Editorial & Publishing Offices:
MACMILLAN & CO., LTD.
ST. MARTIN'S STREET
LONDON, W.C.2

NATURE

Telegraphic Address:
PHUSIS, LESQUARE, LONDON

Telephone Number:
WHITEHALL 8831

No. 3455 SATURDAY, JANUARY 18, 1936 Vol. 137

Scientific Workers and Technical Legislation

The Profession of Chemistry

THE Report of the Poisons Board published last July has raised a number of questions of interest to many scientific workers other than those engaged in the preparation of pharmaceutical products or the sale of poisons. Essentially the Pharmacy and Poisons Act of 1933 outlines a method by which the State proposes to deal with a definite technical problem and a proved public danger. The many ramifications and interests involved make the delineation of detail an essential factor, if the Act is to achieve its purpose. The successful delineation of detail depends largely upon the disinterested and public-spirited co-operation of professional workers, which must be strong enough to resist pressure from vested interests which might invalidate or evade the control imposed.

From a general point of view, therefore, the details of the Act are highly suggestive as to the technique by which scientific and technical opinion may assist in the elaboration of legislation to meet the social and industrial problems of to-day. The Report raises more controversial problems which are not only of considerable interest from a narrower professional point of view, but also have some bearing on the general problems of what may be termed the profession of science.

Notably is this true of the proposal for the supervision of the manufacture of pharmaceutical provisions containing poisons, to which attention has recently been directed again in the annual report of the Council of the British Association of Chemists. The Poisons Board explains in its Report that it considers it unnecessary to exercise this power to the full extent of covering all pharmaceutical preparations, and that the proposed rule applies only to the manufacture of preparations for the purpose of the internal treatment of human ailments. The details of the Poisons Board's present proposal are, however, much more controversial. It is recommended that the control of the manufacture of the pharmaceutical preparations in question should be restricted to registered pharmacists, medical practitioners, fellows and associates of the Institute of Chemistry and/or persons who for three years have been continuously engaged in such work.

According to the Report, the Board considers the supervision of the manufacture of pharmaceutical products is peculiarly the province of the pharmacist. This opinion has been hotly contested by members of the British Association of Chemists, who claim with reason that the supervision of the manufacture of chemical preparations is exactly what the chemist is trained to undertake. The chemist can also urge that it is only as pharmacists or medical practitioners possess chemical qualifications, in addition to their own particular professional qualifications, that they can be competent to exercise effective supervision of the manufacture of pharmaceutical preparations. Even those with the most rudimentary knowledge of the contents of the medical curriculum cannot fail to be impressed, moreover, with the weakness of a proposal which would endow any general medical practitioner with the competency for supervision of intricate chemical operations often involving engineering as well as chemical knowledge. In fact, the Council of the British Association of Chemists has expressed the opinion that neither the medical man, the pharmacist nor even the

chemist as such is necessarily qualified to undertake the supervision required, and it considers that accredited bodies should have power to recommend suitably qualified persons.

The proposal in regard to members of the profession of chemistry raises, however, another important issue. While any member of the professions of pharmacy and medicine is recognised as competent, such recognition in the profession of chemistry is only to be extended to members of the Institute of Chemistry. The reason advanced for this proposal is that members of the Institute, like members of the medical and pharmaceutical professions, are subjected to disciplinary control and that the qualification can be withdrawn in cases of professional misconduct. Since a university degree in chemistry cannot be withdrawn in such event, it is suggested that holders of such degrees should apply for the necessary qualifications by becoming a member of the Institute of Chemistry, a procedure which would not necessitate a further examination.

These proposals and the comments on them in the Poisons Board's Report have been promptly challenged. It has been pointed out that the British Association of Chemists also issues documentary evidence of competency in chemistry, and has the power to withdraw that evidence in the event of professional misconduct. Moreover, this organisation has substantially stronger claims than the Institute of Chemistry to be regarded as representative of the industrial chemist. Though the Institute of Chemistry represents some forty per cent of the chemists in Great Britain, the implication in the Report of the Poisons Board that it occupies a position in the profession corresponding with that of the General Medical Council or the Council of the Pharmaceutical Society in the medical and pharmaceutical professions is not warranted by the facts.

The proposal, which would in future compel a graduate to subscribe to the Institute of Chemistry if he is to practise in a certain branch of chemistry, has already aroused strong opposition from the universities and from the profession in general. The Board contends in its Report that a university degree or diploma in science does not necessarily imply that the holder is qualified in chemistry. According to the regulations of the Institute, however, any graduate of a recognised university holding a degree with first or second class honours degree in chemistry is admitted to the associateship, and the examination for the associateship is a general one in chemistry, and can scarcely be regarded as conferring a special qualification to handle dangerous drugs. Had the Board stipulated a fellowship of the Institute in food and drugs, or the possession of the diploma of the Institution of Chemical Engineers, the qualification might have been considered unnecessarily narrow, but there would have been reason for the Rule.

The position, of course, would manifestly have been different had there been in existence any general register of chemists. No reasonable objection could then have been raised to requiring graduates in chemistry to apply for registration in the same way that a graduate in medicine is admitted to the medical register kept by the General Medical Council. Abortive efforts, partly on the initiative of individual members of the Institute, have already been made to establish such a register of chemists ; but the failure of such efforts is largely to be attributed to lack of support from the Institute as a whole and the apathy of the majority of the members of the profession.

The existence of a general register might equally have avoided dangers inherent in the final proposal of the Poisons Board in regard to qualifications, that to admit those who have for three years been continuously engaged in such work. In the absence of any adequate definition of control or supervision, there is serious risk that the standard may be set dangerously low and admit those who are little more than charge hands or laboratory assistants without adequate scientific or technical knowledge on which to call for action in emergency. Responsible professional opinion holds that the only satisfactory way of admitting to a register persons whose qualifications are based merely on the occupation of a particular post is the careful scrutiny of their individual claims by a competent professional board, which would demand evidence of something more than ability to deal merely with routine duties.

