rate of drop material seem to decide overall diameter. If too viscous, the film is plucked away; if too mobile, too rapid spread with but transitory system formation occurs. High, but not too high, viscosity produces best results and, amongst many other substances tried, a brand of immersion oil, whilst the soot film should be neither too patchily thin nor obscuringly dense.

If Mr. Coste decides to try posing the drop, as first used, he will surely find enhanced beauty due to interaction but slightly impeded by impact, and the setting-up of well-marked periodicity.

S. C. BLACKTIN.

312, Ringinglow Road,
Sheffield, 11.
May 18.

Vitamin C in the Adrenal Gland

A NUMBER of attempts have been made to obtain cytological preparations of vitamin C in the adrenal, based upon the well-known reducing power of the vitamin (ascorbic acid)[1].

The solubility of vitamin C in water makes it impossible to use the customary fixatives. In this work fixation was therefore accomplished by suspending pieces of the gland in the vapour of formaldehyde, obtained by heating paraformaldehyde. The gland tissue fixes rapidly and well by this method.

The method of demonstration which gave the best results was the impregnation of the gland using silver nitrate[2]. This gave good, though erratic, results. Following fixation, the gland was placed in 2·75 per cent solution of silver nitrate for twenty-four hours. Further methods using alcoholic silver nitrate of various strengths gave varying results.

In the mouse adrenal the cortex first stained an intense black and after two or three hours the medulla also became black. Paraffin sections of the gland showed cortex and medullary cells to contain large numbers of very small brownish black granules. The usual tendency towards surface tension aggregation at membranes was present, with the result that the nucleus was practically obscured by the mass of granules surrounding it. The cytoplasm of the cell was bordered by aggregations of these granules, and a number were scattered through the cytoplasm itself. Fig. 1 illustrates the arrangement of the granules within the cell. The cortex exhibited this reaction in patches, but the medulla showed an even impregnation, without the tendency to aggregation at membranes that was present in the cortical cells.

In the adrenal gland of the cat the peripheral cortical cells (zona glomerulosa and outer zona fasiculata) tended to impregnate more strongly than the inner cortical cells and the medulla. This was not due to imperfect penetration as the gland was cut up into a number of transverse portions for impregnation.

Guinea-pig adrenals showed impregnation of both cortex and medulla.

In the adrenals of the animals used in this work a number of cortical cells were packed with globules (lipoidal ?) and the granules of vitamin C were aggregated around the edges of the globules, presumably due once more to surface tension action.

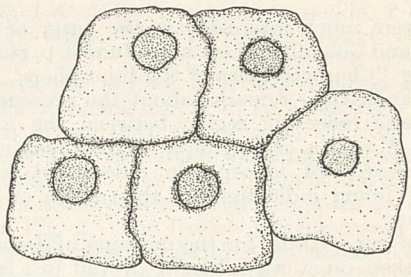


FIG. 1.

As a control, a number of pieces of adrenal gland were soaked in water for an hour, thus allowing the vitamin C to dissolve out. There were no black granules present in the material on subsequent examination.

GEOFFREY BOURNE
(Hackett Research Student).
Department of Biology,
University of Western Australia.
April 24.

[1] Szent-Györgyi and Haworth, NATURE, 131, 24, Jan. 7, 1933.
[2] Compare Szent-Györgyi, *Biochem. J.*, 22, 1393; 1928.

Carbonic Anhydrase and the State of Carbon Dioxide in Blood

MANY physiologists hold that sodium bicarbonate is the main form in which carbon dioxide is carried in the blood, and that the elimination of the latter in the lungs is due to the reaction

$$HP\,[\text{representing the weak protein acids of the blood}] + NaHCO_3 \rightleftarrows NaP\ [\text{protein salt}] + H_2CO_3 \qquad (i)$$

followed by

$$H_2CO_3 \rightleftarrows CO_2 + H_2O \qquad (ii)$$

Reaction (i) is very fast, but reaction (ii) is known to be slow. Calculations by Henriques[1] and others show indeed that (ii) is too slow to explain the observed rate of CO_2 escape in the expired air. Either then there must be a catalyst for reaction (ii) in the blood, or else some quite different chemical mechanism must operate.

The factor catalysing the $H_2CO_3 \rightleftarrows CO_2 + H_2O$ reaction.

Following on the work of Hawkins and Van Slyke[2], and Brinkman and Margaria[3], we[4] isolated in 1932 from ox-blood, a white substance of which 1 in 10,000,000 is active. This extract is a typical enzyme, and since it seems to be distinct from other known enzymes, has been christened 'carbonic anhydrase'.

A second mechanism. Direct combination of CO_2 with proteins.

Such compounds (possibly of a carbamate type) have been suggested by Bohr, Buckmaster, Mellanby and lately Henriques. Their detection in normal blood is hindered by the presence of the carbonic anhydrase, but by poisoning the latter by addition of $M/10$ HCN we have found new and clear-cut evidence for their existence.

(*a*) If such cyanide blood (free of CO_2) is shaken with CO_2, there is first a rapid uptake followed by a long slow one. The latter is due to the reaction $CO_2 + H_2O \rightarrow H_2CO_3$ which in absence of catalyst proceeds slowly. In the rapid stage much more CO_2 is taken up than can be accounted for by mere physical solution. The excess must be due to a chemical combination, which is *not* bicarbonate.

(*b*) Ammonia, glycine and peptide solutions behave just like the cyanide-blood. The CO_2 uptake in the rapid stages is in all these cases much increased by alkalinity and by lowered temperature. For the simpler NH_2 containing compounds (ammonia, etc.) it is certain that the compound so formed is a carbamate, that is,

$$RNH_2 + CO_2 \rightarrow RNHCOOH$$

So it seems extremely probable that the same is true of the cyanide-blood also.

(*c*) At 0° C. and physiological *p*H, 10–20 vols. per cent CO_2 are taken up in this carbamate-like form by cyanide blood, when the gas phase contains 40–50 mm. CO_2 pressure.

(*d*) In reduced blood, the carbamate-like compound, at CO_2 pressures from 20–60 mm. mercury amounts to about 5 vols. per cent more (measured as c.c. CO_2) than in the case of oxygenated blood, thus suggesting that hæmoglobin is the chief blood protein concerned. At 15° C the difference is almost as large, but the absolute amounts are much less. Since controls suggest that the only effect of this cyanide is to poison the carbonic anhydrase, we must suppose that these carbamate-like compounds are also present in normal blood and hence are important both in experiments on blood at 15° C and below, and also in CO_2 transport by cold-blooded animals.

(*e*) At mammalian body temperature (37° C) the carbamate-like compounds must, owing to the temperature effect noted above, be much less in amount. Some, indeed, of the difference between those physiologists who have upheld the bicarbonate mechanism as the sole mode of CO_2 carriage, and those who have supported a direct combination of CO_2 with the blood proteins may be due to the former usually having worked at 37° C and the latter at 15° C or below. We are at present extending our work to 37° C so as to assess the rôle of carbamate-like compounds in mammalian CO_2 transport.

Finally we would emphasise again that the formation of these carbamate-like compounds is quite distinct from the bicarbonate mechanism and, unlike the latter, does not seem to be catalysed by carbonic anhydrase.

N. U. MELDRUM.
F. J. W. ROUGHTON.
Physiological and Biochemical Laboratories,
Cambridge.
May 8.

[1] Henriques, *Biochem. Z.*, **200**, 1; 1928.
[2] Hawkins and Van Slyke, *J. Biol. Chem.*, **87**, 265; 1930.
[3] Brinkman and Margaria, *J. Physiol.*, **72**, 6P; 1931.
[4] Meldrum and Roughton, *J. Physiol.*, **75**, 3P; 1932.

The Astronomical Radiative Stability

SIR JOSEPH LARMOR in his letter in NATURE of June 3 concludes that because the temperature of the earth's surface has never changed by 50° C. in excess or defect of its present value since the commencement of organic evolution—as that would have destroyed all organic life—the effective temperature of the solar radiating surface cannot have changed from its present mean value, 6,000° K., by 1,000° in excess or defect.

This conclusion is based on the erroneous assumption that the temperature of the earth's surface reacts to a change in solar radiation like a black body able to radiate into free space. The reality is entirely different, for the surface is surrounded by an atmosphere of water vapour which is extremely opaque to long-wave terrestrial radiation, and the temperature of the earth's surface plays only a subordinate part in the balance of incoming solar radiation and outgoing terrestrial radiation. I discussed the question of the balance of solar and terrestrial radiation in a paper published in 1928[1], taking into account the selective absorption of water vapour and the actual temperature existing in the earth's atmosphere.

One of the chief results of the investigation was to show that, if the solar radiation increased, there would be an initial rise of temperature, but that this would lead to an increase of cloud amount which would reflect the short-wave solar radiation, and the balance would be reached by increased reflection and not by increased temperature. I gave reasons to believe that the results of increasing or decreasing the solar radiation within very large limits would be mainly an increase or decrease of cloud, the temperature changes being relatively small. This conclusion was supported by a calculation which showed that if the solar radiation decreased to three-fifths of its present value, clouds would entirely disappear, while if it increased to twice its present value, the sky would be completely overcast. As it happens, Mars and Venus, both planets with water vapour in their atmospheres, are respectively at such a distance from the sun that they receive a half and double the amount of solar radiation received by the earth, and the former has no clouds and the latter is completely cloud covered.

The limits of solar variation discussed by Sir Joseph Larmor, ± 1,000°, are those which would correspond with halving and doubling the solar radiation: and would therefore be compensated by varying the amount of cloud from no clouds to overcast skies, with relatively small changes of temperature. Instead of Sir Joseph's conclusion that such variations of solar radiation have never taken place, there is good reason to believe that changes of solar radiation of this magnitude are of relatively recent occurrence. More and more evidence is being found that, during the Pleistocene period, there were several large variations of rainfall simultaneously all over the earth[2]. Evidence of two pluvial epochs and two dry epochs is found in most regions, and the advance and retreat of the ice, which were characteristics of this geological period, were secondary effects of the changing precipitation. The variation in the precipitation between a dry and a pluvial epoch was very great, much greater than is generally realised. The average rainfall during the pluvial epochs was probably four or five times the present rainfall, and as the precipitation extended over most of the present deserts, the

sky was probably nearly overcast in all parts of the world. This could only have been brought about by a very large increase of solar radiation.

G. C. SIMPSON.

Meteorological Office,
London.
June 6.