Whatever may be the outcome of the discussions which the publication of the Report of the Poisons Board has initiated, or the effect of the representations which may be made to the Home Secretary, its proposals have indicated a conspicuous lack of harmony in the profession of chemistry, the significance of which should be duly noted by other classes of scientific workers. It is only as scientific workers can present a united front and can work harmoniously together that they can expect their representations to the State to have their full and desirable effect.

Social Psychology and Population Problems

(1) A Handbook of Social Psychology
By W. C. Allee, Gordon W. Allport, Friedrich Alverdes, R. E. Buchanan, Frederic E. Clements, J. F. Dashiell, Erwin A. Esper, Herbert Friedmann, Edwin Deeks Harvey, Melville J. Herskovits, Catharine Cox Miles, Walter R. Miles, Gardner Murphy, Lois Barclay Murphy, O. E. Plath, Thorleif Schjelderup-Ebbe, Victor E. Shelford, Warren S. Thompson, W. D. Wallis, F. L. Wells, Raymond Royce Willoughby, Clark Wissler, Ada W. Yerkes, Robert M. Yerkes. Edited by Carl Murchison. (International University Series in Psychology.) Pp. xii+1195. (Worcester, Mass.: Clark University Press; London: Oxford University Press, 1935.) 27*s.* net.

(2) The Growth and Distribution of Population
By Dr. S. Vere Pearson. Pp. 448. (London: George Allen and Unwin, Ltd., 1935.) 12*s.* 6*d.* net.

(1) IF by a handbook is meant a small book such as may be held in the hand—the original meaning of the word—then this volume of some 1,200 closely printed pages is not a handbook; and if by social psychology is understood, for example, "the study of personality as it develops in relation to social environment" (Kimball Young), a large part of this book is not social psychology. The same applies if some other well-known definitions of social psychology are adopted; such as "the science of man in his social relationships" (Thouless), "the science which explains human social life" (Folsom), "the interpretation of the psychical processes manifested in the growth and functioning of a group as a unity" (Ellwood), "the study of the psychic planes and currents that come into existence among men in consequence of their association" (Ross). The only definition that possibly covers the scope of this book is Allport's—"the science which studies the behavior of the individual in so far as his behavior stimulates other individuals or is itself a reaction to their behavior". The individual, so far as this work is concerned, can be a man, a bacterial cell, a weed, an oyster, an ant, a bee or a monkey. The mechanical (using this word in no derogatory connotation) implications of this definition are evident in the treatment and arrangement of the whole work.

The book is divided into six parts, the first of which treats of population behaviour, rate of increase and other social phenomena among selected populations of bacteria, plants and human beings. Interesting in itself, this part throws little light on human social psychology. The article on "Human Populations" might have been much more fruitful in results had it been written by a psychologist and not by a population expert. The second part deals with social phenomena in infra-human societies, and summarises the knowledge that is available on insect societies, bird societies and mammalian herds. The third part, entitled "Historical Sequences of Social Phenomena", is devoted to social histories of the Negro, red man, white man and yellow man. Here is a great deal of information about the cultural development of these races, but very little psychological interpretation.

With the fourth and fifth parts, entitled respectively "Analyses of Recurring Patterns in Social Phenomena" and "Analyses of Some Correlates of Social Phenomena", we come to subjects that are more generally considered in social psychology, such as the psychological basis of language, the nature of magic and cognate phenomena, the role of age and sex differentiation in social relationships, the meaning of 'attitudes' and social maladjustment. In these sections too there are interesting analyses of the influence of physical environment and climate on social behaviour, and of the technological and economic patterns observable in material culture. The concluding part discusses the experimental work that has been carried out on the social behaviour of simple animal aggregations, birds, primates, children and adults. It is unfortunate that the work in the Clark Laboratories on the experimental measurement of social hierarchies in animals was not sufficiently developed for inclusion here.

To single out particular contributions for special notice would be an invidious task. All the articles are of high merit, although not every article is sufficiently treated from a social psychological point of view or deserves a place in a handbook of social psychology. That is why the volume is not so much a handbook as a compendium giving a representative cross-section of the more important methods and approaches utilised in investigating social phenomena. The excellent bibliographies attached to each article enhance still further the value of this book.

(2) Dr. Pearson's book is a useful contribution to the recent literature on population if for no other reason than that it is not guilty, as so many works are, of discussing population problems *in vacuo*. It endeavours to go behind birth, death

and marriage rates to the institutional setting in which they operate and to the social forces that influence their expression. It recognises, implicitly at any rate, that there is no general law of population—certainly no Malthusian law—but that each social system, each historical epoch, has its own principles of population which can only be determined by a close scrutiny of all the factors entering into population growth and distribution.

Some of these factors are law and custom, property rights, the size of agricultural holdings, the existing density of population, changes in industrial and commercial habits, and the activities of governmental and economic institutions. On these matters as well as on the more generally recognised factors such as fertility of the soil, climate, accessibility to other human beings, technological inventions and medical discoveries the author has many interesting comments to make. He also discusses in a popular manner the growth of cities, rural depopulation, health in town and country, garden cities and town planning.

From a scientific point of view the recommendations and conclusions are the most vulnerable part of the book. For all population evils the author has the following simple panacea—"the abolition of private property in land so that all taxes can be swept away and only the community's own revenue, the rent of site values, be used to finance public services" (p. 419). How such a "reign of true justice giving equality of opportunity to all" (p. 402) will abolish wars, emigration, overpopulation, and how it is to be brought about, we are not told. J. R.

Hindu Mathematics

History of Hindu Mathematics: a Source Book. By Bibhutibhusan Datta and Avadhesh Narayan Singh. Part 1: Numeral Notation and Arithmetic. Pp. xx+261. (Lahore: Motilal Banarsi Das, 1935.) 6 rupees; 10*s*. 6*d*.

THE book before us is Part 1 of a history which is intended to consist of three parts. This first part deals only with the history of the numeral notation and of arithmetic; the second will be devoted to algebra; the third part is to contain the history of geometry, trigonometry, the calculus and various other topics such as magic squares, the theory of series, and permutations and combinations.

The numeral systems and notation in use in India from the earliest times form the subject of the first of the two chapters into which the volume is divided. The object of the authors is to set at rest finally the question of the Indian origin of our decimal 'place-value' system of notation. The difficulty arises mainly from the absence of strictly mathematical texts dating before the second or third century A.D. For the centuries before the Christian era, the authors have had to collect from all sorts of non-mathematical literature, from the Vedas (say, 3000 B.C.) and the Brāhmana literature (say, 2000 B.C.) downwards, allusions to mathematics and arithmetic which may throw light on the question.

Large numbers had a fascination for the Hindus from very early times. Apparently, before 500 B.C., they had separate names for all powers of 10 up to a billion (a million millions). Next, in the period before 100 B.C., names were given to all numbers formed by multiplying the 'koti' (10,000,000) continually by 100 until 10^{53} is reached. (When it is claimed that the Hindus "anticipated Archimedes by several centuries" in evolving a series of number names sufficient to exceed the number of grains of sand which the whole universe could contain, it is right to point out that, with Archimedes, this number (10^{63}) is only 10,000,000 units of the eighth 'order' in his system of numbers, and that the system extends not only to the 100,000,000th 'order', which ends the first 'period', but to 'periods' beyond that as far as the 100,000,000th !).

The different numeral systems employed in India, including the word-numbers and the alphabetical numerals, are described, and the many theories of their origins examined. It appears that the earliest use of the 'place-value' in a mathematical work occurs in the Bakhshālī MS., the content of which may go back to A.D. 200 or 300, though our present copy is only of the eighth or ninth century; the use of a symbol for zero is found so early as A.D. 200; in the Bakhshālī MS. it takes the form of a dot. We may admit the incalculable debt that the world owes to the Hindus for the initiation of the decimal place-value system involving a multiplication-table short enough to be easily remembered; but we must marvel the more at the Babylonians of 2000–1800 B.C., who consistently worked with their sexagesimal system, which required a multi-

plication table going up to 59 times 59, and which, moreover, included sexagesimal fractions (successive powers of 1/60) written straight on after the units as digits just like the powers of 60, whereas decimal fractions were not used until the first years of the seventeenth century A.D.

Apart from the Bakhshālī MS., the exclusively arithmetical treatises seem to date from the eighth century A.D. onwards, though astronomical works by Aryabhata I (499) and Brahmagupta (628) contain mathematical sections. The latter observes that "he who distinctly knows the twenty logistics, addition, etc., and the eight determinations including (measurement by) shadow is a mathematician". The twenty logistics include the four fundamental operations, then the finding of squares, square roots, cubes and cube-roots, fractions, rule of three, barter and exchange, etc. The characteristic of the treatises is that they state precise rules for the various operations in the most succinct form, whereas the ancient Babylonian and Egyptian texts work out multitudes of examples without stating any rules at all.

Chapter ii on "Arithmetic" covers 123 pages and gives an elaborate account of all the operations, with examples of their working in detail. Thus seven methods of multiplication are described; next come long division, squaring and extracting the square root, cubing and extracting the cube root, checks on operations such as "casting out nines", operations with fractions (written like ours but with no line between the numerator and denominator, whereas the Greeks wrote the denominator above the numerator), the rule of three, proportion, commercial problems, interest problems of all sorts, some leading to quadratics, some to simultaneous equations, barter and exchange, miscellaneous problems including the use of "regula falsi", the "method of inversion", the solution of quadratic equations, and finally a section on the "mathematics of zero".

All who are interested in the history of arithmetical operations will welcome this excellent account. Among a few curiosities in their writing of English we may note the authors' habit of writing 'upto' as one word. T. L. H.

The Cause of the Ice Age

The Atlantean Continent: its Bearing upon the Great Ice Age and the Distribution of Species. By H. Edward Forrest. Second edition, revised and enlarged. Pp. 352 + 12 plates. (London: H. F. and G. Witherby, 1935.) 10*s*. 6*d*. net.

THIS book puts forward a theory concerning the cause of the Ice Age. Speculation on this fascinating subject has occupied the minds of astronomers, geologists and meteorologists for many years.

The author suggests that in Pleistocene times there was a great Atlantean Continent occupying the present site of the North Atlantic Ocean, extending northward into arctic regions. The existence of this great land area, combined with a range of high mountains reaching to 17,000 ft. extending from Greenland through Iceland to Spitsbergen, so altered the climate as to produce arctic conditions over the British Isles and Northern Europe. From this northern range, called the Atlantean Alps, there emanated a great ice sheet between 2,000 ft. and 3,000 ft. thick which, moving in a southerly direction, overwhelmed Great Britain down to the Thames Valley and the whole of Ireland except a small portion of the south, extending in Europe to about the latitude of Berlin. All this took place probably within man's occupancy of Europe.

The idea is not new. A redistribution of land has been suggested, though perhaps not in such a definite form or on such a large scale. It is doubtful if such a radical upheaval of the bed of one of the great permanent oceans would be widely accepted. The author produces in support of his views a mass of evidence from glacial markings, transport of erratics and the existence of glacial deposits over a vast area. He also deduces from the similarity of the flora and fauna of Europe and America that there must have been a land connexion between the two continents.