[1] "Further Studies in Terrestrial Radiation", *Mem. Roy. Met. Soc.*, **3**, No. 21; 1928.
[2] "The Climate during the Pleistocene Period", *Proc. Roy. Soc. Edin.*, **50**, 262; 1930.

Origin of Tektites

DR. L. J. SPENCER'S contribution to NATURE of January 28, on the "Origin of Tektites", has interested me greatly, especially for the reason that his views tend to support that of the late Prof. J. W. Gregory and my own, as to the terrestrial origin of the australites. Dr. Spencer's explanation, however, does not appear to account for the occurrences and shapes of these australites, for the bomb-shaped ones have undoubtedly received their form by a spinning action, and not by a mere fusion of the sand covering the continental duricrust. Moreover, the australites are found in every State of Australia, and where they are abundant there is at present no evidence of meteoritic falls.

We may readily conceive how whirling dust in cyclonic storms, such as are known to take place in Australia, might be fused by the discharge of the lightning which often accompanies these electric storms.

The experiments of Prof. C. V. Boys on the discharge of electric sparks through molten resin tend to confirm this latter opinion, for he produced by this method many of the forms that are found in australites.

F CHAPMAN.

National Museum,
Melbourne.
April 5.

MR. CHAPMAN'S theory of the origin of tektites, which is explained in detail in his book "Open-Air Studies in Australia" (1929), is one of the many contributions to this problem, and was mentioned in my article. But no tektites (aerial fulgurites) have been picked up after the discharge of lightning through dust-storms. On the other hand, bodies with a very close resemblance to tektites have been collected around the meteorite craters at Henbury in Central Australia and at Wabar in Arabia—at Henbury for a distance of a mile from the main crater. 'Bombs' of molten silica must have been ejected from the craters by the violent gaseous explosions, and spinning through the vapours they collected condensed silica with some iron and nickel on their surface. A test for nickel in australites will help to decide between the rival theories.

L. J. SPENCER.

British Museum (Natural History),
South Kensington, London, S.W.7.
May 9.

The "Leeds Portrait" of Joseph Priestley

SOME time ago, I came across a photographic copy of an early portrait of Joseph Priestley among the Canton papers in the library of the Royal Society.

According to H. C. Bolton in his "Scientific Correspondence of Joseph Priestley", the original portrait was at one time owned by Mrs. Bilbrough (née Ellen Priestley) and in 1787 it was taken by Mrs. Crouch (Priestley's sister) to Gildersome, near Leeds, where she lived as housekeeper to William Hudson, a local resident. It is this association with Leeds which has presumably caused it to be known as the "Leeds portrait". How long it remained at Gildersome is not known, but it was photographed in 1860 by Messrs. Caldesi, Blanford and Co., 13, Pall Mall East, London. Since that time, the original appears to have been lost sight of and no reproduction of the portrait has hitherto been published.

It is of particular interest in that it is the earliest known picture of Priestley, representing him at the age of thirty years (1763) as he appeared during the

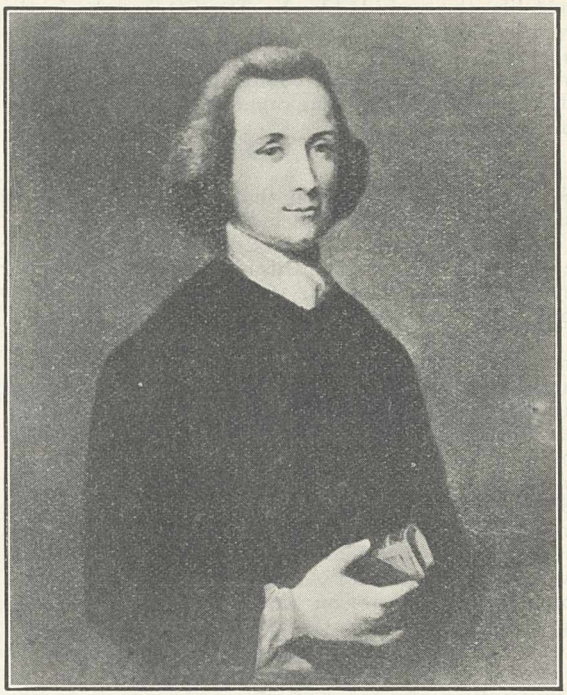


FIG. 1.

first part of his stay at Warrington. It was at this stage of his career that he was introduced to scientific circles in London during a Christmas holiday in 1765, when he made the acquaintance of John Canton and Benjamin Franklin, who were mainly responsible for his election as a fellow of the Royal Society in the following June. It was to them that he owed his first interest in original research, which he undertook in order to prepare the way for his "History and Present State of Electricity" published early in 1767. No other Priestley portrait dates from this important period of his life.

The Royal Society copy, from which the accompanying print (Fig. 1) has been reproduced with the permission of the Council of the Society, was evidently incorporated in the Canton collection by Dr. James Yates because of Priestley's friendship with Canton between 1765 and the latter's death in 1772. Two other Caldesi, Blanford prints are known to exist; one in the Timmins' Collection in the Reference Library, Birmingham; the other in the United States.

I shall be glad to hear of the existence of other copies of this photograph and I shall especially welcome any information which may lead to the finding of the original.

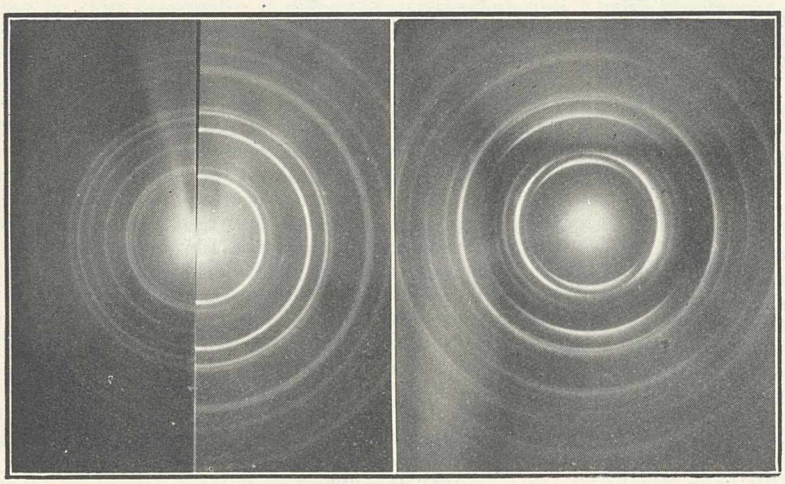
W. CAMERON WALKER.
History of Science Department,
University College,
London, W.C.1.
May 31.

Crystal Structure and Orientation in Thin Films

IN crystal growth, the well-known phenomenon of pseudomorphism extends to all three dimensions. Recently we have found that thin films of aluminium on platinum, of zinc oxide on zinc and of magnesium oxide on magnesium possess abnormal crystal structures. For example, aluminium, normally of face-centred cubic structure ($a = 4{\cdot}05$ A.), when deposited as a sufficiently thin layer on face-centred cubic platinum ($a = 3{\cdot}91$ A.) acquired a face-centred tetragonal structure with basal axis 3·90 A. and major axis 4·02 A. Thus, in its basal dimensions the aluminium was pseudomorphic with the platinum substrate. A similar effect was observed in the case of a thin film of zinc oxide on zinc (triangular close-packed lattice, $a = 2{\cdot}685 \pm 0{\cdot}002$ A.; $c = 1{\cdot}86$). In this case, whilst the basal dimensions of the zinc oxide were similar to those of the zinc substrate, the major axis had increased from 5·178 A. (normal zinc oxide) to $6{\cdot}873 \pm 0{\cdot}002$ A. Thus, the volume of the abnormal zinc oxide cell, basally pseudomorphic with normal zinc, was nearly equal to that of the normal zinc oxide cell.

Owing to deep penetration, the intensity distribution between the rings of X-ray diffraction powder photographs is of great assistance in their analysis, because the ring intensities may be taken as being proportional to the atom densities of the corresponding planes. Hitherto it seems to have been generally supposed that this practice can be extended to electron diffraction analysis and that orientation must result in a splitting-up of the rings into arcs. Owing to the limited penetrating powers of electrons, however, it is quite conceivable that such a view might lead to serious errors in analysis. Consider, for example, a diffracting film consisting (to take the most symmetrical case) of cubic crystals orientated with two axes normal to the electron beam, the crystal array being otherwise completely random. Rings due to (x, y, z) planes, where x, y and z are integers, will be missing from the pattern, which will consist solely of rings due to planes parallel to the beam axis, that is $(x, y, 0)$, $(0, y, 0)$ and $(x, 0, 0)$ planes. With gradual departure from this ideal case, diffraction will also occur from (x, y, z) planes, where z is large compared with x and y, but the intensity distribution between the rings will remain abnormal until all trace of orientation has disappeared. That such cases of orientation can and do occur may be illustrated by the following results :—

The electron diffraction pattern, A (Fig. 1), was obtained by transmission through a thin film of partially oxidised zinc. The reference pattern[1], B, was due to normal zinc oxide ($a = 3{\cdot}220$ A.; $c = 1{\cdot}608$) with random disposition of the crystals. Analysis of A, based solely on ring diameters, showed that the specimen consisted of normal zinc oxide together with small amounts of normal zinc ($a = 2{\cdot}685 \pm 0{\cdot}002$ A.; $c = 1{\cdot}86$) and basally pseudomorphic zinc oxide ($a = 2{\cdot}686 \pm 0{\cdot}002$ A.; $c = 2{\cdot}56$). On comparison of A with the reference pattern it will be seen that many normal zinc oxide rings are either absent or much weakened, whilst others are greatly intensified. For example, rings due to planes parallel to the basal planes of the hexagonal crystals are missing, whereas those produced by the $(x, y, 0)$ planes are abnormally strong. These facts show that the normal zinc oxide crystals in the specimen were orientated in such a manner that their bases were normal, or nearly so, to the electron beam axis, the directions of the basal axes, however, being completely random.



B A

FIG. 1.

FIG. 2.

The pattern (Fig. 2) was obtained from a similar film which had been stretched. Whilst the composition of the film (normal zinc oxide, zinc and pseudomorphic zinc oxide) remained unchanged, the distribution of intensities between the rings is now entirely different, and the rings tend to break up into arcs. Comparison of the relative ring intensities with those of the reference pattern, B (Fig. 1), shows that, whilst some of the crystals were orientated as in the previous case, others were now disposed in such a manner that two rectangular faces of each crystal were normal to the beam axis. Moreover, the tendency of the rings to break up into arcs shows that the major axes of these crystals were orientated about the direction of stretch of the film.