Having played its part, the Atlantean Continent sank beneath the sea, leaving such remains of its former greatness as Bermuda, the Azores, Madeira and some other islands with perhaps the ancient classical tradition of Atlantis. It was let down, as it were, by two faults now marked by the continental shelf on both sides of the Atlantic.

If we accept Mr. Forrest's theory, we must suppose several oscillations of land-level on a large scale in order to account for the variations

of climate which accompanied the Ice Age. This would point to a period of great instability in the lithosphere during Pleistocene times, which is admitted by geologists. Still, it is not easy to imagine the immense geographical transformations which this supposition involves. Moreover, the disappearance of the ice sheet and the relief of pressure which this afforded should, according to the doctrine of isostasy, cause the land which had lain beneath it to rise, whereas the author thinks it has, since the ice age, been pressed below the ocean as much as 12,000 ft. There are evidently so many difficulties connected with the case, that the problem of the ice age still remains without a satisfactory solution.

It may not be without interest to name the various causes which have been put forward to account for climatic variations in geological times. They are: variation in the intensity of the sun's radiation; the passage of the earth through hot and cold zones of space; alteration in the position of the earth's axis; variation in the eccentricity of the earth's orbit; presence of varying quantities of carbonic acid gas in the atmosphere; the extensive alterations in the geographical distribution of land accompanied by variation in land heights. Alternations of land and sea are now one of the best established of geological facts, and probably a solution of the problem lies along these lines. H. L. C.

Lunar Topography

Named Lunar Formations

By Mary A. Blagg and K. Müller. Drawn up by them for Commission 17 and approved at the Meeting of the International Astronomical Union held at Cambridge, Massachusetts, in 1932. Vol. 1: Catalogue. Pp. xii+196. Vol. 2: Map of the Moon. By W. H. Wesley and Mary A. Blagg, based on the Fiducial Measures of S. A. Saunder and J. Franz. Pp. 15. (London: Percy Lund, Humphries and Co., Ltd., 1935.)

WHEN Galileo and his contemporaries examined the moon with the newly invented telescope, they found a surface covered with a variety of formations of which they made rough charts. To these formations there were added later the names of terrestrial objects as well as those of famous men, many of whom had no connexion with selenography or even astronomy. Hevel (1647) was the first to name lunar objects; his example being followed by other selenographers, who adopted the names already given, altered them, or added new ones according to their unfettered discretion. The whole structure of lunar nomenclature has thus been built up in a most haphazard way.

The resulting confusion from this isolated action became so great that a committee was appointed by the International Astronomical Union, and to Miss Blagg and Dr. K. Müller was given the task of collating the names on the maps of Mädler (1834), Neison (1876) and Schmidt (1878), but, for some reason, use was not made of Goodacre's large map (1910).

The two volumes now under review show that this great task has been efficiently accomplished and a work of reference produced which must form the standard for a long time to come. Vol. 1 has a foreword by Sir Frank Dyson, chairman of the committee, which gives the history of the effort and the scope of the committee's task. This volume consists of a catalogue of the *named formations* and deals with no less than 677 objects against Neison and Goodacre's list of about 520. Each page shows, in columnar form, the chosen designation, the position of each object based on Saunder's and Franz's measures, a list of symbols which indicate the character of the object measured and mapped, and so forth. The great difficulties inherent in work of this nature have been successfully overcome.

The second volume is a map of the moon in atlas form, the disc being divided into fourteen areas; but no indication is given of the scale in relation to the moon's diameter. This part of the work is not so satisfactory, arising from the fact that the drawing of the map is the work of two people and their methods of delineation are totally dissimilar. Mr. W. H. Wesley completed the four inner areas in his usual artistic manner, but his death unfortunately prevented him from completing the whole of the maps.

The main purpose of the committee has been efficiently carried out, and the statistical information will be found invaluable to anyone interested in such matters. The student of lunar details, with which selenography is now concerned, will probably not find much help from this source.

W. GOODACRE.

Why the Weather?

By Prof. Charles Franklin Brooks, with the collaboration of Eleanor Stabler Brooks and John Nelson. Revised and enlarged. Pp. xvii+295+32 plates. (London: Chapman and Hall, Ltd., 1935.) 10*s.* 6*d.* net.

THE author of this book, who is professor of meteorology at Harvard University, has the rare gift of being able to write vividly and clearly about weather in its various aspects. The book under review is a second edition of a book which first appeared in 1924, and has now been amplified and rearranged. It aims at giving, in the simplest possible language, a description and explanation of almost all the phenomena of weather as observed in the United States of America, including depressions, anticyclones, tornadoes, thunderstorms, ice-storms, rainbows, haloes and many others. The descriptions are illustrated by a series of about fifty photographs, all very well reproduced. The explanations are in the main satisfactory, partly of course because the author has wisely avoided the topics which would involve him in difficult theory. That he is up-to-date is shown by the inclusion in his description of lightning of Schonland's account of the 'leader stroke' which initiates the discharge.

The arrangement of the book is very different from that usually followed, as is seen from the fact that the first mention of the constitution of the atmosphere comes on p. 195. The book is divided into four sections, one for each season of the year. In each section the weather of the season is described, and, so far as this is possible, explained. The terms employed are those in use in the United States, which occasionally differ from those used in the British Isles. A notable example of this is the use of the word 'sleet' to denote hard pellets of ice, instead of the mixture of snow and rain to which this name is given in England.

Throughout the book the bearing of weather on everyday life is emphasised. The order in which it is arranged is dictated by dramatic value rather than by any systematic theory; but, in view of the very complete index, there is no great disadvantage in this from the point of view of using the book for reference purposes. This is a welcome addition to the list of books on the subject of weather. D. B.