G. I. FINCH.
A. G. QUARRELL.

Imperial College of Science and Technology,
London, S.W.7.
May 30.

[1] NATURE, **131**, 842, June 10, 1933.

'Bull-Dog' Calf in African Cattle

THE achondroplasia-like condition which gives rise to the 'bull-dog' calf is not uncommon in certain breeds of cattle, notably in the Dexter, in which it has been shown to have a definite genetic basis and to be due, possibly, to a retardation in the functioning of the pituitary during fœtal life (Crew[1]). In the Norwegian Telemark breed, Wriedt[2] has described a very similar condition which, however, is different genetically. It has also been reported in the case of the sheep (Crew and Roberts[3]).

The purpose of this note is to record the fact that the 'bull-dog' calf occurs in cattle indigenous to Africa. The first case came to my notice in April 1929 and occurred on one of the few farms in Uganda owned by Europeans. Since then no fewer than twelve other monsters have been born, all of which presented the same characteristic abnormalities which justify the appellation 'bull-dog'. The specimens examined by me were quite typical of the condition as described by Crew, and every one of them occurred in Nganda cattle which are of a definitely fixed type and, so far as I can ascertain, breed true. They are supposed to have originated from a cross between the Ankole and the Eastern Province cattle. The Ankole cattle are characterised by their enormous horns, up to 6 ft. in span, leggy stature, and by the absence of hump, whilst the Eastern Province animals are typical zebus of small size. The Nganda cattle have medium-sized horns and a small hump. Buganda, the area in which these Nganda cattle are to be found, lies between Ankole on the western side and the Eastern Province to the east of the Nile. Although the owner of the farm on which these 'bull-dogs' occurred had cattle of all three types (Ankole, Eastern Province and Nganda) it was only the latter breed which produced them. Of the twelve which have been born since 1929, all save one were first calves. One of them was born alive but was killed after a few hours.

The Bahima, the pastoral tribe of the Ankole district in the west of Uganda, are employed as herdsmen, and unquestionably it is known to them that such 'bull-dog' calves are not uncommon. But it is impossible to obtain any information as to their incidence in the tribal herds for the reason that the monster is regarded as an omen of bad luck to the herd and to its owners. Some of the herdsmen would not even look at the 'bull-dog' calf, and the opinion prevails that if a woman of the tribe sets eyes on it she is bound to become bewitched and to produce a similar abnormality herself. So it is that, though the 'bull-dog' calf is probably fairly common among the cattle of the Western and Buganda Provinces, one hears nothing of them. They are got rid of quickly and never mentioned. This is the reason why the 'bull-dog' calf is never encountered in herds owned by natives: it was only because these cattle were owned by Europeans that I am able to record their occurrence in Nganda cattle.

J. CARMICHAEL.

Grange Close,
Ripon,
Yorkshire.

[1] Crew, F. A. E., "The significance of an achondroplasia-like condition met with in cattle", *Proc. Roy. Soc.*, B, **95**, 228–254; 1923.

[2] Wriedt, Chr., "Letale Faktoren", *Z. Tierz. Zücht.*, **3**, 223–230; 1925.

[3] Crew, F. A. E. and Fraser Roberts, J. A., "The genetics of the 'sheep'", *Bibl. Genet.*, **2**, 263–286; 1925.

Distribution of Nitrates in the Soil and Root Development in Coffee

IN the course of some preliminary investigations, after rains, upon the distribution of nitrates in the lower levels of a Kikuyu lateritic red loam, upon which coffee was growing, it was found that the curve showing distribution with depth was always of the form shown in Fig. 1. As the surface soil dried with drought, the nitrate content decreased, in some cases to so little as five parts per million, but the general shape of the curve remained the same, rising, generally, to a level of about forty parts per million, samples being taken at every foot to a depth of 8-12 ft.

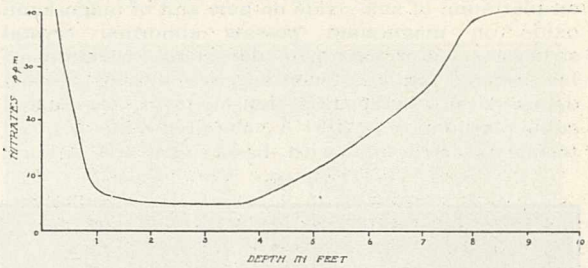


FIG. 1.

Comparing the curves of nitrate distribution with graphs of root distribution, it appears that the zone of low nitrate concentration coincides with the zone of vigorous development of root growth, that is, the coffee bush does obtain a substantial part of its nitrogen requirements from the lower levels of the soil. This investigation is being extended, but in the meanwhile it would be interesting to learn if any similar observations have been made in connexion with other fruit trees or crops. No references can be found in our limited library.

V. A. BECKLEY.
F. MCNAUGHTAN.

Scott Agricultural Laboratories,
Department of Agriculture,
P.O. Box 338,
Nairobi, Kenya.
April 19.

Neutron, Proton and Positron

THE neutron is usually looked upon as an aggregate of a proton and an electron. If it were so, there ought to be a strong tendency for hydrogen atoms to be converted spontaneously into neutrons, and the number of neutrons present in the universe should be much higher than it is assumed to be. I suggest that *the proton be considered as an aggregate of a neutron and a positron*. The neutron would be looked upon as an elementary material corpuscle without electric charges altogether. The proton would be able to dissociate into a neutron and a positron.

The very small number of neutrons and positrons met with in the universe would then be easily explained by the fact that the dissociation of protons requires a large quantity of energy and is by no means spontaneous.

N. THON.

Laboratoire d'Electrochimie,
Institut de Chimie,
Paris.
May 10.

Research Items

'Diffusion' and Disease. An argument in favour of Dr. Paul Rivet's theory of the Oceanic origin of certain of the Indian peoples of America has recently been deduced from the character and distribution of typhus by Dr. Charles Nicolle (*J. Soc. Américanistes*, S. 2, **24**, fasc. 3). Two distinct forms of typhus are now recognised. The older and classical form is found in man only, is carried by lice and has a distribution which is confined to the Old World, where it extends from Europe, through North Africa (but is not found in the tropical area) to western and central Asia and China. Although rats can be inoculated they are found not to be carriers, and are free from the virus after they have recovered from the fever. The second form has been identified as a disease of the rat, which is communicable to man, and is endemic in America. Its distribution, though not yet exactly determined, seems to be confined to America and the coastal parts of eastern Asia—Malaysia—Australia and New Zealand. It may be that eventually it will be found to embrace all parts. This form of typhus could not have been introduced into America by the Norsemen, as the carrier, the grey rat, was not then known west of the Urals; yet the disease was prevalent in America before the Spanish conquest, as is recorded by the chroniclers. As the rat could scarcely have accompanied the original migrations of the Indians over the inhospitable northern lands and also typhus does not occur in Alaska, one route alone remains, namely, that from Oceania, the rats having been carried on the canoes of the immigrants. There is evidently need of inquiry into the types of rats and of their parasites in Polynesia.

Prehistory of South-East Asia. An account of the search for evidence of prehistoric man in Siam, and of certain conclusions to be drawn therefrom, is given by Dr. Fritz Sarasin in *L'Anthropologie*, **43**, Nos. 1–2. Siam, in contrast to Indo-China and Malaya, has furnished little evidence of prehistoric man, owing in part to the fact that the country is thickly covered with virgin forest, in part to the occupation of the caves, in which such evidence might be sought, by Buddhist shrines or by hermits. A number of caves were inspected in both the northern and southern extremities of the chain of low hills which traverses the country. Several of them, where the paving usual in such shrines did not cover the whole floor, yielded a number of implements of palæolithic type; and in one secondary cave trenches were dug. Here bed rock was reached at a depth of 1·6 m., through 20 cm. of sand, 80 cm. of loamy soil, tinted grey by ash, and containing pottery and crude implements of palæolithic type, round hammer-stones, fragments of red ochre and broken bones, and below these yellow earth with no traces of human occupation. Comparison of the material obtained with evidence from Indo-China and Malaya leads to the conclusion that in the archæology of south-east Asia it is possible to distinguish: (1) a palæolithic culture of a simple and very primitive type without any indication of polished implements, represented in the archaic Hoabinhian of Tonkin, the Siamian of Siam, and the Malayan Linggong culture, its age, probably, being miolithic (Menghin); (2) a debased palæolithic with isolated proto-neoliths in juxtaposition and no pottery, represented in middle Hoabinhian, the older Bacsonian of Kéo-Phay, and the lower deposits of Gua Kerbau in Perak, of later age than (1); (3) a culture which is still palæolithic in its principal characters, but with an increased number of polished implements and greater refinement in form, pottery appearing; represented in upper Hoabinhian and Bacsonian and the upper deposits of Gua Kirbau, its age epimiolithic (Menghin); (4) full neolithic. The palæolithic of south-east Asia is certainly post-glacial and, therefore, relatively recent.

Relationships of the Mammals of Vancouver Island. E. Raymond Hall lists twenty kinds of mammals from Vancouver Island, British Columbia (Univ. California Pub. Zool., **38**, 1932, p. 415). Four are new subspecies, including a Vancouver Island wolf (*Canis occidentalis crassodon*), and the brown rat has been introduced. Comparison of this mammalian fauna with the faunas of the mainland and Alaska shows that, structurally, nine of the kinds have their closest relatives on the mainland of southern British Columbia, while six others more resemble forms which occur in south-eastern Alaska. On the whole, the insular fauna seems to have almost equal affinity with Alaska and with the proximal mainland in British Columbia.

Gorgonacea from the Great Barrier Reef. Prof. Sydney J. Hickson, in reporting on the Gorgonacea from the Great Barrier Reef Expedition 1928–29 (*Sci. Rep.*, **4**, No. 13, 1932. British Museum (Natural History)) is in agreement with the naturalists of the expedition that gorgonids are rare on the Barrier Reef. In one locality investigated, however, he finds these corals are richly represented. This is the Penguin Channel lying between Snapper Island and the mainland, a short and narrow channel about one mile north-west of Low Island and about 13–14 fathoms deep, where no less than 42 specimens, belonging to 19 genera and 15 species, were obtained. The conditions in this channel are peculiar, with a flow of water in one direction over a rocky bottom and apparently very favourable to the growth of the Gorgonacea. This is entirely different from Panama Bay, where Prof. Hickson (1928) described the Gorgonacea as flourishing in an open and very muddy sea. There are no species common to the two regions although certain forms of ramification occur in both. The enormous variability of many species has not been sufficiently recognised and the spicules are found to vary so much in some genera that it is not safe to use them as specific characters. Careful examination of a number of specimens shows that many so-called species are really only local varieties of a much smaller number. The general forms of the ramifications are regarded as good characters for systematic determinations. The author also considers that colour may be of much value in systematic work, the pigment which colours the spicules being either present or absent. The species without any colour in any of the spicules are apparently distinct from those with colour in some or all of the spicules. From the few observations on the gonads the facts seem to indicate that most are in approximately the same stage in February and spawned later, perhaps in June and July.