Coloured Plates of the Birds of Ceylon

By G. M. Henry. With a Short Description of each Bird by W. E. Wait. Part 4. Pp. iii+16+16 plates. (Colombo: Colombo Museum; London: Dulau and Co., Ltd., 1935.) 30*s.*

A WORD of praise must be given to this further fascicle of a work which is being published gradually by the Government of Ceylon, although it consists only of sixteen figures and a minimum of text. Mr. Henry's pictures are beautiful, and the subjects are mainly tropical species particularly worthy of illustration in colour: the plates have been well reproduced, in handsome format. The birds have not been selected in any obvious order, and the final extent of the work is said to be still undecided.

Wien–Harms Handbuch der Experimentalphysik

Ergänzungswerk. Herausgegeben von M. Wien und G. Joos. Band 2: Beugungsversuche mit Materiewellen; Einführung in die Quantenmechanik. Von Prof. Dr. E. Fues. Pp. xv+351. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1935.) 30 gold marks.

WHEN the Wien–Harms "Handbuch der Physik" was originally planned, very little was known concerning the diffraction of electrons, and it is obvious that some place had to be found for this subject in the "Ergänzungswerke", which will no doubt continue to be published at suitable intervals in order to keep this important work up-to-date. In like manner, quantum mechanics was in its infancy, and even in a series on experimental physics an introduction to its study had to be provided.

Both subjects have been very satisfactorily covered in the present volume by Dr. Fues. He has taken considerable pains to emphasise the wave mechanics point of view in all the experimental features he describes. He gives a very good survey of the apparatus and technique of electron diffraction, which will be of signal use to those who are unfamiliar with the German literature; one would have expected, however, a little more recognition of English work, in particular, that of Finch. His account of the work on vapours is extremely good, and a very pleasing feature of the book is its wealth of photographic reproductions and other diagrams. The discussion of the index of refraction and allied phenomena is most instructive; so, too, are the discussions of the experiments with slow electrons and on the diffraction of atomic and molecular rays.

The introduction to quantum mechanics covers some two hundred pages, and gives a survey of the present state of the theory which will be found adequate for the requirements of most readers of the "Handbuch". The present volume maintains the high standard of printing and production which its precursors have set. L. F. B.

Initiation à la vie en Argentine

Par Max Daireaux, L. Diffloth, Roberto Gache, Pierre Janet, Gaston Jèze, F. Legueu, G. Lewandowski et J.-H. Ricard. (Choses d'Amérique.) Pp. 192. (Paris: Armand Colin, 1935.) 12 francs.

THIS appreciation of modern Argentina is particularly interesting to English readers in the stress which it lays on Franco-Argentinian cultural relationships. There is full realisation of the virility of the young Argentinians, clever but perhaps too self-reliant in that they are tending to lose contact with their European colleagues in science, applied science, art and literature. On the other hand, in a somewhat superficial review of the position of science in Argentina, the close appreciation of French workers is emphasised. There is a note of jealousy in the references to the elaborate equipment of scientific institutions, and a rather arrogant assertion that all Argentinian literature is self-evidently a child of French parentage which contrasts with the condemnation of the snobbishness of the Argentinian intelligentsia in ignoring native art.

Religion and Science

By Bertrand Russell. (Home University Library of Modern Knowledge, No. 178.) Pp. 256. (London: Thornton Butterworth, Ltd., 1935.) 2*s*. 6*d*. net.

THIS small book displays the author's outstanding skill in the popular exposition of abstruse subjects. The earlier half of it is historical, dealing with the past relations between ecclesiastical Christianity and the natural sciences, and contains a depressing record of bigotry and cruelty; though we are warned that "the threat to intellectual freedom is greater in our day than at any time since 1660"—a threat which no longer comes from the Churches.

The later chapters are concerned with such subjects as determinism, mysticism, and the relations between science and ethics. On the bearing of the new quantum mechanics on the idea of determinism, the author holds that "Eddington's attempt to reconcile human free will with physics, though not at present strictly refutable, does not seem to me sufficiently plausible to demand a change in the theories on the subject which were held before the rise of the quantum mechanics". With regard to mysticism, we read that "when the mystics contrast 'reality' with 'appearance', the word 'reality' has not a logical, but an emotional significance". The same view is taken of ethics. Ethics "contains no statements, whether true or false, but consists of desires of a certain general kind, namely, such as are concerned with the desires of mankind in general". In a word, ethical, mystical, and (it would follow) æsthetic judgments are altogether devoid of objective validity. This is not a result in which we can comfortably acquiesce, and there is no doubt that some theory of values on quite other lines than the traditional ones needs thinking out.

Of interest also is the section on soul and body, which indicates how the conception of substance has disappeared from psychology and physics alike, whether as perception and consciousness, or as matter and motion. But does this shed more light on the nature of reality or upon the nature of scientific method?

This is a very stimulating book. J. C. H.

The Faith and Modern Science

By Reginald J. Dingle. Pp. xvii+195. (London: Burns, Oates and Washbourne, Ltd., 1935.) 5*s*.

THE central problem of this timely book is to determine how far speculation along the lines suggested by contemporary scientific writers is legitimate within the limits of theological orthodoxy. Though primarily addressed to Catholics, the book is certain of interesting a much wider circle of readers. The author, assuming the attitude of a man-in-the-street, develops his points with wit and persuasion. The new physics, the position of miracles and the new psychologies are submitted in turn to a pertinent criticism, with the result that several misconceptions on both sides are cleared away and placed in their correct setting. As Prof. Temple, who contributes a foreword to this work, puts it, there is no antagonism or contradiction between faith and science, but merely between scientific opinion and theological opinion. T. G.

Angewandte Geophysik: für Bergleute und Geologen

Von Prof. Dr. Hermann Reich. Teil 2. Pp. iv+153. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1934.) 10.60 gold marks.