Disposal of Debris by Blood-Vessels. Science Service reports that, at the meeting in Cincinnati, on April 12–13, of the Federation of American Societies for Experimental Biology, Drs. E. R. Clark and E. L. Clark of the University of Philadelphia reported further observations on the thin layer of tissue in a rabbit's ear which they have examined microscopically through two thin transparent windows. Their recent work has been directed to the solution of the problem as to how the body disposes of debris cast out of the blood-vessels. Lymphatic tissue, which has been credited with this scavenging, appears to be much less important in this respect than was previously thought, for in spite of the absence of lymphatic tissue or vessels in the area between the two windows, and with no outlet except by way of the small blood vessels, a central mass of blood cells, fibrin and blood plasma clears up rapidly and the debris disappears. The space it occupied becomes filled with small blood vessels and connective tissue. Some of the mass may be taken up by macrophages but most of it is disposed of otherwise. Whether it is first digested by enzymes or in some other way is transformed so that it can be absorbed by the blood is not known, but observations through the windows showed that it can leave the tissues in the window-chamber only by way of the small blood vessels, there being no lymphatic vessels to carry it away. Drs. Clark and Williams observed in the same tissue that the nerves controlling the contraction of the muscle cells of the arterioles may undergo new growth and may re-establish their control over the contraction of the blood vessels. Dr. Clark said that this appeared to be the first study which correlates the surface regeneration of the sympathetic nerve with the functional activity of the part of the body it supplies.

Effect of Weed-Killers on the Soil. A question of importance in the use of chemicals for weed eradication is the possibility of such compounds exerting a deleterious effect on the soil, with risk of injury to the subsequent crop. Some investigations on these lines have been carried out by W. E. Bowser and J. D. Newton both in the field, greenhouse and under controlled conditions (*Canadian J. Research*, 8, 73). The liability of damage depends in part at least on the rate of decomposition of the chemical, its rate of movement in the soil and its effect on microbiological activity. Sulphuric acid and copper sulphate, which are employed chiefly as leaf sprays for the suppression of annual weeds, showed no lethal effect on the soil and nitrification was not affected. Sodium chlorate, on the other hand, which is mainly used for the eradication of perennials, remained undecomposed for a considerable time, poisonous effects being found nearly two years after application had been made. The rate of decomposition, however, was accelerated in the presence of much organic matter, and further, leaching removed the toxic compound from the surface layers of the soil, facts which suggest that a shallow rooted crop supplied with a good dressing of an organic manure would be advisable after a sodium chlorate treatment. Sodium bichromate decomposed rapidly, showing no residual toxic effects, but both this compound and sodium chlorate were alike in exerting a depressing influence on the numbers of soil micro-organisms.

The Genus *Diaporthe*, Nits. A very complete account of the ascomycetous fungi comprising the genus *Diaporthe* appears in vol. 17, part 4, of the *Transactions of the British Mycological Society* ("The British Species of the Genus *Diaporthe*, Nits and its Segregates" by L. E. Wehmeyer, pp. 237–295, March 1933). A brief key to the segregated genera is followed by very extensive keys to the British species of *Diaporthe* proper and of *Cryptodiaporthe*. Each species is afterwards described in great detail. The single species of *Apioporthe* and the two of *Diaporthopsis* receive full treatment. The publication of this account is all the more welcome since several species of the genus under review often attack the same host plant, causing great difficulty of determination in the absence of specialised knowledge.

An Electrical Calculating Machine. R. M. Mallock has described (*Proc. Roy. Soc.*, May) an electrical machine for finding the roots of a set of linear simultaneous equations. The machine consists of a number of transformers, one for each unknown and one for the numerical constants. Each transformer bears several windings. The number of turns in a winding may be varied by a dial switch, and the number of turns are made proportional to the coefficients in the equation. The windings are connected in series circuits corresponding to the equations. If now one of the transformers is excited, the fluxes in the cores adjust themselves to make the total voltage in each equation circuit zero, and the fluxes are then proportional to the roots of the equations. Errors are produced by magnetic leakage and by the resistance of the coils, and the latter are reduced by supplying magnetising current to each transformer from a valve amplifier and thus reducing the current necessary in the equation circuits. The machine which has been constructed will solve ten simultaneous equations with errors in the roots which may be less than 0·1 per cent of the largest root. If the number of unknowns is less than the number of equations, the machine may be used to obtain directly the 'least square' value of the roots, the weights of the equations being introduced as resistances in the equation circuits. The machine may save much labour in physical and engineering problems.

Absorption of Penetrating Radiation. Prof. E. Regener holds both the height record and the depth record for measurements of the ionisation due to penetrating radiation. In a recent paper (*Phys. Z.*, 8, 306; 1933) he describes both how he made measurements in Lake Constance down to a depth of 230 metres below the surface, and how he sent up an ionisation chamber attached to a free balloon to a height of 25 km., corresponding to an atmospheric pressure of 22 mm. of mercury. The design of the self-recording instruments is described in some detail. In order to avoid the disturbing effect on the sensitivity of the electroscope of the very low temperature of the atmosphere at such great height, use was made of the principle of the forcing-house. The ionisation chamber was completely surrounded by a light cage, the top half of which was covered with cellophane and the bottom half with aluminium foil. This proved very effective, for the temperature of the apparatus itself actually rose to 35° C. at a height of 20 km. The absorption curve obtained from these measurements in water and in the atmosphere is analysed into five homogeneous components of radiation, with absorption coefficients of $0{\cdot}205 \times 10^{-3}$, $0{\cdot}735 \times 10^{-3}$, $2{\cdot}0 \times 10^{-3}$, $4{\cdot}1 \times 10^{-3}$ and $8{\cdot}5 \times 10^{-3}$ cm.$^{-1}$ of water. The contribution of

the first three components to the ionisation at the top of the atmosphere is estimated as 0·16, 1·2, 3·2, and of the last two together as 328 ion pairs per c.c. per second. On the assumption that these absorption coefficients refer to homogeneous electro-magnetic radiation, Prof. Regener estimates the wave-lengths of the two harder components to be $3{\cdot}28 \times 10^{-14}$ cm. and $13{\cdot}7 \times 10^{-14}$ cm., by assuming the validity of the Klein-Nishina formula when the nuclear electrons are also taken into account. These wave-lengths are in close agreement with those of light quanta having energies equivalent to the masses of α-particles and protons. The possible mechanism of annihilation processes which could give rise to such quanta is discussed. The softest of the five components is attributed, following Millikan, to the building-up of a helium nucleus out of protons and electrons. The total energy of the penetrating radiation which falls on the top of the earth's atmosphere is estimated as $3{\cdot}5 \times 10^{-3}$ ergs per sq. cm. per second; this is 30 per cent lower than the erroneous figure given in Prof. Regener's letter in NATURE of January 28, 1933, p. 130.

Lead from Cyrtolite. The mineral cyrtolite from Brunswick, New York, contains lead and uranium in the ratio 0·0513 and is nearly, if not quite, free from thorium. The atomic weight of the lead extracted from this cyrtolite has been determined by Baxter and Alter (*J. Amer. Chem. Soc.*, April). The lead was converted into chloride after exhaustive purification and the comparison with silver effected nephelometrically, the end point being approached from both sides. The estimated accuracy is 0·02 in the atomic weight of lead, which was found to be 205·924, that of common lead being 207·211 and that of lead from Swedish kolm, previously investigated by Baxter and Bliss, who found 206·013, being 206·007. Cyrtolite lead is essentially free from common lead, so that the lead-uranium ratio may confidently be employed in calculating the age of the mineral. The explanation of the low atomic weight is not obvious. Aston finds the lead isotopes integral with the mercury isotopes, which on the physical scale $O^{16} = 16{\cdot}0000$ had values 0·01 per cent higher than integral, the accuracy claimed being 0·01 per cent. If the conversion factor 1·00022 to the chemical scale O = 16·0000 is used, the atomic weight of radium lead falls between 205·96 and 206·00. However, if the latter is always accompanied by actinium lead, Pb^{207}, in the proportions found in Katanga lead by Aston (NATURE, 129, 649, April 30, 1932) the average atomic weight of uranium lead should be 0·07 unit higher, a difference which Baxter and Alter say is far outside the apparent accuracy of their experiments. This suggests the possible presence in uranium lead of isotopes of mass below 206. Alternative explanations are that the atomic weight found by Baxter and Alter is too low or that the packing fraction of lead found by the mass-spectrograph is incorrect.

Astronomical Topics

The New Planet, 1933 HH. Further calculations have been made on the orbit of this planet by Dr. A. Kahrstedt of the Berlin Rechen-Institut. He uses photographic positions obtained at Johannesburg, extending from April 22 until May 17; but even this interval of 25 days proves to be insufficient to permit of an exact determination. He gives the two following orbits, both of which satisfy the observations within a few seconds of arc; the epoch for both is 1933 May 8.0, and the equinox 1933.0.

	First Orbit	Second Orbit
M	225·0638°	259·0403°
ω	130·3251	98·5149
Ω	340·0096	341·1686
i	7·2154	7·1040
φ	10·6735	8·1309
n	1859·510″	1550·297″
log a	0·187072	0·239728
Period	1·90813 y.	2·28871 y.

Both orbits indicate that the planet will be an easy telescopic object during the autumn. According to the first orbit it would approach the earth within some thirty million miles in December, and might be faintly visible to the naked eye; the second orbit would place it about twice as far away. In either case it would rank amongst the brightest of the minor planets, and its tardy discovery is somewhat of a mystery. It was badly placed at first for northern observers, but it is now observable as a morning star shortly before dawn. The following ephemeris is for 0^h.