THIS small book is interesting, up to date and well-illustrated. It opens with a chapter giving a very useful account of the physical properties of rocks of various kinds, particularly of their density, elasticity, and magnetic and electric properties, with a brief notice of the methods of determining such properties of natural rocks. The high electrical conductivity of sulphide rocks is specially noted. The second chapter discusses the methods of geophysical investigation, magnetic, electric, gravimetric and seismic; the relative costs of the different methods are indicated. In the third chapter, the results of many such investigations are described, with maps and diagrams. The book concludes with a brief account of the application of geophysical methods for economic purposes, namely, for mineral prospecting, for the discovery of underground water, and for the investigation of the suitability of land on which large buildings are to be erected.

The book contains abundant references to original memoirs and other books.

Collective Index of the Journal of the Institute of Brewing, 1924 to 1934

Compiled by W. H. Bird and Kathleen F. Mapley. Pp. iv+232. (London: Institute of Brewing, 1935.)

SCIENTIFIC workers who have occasion to consult the *Journal of the Institute of Brewing* appreciate fully its great value as a source of information. This applies not only to matters of brewing interest, but also to the fermentation industries as a whole, as well as to their numerous scientific and technical ramifications; to many, therefore, the decennial index may be regarded as a necessity. It contains the usual author and subject indexes, followed by lists of book reviews, general business matters of the Institute, correspondence, journals abstracted and obituaries. The standard of production is similar to that of the *Journal* itself, and consequently requires no further praise from a reviewer; no serious errors have come to light from tests that have so far been made. Commendable features are the prompt rate of publication, the inclusion of a list of errata in the *Journal* and the fact that, unlike previous issues, the volume is already bound. J. G.

Relativity Physics

By Prof. W. H. McCrea. (Methuen's Monographs on Physical Subjects.) Pp. vii+87. (London: Methuen and Co., Ltd., 1935.) 2*s*. 6*d*. net.

THIS monograph collects, in 87 pages, those deductions of the results of relativity theory that find most frequent application in physics. The applications of special relativity to kinematics, mechanics, optics, electromagnetic theory, atomic physics, thermodynamics, statistical mechanics and hydromechanics, are dealt with in successive chapters, the results in each case being generally emphasised by italics. A good index, and a bibliography at the end of each chapter, complete a very handy book of reference.

Philipp-Lenard-Institut at Heidelberg

CEREMONIAL DEDICATION

THE centre of physics teaching and research at the University of Heidelberg, hitherto known simply as the Physikalisches Institut, has recently been solemnly renamed the Philipp-Lenard-Institut. On December 13, at what the local Press justifiably called a unique ceremony, the Minister of Education (*Kultusminister*), Dr. Wacker, deputising for *Reichsminister für Wissenschaft, Erziehung und Volksbildung* Dr. Rust, who was unable to attend owing to illness, formally dedicated the building. His speech may be summarised in a sentence taken from it which, literally translated, reads: "It is, then, very superficial to speak of science 'as such', as a common property of mankind, equally accessible to all peoples and classes and offering them all an equal field of work. The problems of science do not present themselves in the same way to all men. The Negro or the Jew will view the same world in a different way from the German investigator." Prof. J. Stark, the president of the Reichsanstalt, who followed him, was, according to the German report, "particularly zealous against the followers of Einstein and attacked with the greatest frankness the scientific methods of Prof. Planck, who, as is notorious, even to-day stands at the head of a celebrated learned institution!" The ceremony concluded with a *Sieg-Heil* and the Horst-Wessel song.

On the next day, a further ceremony took place, the following account of which is literally translated from the German Press, where it appeared under the heading "A Germ-cell of German Science" (*Eine Keimzelle deutscher Naturwissenschaft*). With one exception, those who took part in this imposing function are, in spite of their high academic positions, comparatively little known in scientific circles in England. The exception is, of course, Prof. Lenard, the student of Hertz, whose papers he edited. A life of Hertz by Prof. Lenard appears in his "Great Men of Science", published before the new régime came into force in Germany and reviewed by Lord Rutherford in NATURE of September 9, 1933 (132, 367).

On December 13 the Minister of Culture and Education, Party-member Dr. Wacker, ceremonially dedicated the Philipp-Lenard Institute of the University of Heidelberg, in the presence of the Reichstatthalter Robert Wagner. On the next day an imposing number of German physicists assembled to make public confession of their union against the Jewish evil (*jüdischer Ungeist*), from which German science must be completely freed. The director of the Institute, Prof. Dr. A. Becker, also welcomed numerous guests, who, with active sympathy, followed the seven speakers, whose discourses occupied the morning and afternoon.

Party-member Prof. Dr. Tirala (Munich) spoke on "Nordic Race and Science", to which race we owe the great series of discoveries, from Hipparchus and Leonardo da Vinci to Kirchhoff and on into the present time. He clearly characterised the essence of German blood in the fight for knowledge of Nature and was able to bring out the features common to all these Nordic investigators.

Party-member Prof. Dr. Krieck (Heidelberg) went into the changes of the conception and system of science in the national-socialist world-philosophy (*Weltanschauung*). Without ambiguity he made clear the new direction towards objectives of scientific co-operation. After him Party-member Prof. Dr. I. Stein sketched out the significance of scientific knowledge in the education of the doctor. He recalled the epidemics which the ancient Greeks regarded with fatalistic helplessness until Hippocrates came to aid with new methods of investigating Nature. After the Middle Ages came the mighty phenomenon of Paracelsus, who sprang of Nordic blood. Experiment came to the aid of experience. Under national socialism the medical man realises his high responsibility for blood and race, health and potency of his people.

Prof. Dr. A. Seybold (Heidelberg) spoke on the co-operation of physical and biological research, which was being aimed at in the new Germany. In a convincing way he exposed the advantage, nay, the necessity, of this co-operation, such as is being furthered in the woodland camps. As pioneers he acclaimed three German investigators: Albrecht von Haller, Goethe and Johannes Müller.

After the luncheon interval Prof. Dr. H. Rukop (Berlin) spoke on problems of physics in science and industry, and laid stress on some characteristic ones, such as cathode rays, phosphorescence and so on. He contrasted the physicist in industry with the research worker in pure science, and emphasised the kind of features demanded of the physicist in industry: speed, constant alertness and so on.

Prof. Dr. Tomaschek (Dresden) had chosen as his subject "The Development of the Conception of the Ether". He went back to the Hindus, who were certainly excellent mathematicians, but were unable to attain to any scientific discoveries. The ancient Greeks came nearer to the nature of the ether, for which they provided the name. For a thousand years the urge to knowledge was lost in the preconceived dogma of the theologians, until Heuss, Euler, Young and other lonely pioneers brought forward a conception of the ether which was long derided. To Faraday above all it fell to lift

the veil which Nature had drawn over her secrets. He conceived with clarity the idea of lines of force.

A series of slides, including portraits of Heuss, Euler, Young, Faraday and others, enlivened his discourse. In an enthralling way he contrasted the Nordic conception of infinity with the strange shrinking of the Semites from such infinity (the Bedouin tent). In the same spirit he explained Einstein's theory of relativity, with which he settled in great style. To the abstract mathematical junk of the Jewish physicists he opposed the living conception of high and holy laws of Nature, such as the Nordic investigator wins for himself in reverence before the logic and greatness of Nature. At the conclusion of his stirring address, Prof. Tomaschek emphasised that overloading and complicating the methods of research with many mathematical formulæ would certainly not lead to Nature. He hoped that German youth, brought once again near to this Nature, would once more find the way to meet her with clear young eyes.

Party-member Dr. A. Bühl (Karlsrühe) subjected the teaching of physics in the German schools and universities to sharp criticism. In addition to the values of humanistic education he demanded more physics even in the secondary schools, and directed attention to many questionable practices of the teachers of physics in the schools. It was much more important to provide clear and well-understood foundations than to give prominence to hypotheses, which did not acquire a meaning until the scientific struggle began.

Geheimrat Lenard delivered the concluding words, and expressed his approval of these addresses. He exhorted all to continue energetically the fight against the Jewish spirit, which had by no means vanished from the German universities. He recounted many examples of Jewish arrogance (Einstein), supported by Jewish publishing houses (Springer), and expressed his confidence that this movement for German co-operation would embrace all our centres of higher learning.

Synthesis of a Natural Colouring Matter

ORGANIC chemists have devoted much time and ingenuity to building up the complex products of life ever since Wöhler and Liebig first broke down the barrier which had separated them from the artificial products of the laboratory, by their synthesis of urea. Sometimes the problems presented are of a peculiarly baffling nature, and we can only marvel at the astonishing progress which has been made both in unravelling and in reassembling the intricate structures of molecular architecture found in Nature. The prolonged and brilliant researches of Emil Fischer upon sugars, proteins and purines have inspired later workers to engage upon still more elusive problems. In Great Britain, Prof. R. Robinson, of Oxford, has already succeeded in laying bare the constitution of numerous alkaloids, colours and other products of plant life. Among these are the anthocyanins or the pigments of flowers. The rapid growth of this branch of chemistry in recent years is apt to become bewildering to the student. We are therefore indebted to Prof. Robinson for the clear exposition which he gave in his Friday evening discourse on November 15 at the Royal Institution, describing the general lines on which one single investigation was carried out, with the view of illustrating the special technique which has had to be evolved.

The pigment chosen was that of the scarlet *Pelargonium*, which occurs also in pink carnations and red dahlias. The problem was approached by three separate methods, namely, isolation as a chemical individual and characterisation of the purified natural pigment, analytical dismemberment of the complex molecule into simpler ones of known constitution, and finally, synthesis therefrom of the identical compound by methods which leave no doubt as to the constitution. The analytical and synthetical methods are complementary and entirely independent of one another. Proof of structure depends equally on both.

Extraction of the pigment from petals by solvents was effected in 1903 by Griffiths and in 1905 by Molisch. In 1911 Grafe, using Molisch's method, extracted 10 gm. of a beautiful crystalline pigment from 28 kgm. of fresh petals. A greatly improved method was devised by Willstätter and Bolton in 1915, who obtained pelargonin chloride, $C_{27}H_{31}O_{15}Cl.4H_2O$, although the natural colour is probably the tartrate. The chloride can be prepared from the natural pigment, and is more suitable for characterisation than the tartrate. Hydrolysis by acids splits the molecule of this chloride into pelargonidin chloride, $C_{15}H_{11}O_5Cl$, and glucose, the reaction being

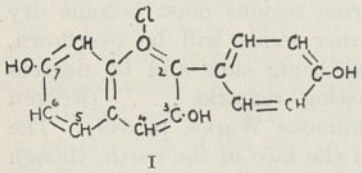
$$C_{27}H_{31}O_{15}Cl + 2H_2O = C_{15}H_{11}O_5Cl + 2C_6H_{12}O_6.$$

Removal of glucose in this way has no marked effect on the colour, so that the chromophore has evidently not been broken down. Thus pelargonin chloride appears to be a diglucoside of pelargonidin chloride. By partial hydrolysis it has also been possible to obtain a monoglucoside, and it was

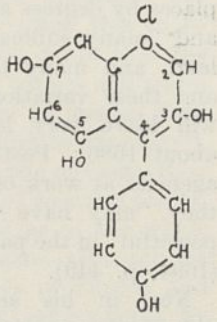
observed that both glucosides were strongly fluorescent substances. It was, however, necessary to determine the mode of linking of the glucose to the pelargonidin. Now glucose occurs most frequently in the form of β-glucosides, in which the hydroxyl groups lie alternately above and below the plane of the pyranose ring. This gave a clue to the probable structure which afterwards proved to be correct; but it was also necessary to ascertain whether the glucose units were linked together or to different points of the main structure. The latter formation was ultimately adopted.