	R.A.	N.Decl.	Mag.
June 17	$0^h\ 49^m\ 31^s$	5° 8′	9·3
25	1 5 7	7 13	
July 3	1 20 37	9 17	
11	1 36 1	11 20	
19	1 51 20	13 23	8·7

Eclipse of Hi and Ho. The story of these two ancient Chinese officials who were executed for some failure of duty in connexion with an eclipse of the sun is briefly mentioned in many books of descriptive astronomy. Dr. J. K. Fotheringham, in the April number of the *B.A.A. Journal*, gives the results of a careful study of all the documents that throw any light on the matter.

There was a great destruction of documents in China in 212 B.C. by order of the reigning Emperor; many of these were afterwards rewritten from memory, though no indication is given of the degree to which the restored texts can be trusted to be in agreement with the original. Dr. Fotheringham states that at the epoch referred to (about 2000 B.C.), it was not possible to predict eclipses, but the mean length of the lunation was known, and the calendar, which was a lunar one, was regulated accordingly. The fault of the officials was not the failure to predict an eclipse, but the fact that they allowed the calendar to get into confusion, so that an eclipse of the sun was observed on a day that was not the first of the month by their reckoning. This failure is stated in the narrative to have merited death, but their execution is not actually recorded.

Dr. Fotheringham does not think that it is possible to fix the exact date of the eclipse. He says that the one of 2155 B.C., which is selected by some writers, was not visible in China. The only clue is the statement that the eclipsed sun was in Fang. This is the name of an asterism in the head of Scorpio; but the word Fang is also used for "The order of the constellations", in which case it gives no assistance in finding the date.

The article also describes the musical and other ceremonials, including offerings of silk, that were customary at the times of eclipses.

The Royal Observatory, Greenwich

ANNUAL VISITATION

THE annual meeting of the Board of Visitors of the Royal Observatory was held on June 3. The Astronomer Royal, Dr. H. Spencer Jones, presented his report, noting that most of the work described in it had been carried out under the direction of his predecessor. The building and dome of the new 36-inch Yapp reflecting telescope have been completed; the telescope is being made by Sir Howard Grubb, Parsons and Co.; the spectrograph by Messrs. Adam Hilger, Ltd. Both have reached an advanced stage. Considerable progress has been made with the new transit circle which is being made by Messrs. Cooke, Troughton and Simms, Ltd.

Commander Gould has completed the restoration of Harrison's Time Machine No. 1, which is now in going order. He has also made a set of drawings of all parts, indicating those that replace original parts. He notes that Messrs. T. and F. Mercer generously supplied the balance springs and other new parts.

Meridian observations of the moon were made on 91 days. The mean correction to the longitude given by Brown's tables was +4·6″; it has been steadily diminishing since 1923, when it was +7·2″.

The second star catalogue for the epoch 1925 is in the hands of the printers; it contains all the stars, 10,600 in number, between north declination 32° and 64°, down to magnitude 8·0, also fundamental stars outside these limits. The proper motions of all the stars have been determined. The region from the equator to declination 24° is now being observed; this will be the last fundamental programme with the present transit circle. It is noted that, since its erection in 1851, about 600,000 star transits have been observed with it; also that, on the completion of the present catalogue, all the stars in the northern hemisphere down to magnitude 7·5 (and very many fainter ones) will have been observed at Greenwich since 1897. Vol. 6 of the Astrographic Catalogue was published during the year; it completes the determination of proper motions of stars in the zone between declination 64° and the pole; there are 252 stars that have proper motions exceeding 20″ per century.

The parallaxes of forty stars were published during the year, deduced from photographs taken with the Thompson equatorial; it brings the total number of parallaxes determined at Greenwich to 500.

The study of colour-temperatures of stars is being continued; a volume containing results for 63 stars was published during the year.

Good progress is being made with the measurement of plates taken for the determination of the parallax of Eros at the apparition of 1931. A new micrometer by Hilger, with a long screw, has been purchased.

Sunspot activity diminished further during the year; there were, however, two spot groups of considerable size; the largest one crossed the central meridian on Feb. 7. Observations of hydrogen flocculi with the spectrohelioscope were made daily when possible; the largest radial velocity measured was 110 km./sec. outwards on Oct. 6.

The usual magnetic observations were made at Abinger. The mean elements for 1932 were :—Decl. 12° 2·6′ W.; Hor. Force 0·18536; Vert. Force 0·42940; Dip 66° 39·1′.

The mean temperature for the year was 50·5°, being 1·0° above the average; the extremes were 98·9° on August 19 and 20·0° on Jan. 23. The rainfall was 24·77 inches, being 0·53 above the average.

Dr. J. Jackson resigned on March 1 his appointment as chief assistant, having been appointed His Majesty's Astronomer at the Cape. He had held his appointment since 1914, and has taken part in three expeditions to observe total eclipses of the sun.

A. C. D. C.

Falling Water-Level in the Chalk under London

A DISCUSSION on the "Falling Water-Level in the Chalk under London" was held by the Geological Society of London on May 19. In opening the discussion, Mr. Dewey said that London's subterranean water supply, derived from the Chalk, is maintained by rainfall. When artesian wells were first sunk, pressure was sufficient to raise water through the Tertiary beds to above sea-level. To-day, the water-table of the Chalk waters has sunk over wide areas to a depth of 200 ft. below Ordnance datum. This fall has been brought about by two possible main causes: first, the withdrawal of large quantities of water through numerous wells and boreholes sunk by water companies and others to the Chalk in the central area and in the Chalk along its outcrop south and north of the Tertiary beds; and secondly, the diversion of water, in drainage and other works, from the Chalk to sewage farms on the Tertiary beds and its consequent loss to the reservoir. A third, and only a minor source of loss, is the water pumped from the Chalk to supply districts lying on beds below the Chalk. As a result of these abstractions the water-table has fallen continuously for the last sixty years at least. In 1878, the water-table under the City lay at 100 ft. below Ordnance datum: to-day it is at about 210 ft., equal to a fall of 100 ft. in fifty-five years. The rate of fall is accelerative, and during recent years can scarcely have been less than 3 ft. annually. There appears, therefore, to be a grave prospect of the failure of some wells in the central area.

Schemes for the maintenance of the water-level have been suggested, but the risk of pollution has to be carefully considered before they are adopted.

Mr. J. Romanes said that the principal question is whether underground water supplies and underground storage are being used to the best possible advantage. Although no water engineer would think of constructing a surface reservoir until he was satisfied as to the intake, large sums of money have been expended in obtaining water from subsoil sources without any serious thought being given to the question of adequate replenishment. Nature, lavish in the provision of underground storage, is much less generous in replenishment, and the whole trend of the modern development of land drainage and similar services is to curtail still further natural replenishment.

The dangers Mr. Romanes foresees from a continuance of the present conditions are: a failure of the water supply from private wells, involving costly schemes to replace this supply from outside the London area; the spread of contamination in the basin due to the admission of polluted or brackish water; and subsidence due to the removal of an upward hydrostatic pressure on the base of the clay series of something like 3 tons per square foot, or a total upward pressure of more than 90,000,000 tons under the 'City square mile', together with the drying out of the Tertiary gravel beds.

The possibility of artificially aiding replenishment by the introduction of surplus water from the Thames and its tributaries is well worth serious investigation.

Dr. Herbert Lapworth's contribution showed that no general lowering of the water-level has been traced north of the line Bushey–Potters Bar–Hoddesdon, and it is not likely ever to occur north of this line in Hertfordshire. It appears from maps showing lines of equal lowering at 25-ft. intervals that the limiting line of 'no lowering' coincides with places where the underground water-level of the Chalk enters the Lower Tertiary gravel and sand bands between Bushey and Hoddesdon. This fact, which has never before been demonstrated, suggests that the Tertiary sands and gravels at the top of the Chalk are the main 'carriers' or 'replenishers' of London's underground water supply. These Tertiary beds between Bushey and Hoddesdon receive water from the Chalk at a certain rate dependent on the carrying capacity of the Chalk. They can convey water at a more rapid rate if the hydraulic gradient were steepened, but the supply is limited by the amount delivered from the Chalk. North of the Bushey–Hoddesdon line there has been no lowering of the water-level since 1878, and pumping to the south of the line only steepens the gradient of the water-table but does not draw faster into the reservoir.

Mr. E. Batchelor said that experiments by Mr. F. H. King on percolation through a black marsh soil indicate that percolation through the London Clay into the Thanet Sands below is not inappreciable. The percolation through the Chalk since it was raised above the sea has, by dissolving the Chalk, opened many fissures. One inch of percolation through the Chalk not covered by Eocene strata within the basin of the Thames above a point just down-stream of its confluence with the Lea would, if intercepted, yield 60,000,000 gallons of water a day.

The level of the water in a well is individual to that well, and varies with the yield and depth of each well. These levels should, therefore, be shown on a diagram by a series of dots and not by continuous contour-lines. The density of wells to each square mile is much greater in the City of London than elsewhere. The yield of the wells in 1913 was about 3,500,000 gallons a day. It would be greater if the wells were deepened, and still greater if more wells were sunk.

Prof. W. B. R. King commented on the complex nature of the problem. There are three main types of water-bearing rocks to be considered: (*a*) the Chalk where the joints and cracks had been opened by freely circulating rain-water; (*b*) the Chalk under the Tertiary beds and where the cracks had not been opened by circulating water; and (*c*) the Thanet Sands. It is difficult to decide in the London Basin exactly how the water travels to the centre of the area. In the north of France, however, the Thanet Sands are separated from the Chalk by an impermeable clay, and certain bores about six miles from the Chalk outcrop afford evidence that in that region more water travels in the sands than in the cracks and joints of the Chalk.

Association of Teachers in Technical Institutions

THE twenty-fourth annual conference of the Association of Teachers in Technical Institutions was held at Lincoln during the Whitsuntide vacation. A civic welcome was accorded to the Association by the Right Worshipful the Mayor of Lincoln, who was accompanied by the chairman of the Education Committee (Councillor Mrs. Lane) and the Very Rev. the Dean of Lincoln. The president for 1933–34, Mr. F. H. Reid, was inducted by the retiring president, Mr. S. H. Moorfield.

In his presidential address, Mr. Reid covered a wide field. If technical education is to play its part, he said, technical teachers must realise still more that their work touches all points of the social, educational and industrial fields. They have to deal with problems of unemployment for which science and technology will be increasingly responsible, with the problem of equalising the efficiency of distribution and production, with the problems raised by continental countries which are using technical education as a weapon in international competition, with the whole vast problem of preparing students to take their place in a world changing with marvellous rapidity.

Admitting that many of these points were familiar to the audience he was addressing, Mr. Reid insisted that their implications and significance are not yet generally grasped. How else could a London evening newspaper make the following comment: "The machine is enslaving us. The technical sciences are its janissaries. Liberal education is the last stronghold of the free. Beleaguered and starved, its overthrow is only a matter of time." The news which prompted that comment, remarked Mr. Reid, came from the Continent by telegraph or telephone. It was doubtless sent to the room where the article was written by similarly swift and sure methods. The room was almost certainly lit by electric light. The writer was clothed in garments made by modern scientific processes. Just as marvellous processes transformed his thoughts into the printed word. Complex transport arrangements brought the newspaper to its readers in the space of minutes, while the writer doubtless went home by tube, and, warmed and comforted by smokeless fires, gave himself up to the enjoyment of music broadcast by means of the latest "technical sciences". Yet he is enslaved by the machine! How long will it be, asked Mr. Reid, before there is a general realisation that the ordered, efficient State towards which all technical sciences work is the only structure in which beauty and freedom can ultimately really be known?

Among the resolutions adopted by the Conference was one urging that extension of technical education

with a minimum of duplication of effort, can be effected only by some system of consultation and co-operative planning within larger administrative areas than are in existence at present. It was insisted, however, that in arranging such regional co-ordination, teachers should be brought into consultation. Another resolution urged that apprenticeship conditions (or their equivalent) should be restated for the various industries and that the whole question of conditions of entry into industry and of the provision of opportunity for young entrants to qualify for skilled operative and higher posts should be immediately considered.

Food of Icelandic Herrings*

DR. P. JESPERSEN has made an important contribution to the biology of the herring in his investigations on its food in Icelandic waters. A large number of adult fishes have been examined, mostly collected during the great herring fishery of Iceland from June until September. The nets used were the purse-seine, fishing chiefly in the surface layers near the coast, and the drift-net, fishing in the deeper water of the open sea.

The food was found to be very different in the herrings from the two nets even if they were caught in the same water, those from the seine net having far more food in them—not one being found without food—while those from the drift-net were often empty, especially in autumn. This is presumably explained by the fact that the surface waters fished by the purse-seine nets have far more food in them in the summer than the deeper waters fished by the drift nets. The stomachs with the most food correspond with the largest catches of herrings, when there is the greatest amount of plankton. The herrings only come to these northern waters to feed at this time of year as they spawn in the warmer waters of the south and west.

The stomachs were taken from the freshly caught fishes, those from each catch (10–20) being placed in a separate bag and preserved in formalin. Later, the volume of each stomach contents was noted and the food roughly analysed both quantitatively and qualitatively. The percentage of herrings from each net feeding on certain food was then estimated.

As was to be expected, copepods form the largest part of the herring food. Nearly all the purse-seine fishes were feeding on them, euphausiids coming next in importance, amphipods, crab larvæ and pteropods also being eaten. The drift-net fishes fed largely on copepods at times and they also ate the other food mentioned above. Besides these there were present in smaller quantities in the fishes from both nets decapod and cirripede larvæ, cladocerans, gastropods, polychætes, chætognaths, fishes and fish eggs. Sometimes crab larvæ (almost entirely *Hyas coarctatus*, both zoeæ and megalopæ, which occurred in swarms at certain seasons) and *Ammodytes* were eaten in numbers.

Of the copepods, *Calanus finmarchicus* is much the most important food. It is found in huge masses in the waters north of Iceland, colouring the sea red, and it constitutes at least 95 per cent of the copepods eaten. Others taken by the herrings are *Temora longicornis* (very occasionally predominating), *Calanus hyperboreus*, *Metridia longa*, *Pseudocalanus elongatus*, *Microcalanus pygmœus*, *Acartia longiremis* and *Oithona similis*. Euphausiids (*Meganyctiphanes norvegica*, *Thysanoessa* (=*Rhoda*) *inermis*, *Thysanoessa* (=*Rhoda*) *raschii* and *Thysanoessa Longicaudata*) are eaten by the fishes from both nets, the adults chiefly by the drift-net herrings, the younger stages, which inhabit the surface layers, by the seine-net herrings. The pteropods *Limacina retroversa* and *Limacina helicina* occur sometimes very commonly in these seas and occasionally fill the stomachs of the drift-net herrings, especially in August and September.

* P. Jespersen, "On the Food of the Herring in Icelandic Waters". Meddelelser fra Kommissionen for Danmarks Fiskeri og Havundersø. gelser. Serie Plankton. Bind II. No. 3. 1932.

University and Educational Intelligence

CAMBRIDGE.—The Botany School has received from the estate of Mr. S. H. Bickham a valuable collection of several thousand specimens of plants and eighty-five botanical books. The bequest is a very important addition to the herbarium, since nearly all the specimens are of British plants and the herbarium has specialised in British and colonial species.

Prof. D. B. Copland, of the University of Melbourne, has been appointed Alfred Marshall lecturer for 1933–34.

A University lecturer and a University demonstrator in the Department of Anatomy will be appointed shortly; applications should be made to Prof. J. T. Wilson, Anatomy School, Cambridge, by July 10.

The electors to the Wyse studentship in social anthropology announce that they have awarded studentship of £250 for one year to Miss M. M. Hunter, Port Elizabeth Collegiate School and Girton College.

LONDON.—The following City companies have made grants to the University, payment in each case being spread over a period of years:—The Merchant Taylors' Company, £5,000; the Stationers' Company, £100. These benefactions will be applied towards meeting the cost of the new ceremonial hall to be erected on the University's site in Bloomsbury. A grant of £100 has also been made by the Guardian Assurance Company towards the cost of the new buildings.

OXFORD.—The Committee of Management of the Lewis Evans Collection of Scientific Instruments has published its annual report. Many accessions are enumerated, including gifts to the library and to the collection of portraits. The need is pointed out of an endowment for a curator.

SHEFFIELD.—The following appointments have recently been made:—Dr. L. C. D. Hermitte, demonstrator in pathology, the post to be held in conjunction with that of assistant pathologist to the Royal Infirmary; Dr. Eric James, junior assistant bacteriologist and demonstrator.

Prof. E. Mellanby has resigned from the chair of pharmacology, and Mr. J. W. Kershaw from the senior lectureship in mechanical engineering.

THE Association of Technical Institutions will hold its summer meeting at the Municipal College of Science, Manchester, on June 29–July 1, under the

presidency of Sir Hugo Hirst, chairman of the General Electric Co., Ltd. The following papers will be read and discussed at the meeting : "The Training of the Technical Teacher" by J. H. Currie ; "The Textile Industry" by Prof. W. E. Morton ; and "Management Education, the Case System", by Principal G. A. Robinson. Further information can be obtained from Dr. H. Schofield, Loughborough College, Loughborough.

A Busk studentship in aeronautics, established in memory of Mr. E. T. Busk, will be awarded during July. The studentship is valued at £150 for one year, but may be extended to two years. The student will be expected to carry out research in aeronautics, especially in stability problems, meteorological questions bearing on flight, or the investigation of gusts. The investigations may be carried out either at home or abroad. Further information can be obtained from Prof. B. Melvill Jones, Engineering Laboratory, Cambridge.

A RECENT (November, 1932) number of "University of Colorado Studies" is devoted to the publication of a collection of abstracts of theses for higher degrees, an enterprise which few university administrations consider to be worth its expense. Here we have a hundred and seventy abstracts, on an average 350 words each, constituting a cross-section of the course of advanced study and research in progress in the University. More than one-fifth of the theses are records of research in pedagogy. Of the remainder, half deal with humanistic and half with scientific topics. Theses on engineering subjects number 17 (electrical engineering 13), biological 14, chemical 10, physical and geological 6 each. A fairly large number of them are records of regional surveys.

THE *Universities Review* has in its April issue several articles of unusual interest. Prof. S. Brodetsky describes the plight of Jewish university teachers in Germany and the prominent place taken by Jews in intellectual life in that country. He explains the growth of the pseudo-scientific anti-Semitism which found such a successful exponent in Houston Stewart Chamberlain, whose work "The Foundations of the Nineteenth Century" formulated German racial pride and its application to Jews in a way that won the approval of the Kaiser and his advisers and added venom to an already virulent complex, aggravated and sharpened since the War by the rapid growth of an academic proletariat in excess of the capacity of the country to absorb them in useful occupations. The work of its International Relations Committee forms the subject of the presidential address to the Association of University Teachers which is reproduced in this number, and there is a report on continental students in British universities. Academic freedom in the United States is discussed by Preston Slosson who corrects the distorted picture drawn by Upton Sinclair in his "Goose Step" by showing that plutocracy is only one of a host of dangers by which freedom is beset. An informative article by F. A. Went and R. C. McLean on the Dutch university system is a useful addition to the series of similar papers which the *Review* is publishing. Eugen Rosenstock writes about the "mortal disease" of specialisation and urges by way of remedy the grouping of opposites into a sort of common life as in settlements, summer schools and camps.

Calendar of Nature Topics

Shamal

The prevailing wind in the Persian Gulf and the Sea of Oman blows from the north-west and is called by the Arabs 'shamal'. A shamal may occur in any month of the year, but it blows almost without cessation during June and the early part of July, when it is known as the 'great' or 'forty-day shamal'. A shamal may set in suddenly at any hour of the day or night, and generally lasts from one to five days. Although the wind is not usually strong, rarely exceeding thirty miles an hour, it is very hot and dry, and carries great quantities of dust from the deserts of Persia and Mesopotamia. The sky is cloudless, but the haze is often so thick as to obscure the land, making navigation dangerous, and the decks of ships far out at sea are covered by a fine impalpable dust.

Frequency of Birds

The number of birds in an area fluctuates considerably throughout the year, under the influence of changing quantities of food, whether vegetable or animal, of birth rate and death rate, and of migration. But in inland parts of the northern hemisphere the numbers reach their climax in June, a fact to be correlated with the height of the nesting season in the latter half of May (see "Nature Calendar", March 25, p. 445). In June the newly-fledged broods of the year still keep together in their home area, but as the year progresses their ranks are thinned by death and the relicts scatter over a wider territory.

An interesting confirmation of the June climax in bird numbers comes from Yosemite Valley in the Yosemite National Park, California. There, since the summer of 1920, Mr. and Mrs. Charles W. Michael have kept daily records of all species of birds seen by them. At the end of each month a summarised report of all observations for the preceding thirty days has been sent to the Museum of Vertebrate Zoology, Berkeley, California ; and now Dr. Jean M. Linsdale has used the daily records for the period August 1, 1920—November 30, 1931, to estimate the relative frequency of occurrence of the birds in the Valley (*Condor*, **34**, 221 ; 1932.) The species seen numbered 151, but of these only 40 were observed on more than 20 per cent of the days. A rough test of the relative numbers of birds present will be given by comparing the monthly numbers of species seen every day during the month. Extracting from Dr. Linsdale's statistics, we find that these numbers form a simple unimodal curve, at its lowest in January and December with 1 and 0 species seen every day, and rising to an apex in mid-summer with 13, 20, 12 in May, June and July respectively. This indication that June is the month of highest bird population in Yosemite Valley is confirmed by analysis of the monthly totals of observations of the forty most common birds.

Breeding Season of Sea-Lions in California

From the middle of June to the middle of July the breeding season of the sea-lions of California is at its height. Then the breeding adults, grouped in harems of females dominated by a master bull, form rookeries upon the islands off the coast, and when the single pups are born the sea-lion population is at its maximum. It was at this period that, in

1930, a census of the sea-lions was made (Paul Bonnot in *California Fish and Game*, 1931, p. 150). Two species were involved, the California sea-lion (*Zalophus californianus*), the smaller of the two, weighing about 500 pounds, and Steller sea-lion (*Eumetopias jubata*) the male of which weighs between 1,500 and 1,800 pounds. The census revealed that, as a rule, one species avoids the rookeries of the other. Of seventeen island rookeries, the two species occurred together on six only, and generally one was dominant and the other represented by a relatively small number of individuals. The California sea-lion is a southern species, less numerous in California, with 968 individuals, than the Stellers with 6,360, and the latter becomes predominant northwards, where it ranges to the Bering Straits. Counts of individuals made in 1927, 1928 and 1930 show that while the Stellers are increasing in numbers the Californias are decreasing. Since both species are subject to the destruction caused by professional hunters and collectors, the difference seems to be due to the limited range of the Californias, which have been harried to such an extent that several of the larger rookeries have been materially reduced or abandoned, whereas in spite of local destruction the rookeries of the Stellers are replenished by an influx of new individuals from the north, where, under a bounty system, the species is even more intensively hunted.

Early Potatoes

Farmers in England are now about to realise the first cash crop of the season. In a few favoured districts first early potatoes will be ready to lift. Their production is a highly specialised business, the controlling factor being a rare combination of soil and climatic conditions: a warm, free-draining soil sheltered from the north and east, with comparative freedom from frost and drought in May. With these natural advantages growers provide every artificial aid in forcing on the crop. Heavy dressings of bulky organic manures are given and these are further reinforced by generous additions of chemical fertilisers. In the famous 'early districts' the potato crop is taken much more frequently than is normally the case; nevertheless, little faith is placed in manurial residues and each crop is treated with the same generosity. The fact is that the period of high prices at the opening of the season is a very restricted one and no economy is considered worth while which might cause the crop to miss the first demand. Crops are always lifted immature, indeed a further fortnight's growth would almost double their yield but might actually reduce the acre value. Only the earliest home-produced crops come in in June, the Cornish supplies being the first; most of the supplies arrive in July and with them the price gradually comes down to a level not very different from that of the main crops which follow.

Cropping the same land at frequent intervals, the early growers do not escape the troubles almost invariably associated with the localisation of any crop. Of these, the eelworm disease is one of the most serious and is now a grave pest in many districts except perhaps on the very earliest crops. In one respect, disease has affected the industry in a favourable direction. The exclusion of foreign early potatoes likely to be affected with Colorado beetle has to that extent enlarged the market for home-produced supplies.

Societies and Academies

LONDON

Geological Society, April 26. L. S. B. LEAKEY: Fossiliferous deposits in the Homa-Kendu Area, Kenya Colony. The best exposures were found at Kanjera, the site previously discovered by Dr. Oswald, and at Kanam, some three miles farther to the west. The deposits, which must have been laid down in a former very great extension of Victoria Nyanza, were considerably affected by faulting and had a dip varying from 20° to 90°. At Kanjera fragmentary skull-caps of three individuals, as well as a fragment of a human femur, were recovered, and at Kanam a small fragment of a human mandible. These remains are remarkable because they represent very early human beings, who, in spite of their primitive characters, seem to approach *Homo sapiens* more closely than any other fossil humans of comparable age. The Kanam deposits and, therefore, the Kanam mandible are regarded as Lower Pleistocene, whilst the Kanjera deposits and the Kanjera skulls are to be attributed to the Middle Pleistocene.

DUBLIN

Royal Irish Academy, March 16. J. G. SEMPLE: Composite surfaces in higher space. The relations, obtained by Severi, which connect the projective characters of two algebraic surfaces in r dimensional space ($r \geqslant 4$) when they together form the complete intersections of $r-2$ primals of specified orders, are extended in this paper to cover the case when the primals intersect in any number of surfaces. The equations so obtained can then be re-arranged to show that definite virtual projective characters can be assigned to a general composite surface consisting of any number of irreducible surfaces intersecting in specified curves. The virtual unreduced canonical system of a composite surface is also defined, and examples are given of the manner in which the unreduced canonical system of an irrational surface breaks up when the surface degenerates into a composite surface. The bearing of the results obtained on the problem of the limiting envelope of a degenerate surface is also considered.

PARIS

Academy of Sciences, May 1 (*C.R.*, 196, 1253–1344). JULES DRACH: A class of congruences of right lines. C. MATIGNON and J. CALVET: Ageing of the aluminium-beryllium alloys after tempering. The aluminium-beryllium alloys studied, prepared from highly purified materials, after tempering, underwent a very rapid ageing at the ordinary temperature; fifty per cent of the transformation took place in ten minutes. P. A. DANGEARD: Remarks on the presence of a centrosomic apparatus in species of the genus *Lonicera*. The results recently published by Feng have been criticised: the author confirms the accuracy of the observations. J. COSTANTIN: Is the immunity of the sugar-cane *POJ* 2878 absolute? R. FOSSE, P. DE GRAEVE and P. E. THOMAS: The rôle of allantoic acid in the higher plants. E. J. GUMBEL: The representations of unimodal distributions unilaterally limited. P. DUBREIL: Some properties of the characteristic function of Hilbert. P. VINCENSINI: Stratifiable congruences. V. LALAN: Affine developants of minimal curves. B. GAMBIER:

A congruence of circles osculating the lines of curvature u = const. of a surface S_1 and v = const. of a surface S_2. DELSARTE and RACINE: A special binary ds^2. CHR. FOUSIANIS: A theorem of E. Borel. G. D. MATTIOLI: The theory of turbulence in channels. FLORIN VASILESCO: Movements in three dimensions, with a wake. HENRI CHRÉTIEN: An impersonal astrolabe. A. PÉRARD and M. ROMANOWSKI: First comparisons of the national standards of electrical resistance, carried out at the Bureau international des Poids et Mesures. The standards compared were from Berlin, London, Paris, and Tokyo: the Washington (Bureau of Standards) standards were not available. Differences of 0·1 microhm could be detected. The difference between the French and Japanese ohm is nearly a ten-thousandth. PAUL JANET: Remarks on the preceding paper. N. STOYKO and R. JOUAST: The apparent velocity of short radio-electric waves. The apparent velocity of radio-electric waves is always less than the velocity of light owing to differences of path. For short waves (15–40 m.) between Paris and Buenos Aires, the apparent velocity was 269,700 km./sec., a value agreeing with that previously found by the indirect method. For long waves, the velocity found was 245,000 km./sec. The differences can be explained by the difference in the mechanism of propagation of the two varieties of waves. TH. V. IONESCU and MME. IRÈNE MIHUL: High-frequency discharge in gases. Studies on the effect of a magnetic field on the maintenance of the discharge. A magnetic field reduces the potential necessary for the maintenance of the discharge in a tube. H. HULUBEI and MLLE. Y. CAUCHOIS: Weak lines in the K spectra of the elements 45, rhodium, and 42, molybdenum. Confirmation of some earlier results and description of some new lines. C. HAENNY: The magnetic double refraction of some cerium salts in aqueous and non-aqueous solutions. The magnetic double refraction of a saline solution is markedly affected by the presence of an excess of the acid forming the salt. For cerium, the magnetic double refraction and the paramagnetism is essentially due to the presence of the electron detached from the cerous ion. JACQUES WINTER: The diffusion of electrons by atoms. CHARLES LAPICQUE: The non-additive effect of different radiations on copper oxide cells. R. DEAGLIO: The photoelectric effect in the monocrystals of cuprite. The experimental results described prove that the photoelectric effect discovered by Dember is simply a consequence of the property of cuprite of acquiring an electrolytic conductivity when it is illuminated. R. COUSTAL: A connexion between the two general methods for the preparation of phosphorescent zinc sulphide. The author has fused zinc sulphide in nitrogen under a pressure of 160 km. at a temperature of 2000° C. and has obtained a phosphorescent sulphide with an optimum concentration of the copper phosphorogene of about 10^{-5}. —. POIDEBARD: A new method of taking aerial photographs in tropical climates. The photographs are taken at a low altitude and facing the sun. MME. BRANCA EDMÉE MARQUES: The distribution of the radium in the fractional precipitation of radiferous barium chloride. An experimental study of the precipitation of mixed barium and radium chlorides by hydrochloric acid. P. LOCUTY and P. LAFFITTE: The system ammonium sulphate, sulphuric acid, water. MLLE. M. PERNOT: The system mercuric bromide, potassium bromide, ethyl alcohol. JEAN BOUCHARD. The quantitative study of the inhibiting action of some organic compounds on the fluorescent power of uranine. MME. L. S. MATHIEU-LÉVY: The catalytic oxidation of carbon monoxide. The evolution of the catalyst. RENÉ PERRIN and ALBERT PORTEVIN: The evolution of the inclusions in the elaboration of steels. B. BOGITCH: The use of hot air in the fusion of minerals with a water jacket. P. CH. DORIER: The action of 1·3 dichloropropene on the sodium derivatives of the aryl fatty acids. CHARLES DUFRAISSE and J. A. MONIER, JR.: Researches on the dissociable organic oxides. *Bis*–1.1′.(*p*–tolyl)–3.3′.diphenyl–5.5′–dimethyl–rubene: its dissociable oxide. The introduction of the two methyl groups has not affected the property of the rubenes of fixing free oxygen reversibly. MAURICE LOURY: Researches on the acetylene carbinols: phenylcarbethoxyphenylethinyl carbinol, $C_{18}H_{16}O_3$. MME. F. BAYARD-DUCLAUX: Study of methods for putting in circuit specimens of rock for measuring their electrical resistance. The specimen is held by two stirrups, one of which is fixed and the other loaded to known amounts. The pressure is constant and the insulation sufficient. For rocks permitting the production of an optically polished surface good contact can be obtained with electrodes of silver foil under low pressure. For other rocks a higher pressure is required and the minimum pressure must be determined for each specimen. PHILIPPE HAGENÈ: Characters of the humus of pollarded willows. EM. SAILLARD and R. SAUNIER: The determination of the ash of sugar beet juice by measurement of the electrical conductivity. MME. NELICIA MAYER-REICH: The action of oxygen on glucides developed in the absence of air. P. NÖEL BERNARD and J. GUILLERM: The transmissible lysis of the cholera vibrion. It is possible to extract from pure cultures of the cholera vibrion, by the usual methods for the extraction of diastases, a lytic substance. This is specific, has an optimum *p*H of action, and reproduces exactly the phenomenon of bacteriophagy. MLLE. A. MICHAUX: The amounts of total phosphorus in the blood and muscles and the elimination of this element by the renal canal in the course of acute scurvy and chronic scurvy.

CRACOW

Polish Academy of Science and Letters, Feb. 6. S. BANACH: Green's formula. LAD. NATANSON: Permanent fields of radiation. W. SWIETOSLAWSKI and E. WARDZINSKI: The ternary heteroazeotrope: ethyl alcohol, water, carbon disulphide. A description of a modified differential ebullioscope with fractionating column, and its application to the above mixture. W. JACEK: The velocity of solution of marble in acids (3). Study of the rate of solution of marble in hydrobromic acid as a function of the concentration. L. MARCHLEWSKI and J. DABROWSKI: Studies in tautomerism, carried out by means of the spectrophotometric method. The results of Hartley and Dobbie on the constitution of isatin are confirmed. K. DZIEWOŃSKI and J. MAYER: A new method of synthesis of compounds derived from quinoline. CZ. KUZNIAR: Rock salt from Morszyn. J. TUR: The correlation between the formation of the vitelline vessels and that of blood corpuscles. B. SKARZYŃSKI: Studies on the transformation of carotene into vitamin A in animals.

GENEVA

Society of Physics and Natural History, March 2. M. GYSIN: Petrographical researches in the Haut-

Katanga. Note 3. The formations of the Roan series. (1) The author shows the great lateral variations of facies and thickness which the formations of the Roan series undergo in the south-eastern part of the Haut-Katanga. He gives a mean stratigraphic scale subdividing the Roan series into six horizons. The rocks which form these six horizons may be classed in sixteen distinct petrographical types. G. TIERCY: The mean absorption coefficient in a variable star of the Cepheid type. The author studies the relation which exists between the ratio of the total flux corresponding to two phases of the variation, the ratio of the respective mean absorption coefficients, and the ratio of the corresponding pressures of the reversing layer. G. TIERCY and A. GROSREY: Study of the width of a photographic stellar spectrum for stars of the type *A*5. The authors establish for stars of this type a formula giving the variation of the width of the spectrum as a function of the time of exposure and the magnitude, the stellar image being supposed to be kept on the cross wires of the finder during the whole of the exposure. ROSSIER: The diameter of some stars of the cluster *M*.7. The author compares the results obtained by M. Wallenquist with those given by his formula. The results are somewhat uncertain on account of the want of knowledge concerning the sensibility curve of the receivers used.

VIENNA

Academy of Sciences, Feb. 9. EDMUND FRAENKEL and JULIUS ZELLNER: Contributions to comparative plant chemistry. (24) *Heracleum spondylium*, L. The roots of this plant contain two substances of the ostruthin type (to be investigated), considerable proportions of resin, a sterol, a wax-like material, a choline-like base, glucose, and starch. JOSEF KLIMA: Chemistry of the lichens (2). *Alectoria ochroleuca*, Ehrh. In addition to the two known lichen acids, this lichen contains an amorphous lichen substance of non-acid character, a solid hydrocarbon, a sterol, oleic and linolic acids, small amounts of solid fatty acids, a crystallisable sugar-alcohol (probably erythritol), glucose, basic substances of choline type, and lichenin in abundance. LEOPOLD LUKACS and JULIUS ZELLNER: Chemistry of the higher fungi (22). *Ganoderma lucidum*, Leiss, *Hydnum imbricatum*, L., and *Cantharellus clavatus*, Pers. The *Ganoderma* species contain a specific resin and large proportions of a brown colouring matter, which is insoluble in all indifferent solvents and soluble only in alkali hydroxide and resembles certain humic acids; in addition, ergosterol, mannitol, fatty acids, polysaccharides and other substances commonly found in fungi, are present. The two other species yielded no specific ingredients, other than colouring matters of amorphous consistency and low stability. WOLF J. MÜLLER: Theory of passivity phenomena (18). Fluctuation phenomena in anodic passivification. Results are cited which indicate that the thickness of the layer varies during anodic passivification. Hence the covering laws are valid only within certain statistical limits of fluctuation, and passivity phenomena must be investigated statistically, a large number of experiments being made for each separate case. HERMANN VEIT GRABER: New observations in the region of the crystalline shales and massive rocks of Eisenkappel in southern Carinthia.

Forthcoming Events

Monday, June 19

ROYAL GEOGRAPHICAL SOCIETY, at 3.—Annual General Meeting.

BRITISH SCIENCE GUILD, at 4.30—(at the Mansion House, London, E.C.4).—Annual General Meeting. At 5. Prof. R. S. Troup: "Some Problems of British Forestry".

Thursday, June 22

RESEARCH DEFENCE SOCIETY, at 3—(at the London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1).—Annual General Meeting. Maj.-Gen. Sir Leonard Rogers: "The Saving in Life and Suffering, due to Medical and Veterinary Research, with special Reference to the Tropics (Seventh Steven Paget Memorial Lecture).

ROYAL SOCIETY, at 4.30.—Discussion on "The Ionosphere", to be opened by Prof. E. V. Appleton.

Official Publications Received

GREAT BRITAIN AND IRELAND

The Empire Forestry Handbook, 1933. Edited by W. A. Robertson. Pp. 167. (London: Empire Forestry Association.) 5s.; free to Members.

Y.H.A. Handbook to Hostels, 1933. Pp. 72. (Welwyn Garden City: Youth Hostels Association.) 6*d*.

Proceedings of the Society for Psychical Research. Part 130, Vol. 41, May. Pp. 139–253. (London: Society for Psychical Research.) 3*s*.

Department of Scientific and Industrial Research. Building Science Abstracts. Vol. 6 (New Series), No. 4, April, Abstracts Nos. 578–769. Pp. 109–144. (London: H.M. Stationery Office.) 1*s*. 6*d*. net.

The Institute of Physics. Report of the Board for the Year 1932. Pp. 13. (London: Institute of Physics.)

The Royal Society for the Protection of Birds. Forty-second Annua Report, January 1st to December 31st, 1932; with Proceedings of Annual Meeting, 1933. Pp. 60. (London.)

The Lister Institute of Preventive Medicine. Report of the Governing Body, 1933. Pp. 34. (London: Lister Institute.)

The Quarterly Journal of the Geological Society of London. Vol. 89, Part 2, No. 354, May 25. Pp. 85–201+lxxxvi+plates 7–18. (London: Longmans, Green and Co., Ltd.) 7*s*. 6*d*.

Board of Education. Report of the Advisory Council of the Science Museum for the Year 1932. Pp. 37. (London: H.M. Stationery Office.) 9*d*. net.

Twenty One Years: a Review of the Progress and Achievements of the BEAMA. Pp. viii+60. (London: British Electrical and Allied Manufacturers' Association.)

Standing Commission of Museums and Galleries. First Report. Pp. 28. (London: H.M. Stationery Office.) 6*d*. net.

Empire Cotton Growing Corporation. Report of the Administrative Council of the Corporation, submitted at the Twelfth Annual General Meeting on May 26th, 1933. Pp. ii+74. (London.)

OTHER COUNTRIES

Science Reports of the Tokyo Bunrika Daigaku, Section A. No 24: Some Remarks on Montel's Paper concerning Upper Limit of Absolute Values of Roots of Algebraic Equations. By Tikara Tôya. Pp. 275–282. 15 sen. No. 25: Remarks on some Coefficients of a Schlicht Function. By Shigeo Ozaki. Pp. 283–287. 15 sen. (Tokyo: Maruzen Co., Ltd.)

Journal of the Indian Chemical Society, Special Number. Sir Prafulla Chandra Rây: Seventieth Birthday Commemoration Volume. Pp. vi+363. (Calcutta: Indian Chemical Society.)

Journal of the Faculty of Science, Hokkaido Imperial University. Series 4: Geology and Mineralogy. Vol. 2, No. 1, November 1932. Pp. 131+20 plates. (Sapporo.)

Transactions and Proceedings of the Royal Society of South Australia. Vol. 56. Edited by Prof. Walter Howchin. Pp. iii+226+9 plates. (Adelaide.) 15*s*.

Journal of Science of the Hiroshima University. Series B, Div. 1 (Zoology), Vol. 2, Articles 4–7, March. Pp. 49–127+9 plates. (Tokyo: Maruzen Co., Ltd.) 95 sen.

Scientific Papers of the Institute of Physical and Chemical Research. Nos. 422–425: On the Chemical Constituents of Rice-embryo, by Riang-Ha Kimm and the late Taro Noguchi; On the Phosphorescence in Human Tissues, Part 2: On the Phosphorescence of Human Concrements and Pathological Calcific Tissues, and the Effect of Calcination Temperature upon the Phosphorescence of Calcined Tissues, by Shirobee Hoshijima; Diffraction of Cathode Rays by Mica, by Ken'ichi Shinohara and the late Kyûzi Matukawa; Influence of a Magnetic Field on Anode Spot, by Toshio Takamine, Taro Suga and Asao Yanagihara. Pp. 33+4 plates. (Tokyo: Iwanami Shoten.) 50 sen.

Memoirs of the Indian Museum. Vol. 12, No. 2: Classification, Bionomics and Evolution of Homalopterid Fishes. By Sunder Lal Hora. Pp. 263–330. (Calcutta.)

Proceedings of the Royal Society of Victoria. Vol. 45 (New Series), Part 1, 28th February. Pp. iv+31+7 plates. (Melbourne.)