Further degradation of the compound by means of fusion with alkali yielded the well-known substances phloroglucinol and *p*-hydroxybenzoic acid. We may therefore infer that these two aromatic compounds have been condensed together in such a way as to form a pyrylium ring, since salt formation shows that we are dealing with an oxonium compound.

This limits the choice to two structures only, namely :



I



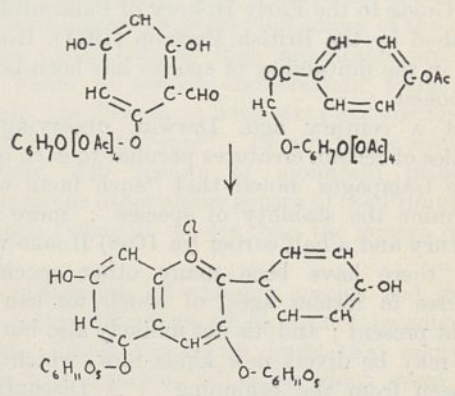
II

The reasons for this limitation are as follows : (i) The results of fusion show that one hydroxyl group must be in the pyrylium ring and (ii) the latter would be unstable if the hydroxyl group were at positions 2 or 4. The final choice depends on synthetic methods.

The location of the two glucose units was then determined by careful study of the properties of numerous synthetic pelargonium derivatives of known constitution. In this way it was discovered that the presence of unsubstituted hydroxyl groups in certain positions exerts a marked influence upon the physical properties of the compounds. Thus the strong fluorescence of the glucosides indicates the protection of the hydroxyl group at position 5 by glucose, whilst the stability of the pigment in the presence of weak acids containing traces of iron is evidence of similar protection at position 3. Hence pelargonin is probably a 3·5 diglucoside. This argument involved a vast amount of experimental work, but it certainly did make possible the prediction of the structure of pelargonin. This was finally confirmed by synthesis.

No further deductions could be drawn from analytical data, and it became necessary to attempt the synthesis of the pigment. Now it is known that pyrylium derivatives result from the condensation of *o*-hydroxybenzaldehydes with compounds containing the group $-CO-CH_2-$ in the presence of hydrogen chloride. But before attempting this condensation, it was necessary to introduce the glucose groups (protected by acetylation) into the two reacting compounds at the positions already diagnosed. This was accomplished by means of tetracetylglucosidylbromide, the required components being acetylated monoglucosides of phloroglucinaldehyde (III) and ω.4 dihydroxyacetophenone (IV).

III IV



The constitution of the former was proved by methylating the two free hydroxyl groups, hydrolysing the resulting dimethoxyglucoside to a dimethylether of phloroglucinaldehyde and proving that the latter would still undergo the pyrylium condensation. This fixed the position of the glucose molecule with certainty. The constitution of the other compound follows from its synthesis from *p*-acetoxybenzoylchloride and diazomethane to *p*-acetoxydiazoacetophenone, which on careful hydrolysis gave the corresponding carbinol. From this the required acetylated glucoside was prepared.

Condensation of these two products in the cold with hydrogen chloride yielded a pyrylium salt (V) which can have only one constitution. When the acetyl groups were finally removed and the resulting compound was carefully purified, it was found to be identical with pelargonin chloride, which is therefore the chloride of pelargonidin-3-5 di β-glucoside. Comparison with the natural pigment was made by a detailed examination of many of its physical properties, no divergences having been found.

Robert Hooke as Geologist and Evolutionist

By W. N. Edwards, Geological Department, British Museum (Natural History)

ALTHOUGH a very large volume would be required to do full justice to every aspect of Robert Hooke's genius, it is somewhat surprising that so little reference has been made in this tercentenary of his birth to his evolutionary views. Indeed, apart from an article by A. P. Pavlow entitled "Robert Hooke, un évolutioniste oublié du XVII^{e} siècle" (*Palaeobiologica*, 1 ; 1928), and brief references, with extracts from his writings, in a "Guide to the Early History of Palæontology" published by the British Museum (1931), Hooke's belief in the mutability of species has been largely overlooked.

Just a century ago, Darwin, observing the varieties of certain creatures peculiar to each island of the Galapagos, noted that "such facts would undermine the stability of species" : more than a century and a half earlier (in 1668) Hooke wrote that "there have been many other species of creatures in former ages, of which we can find none at present ; and 'tis not unlikely also but that there may be divers new kinds now, which have not been from the beginning" ("A Discourse of Earthquakes", Posthumous Works, 1705, p. 291) ; and again, that there have been "divers species wholly destroyed and annihilated, and divers others changed and varied" (*ibid.*, p. 327). The same idea is expressed in similar terms in other passages, and one can only wish that Hooke had pursued it further, instead of wandering off into discussions of Chinese printing, the structure of the Pyramids, and whether the Romans used sheet lead for protecting their ships.

Hooke based his argument on the fossils which he had observed and collected in southern England : many of these were extinct, and others suggested different, even tropical conditions ; the very existence of marine fossils inland implied movements of the crust, and these uplifts of the land and transgressions of the sea would alter the conditions of life and react on the animals and plants. "Alteration of the climate, soil, and nourishment" may "cause a very great change in the shape and other accidents of an animated body" (p. 327), and it is interesting to note that Hooke appeals to the variation of domesticated animals in support of his position.

That Hooke recognised the possibility of identifying strata by their fossils and "raising a chronology out of them" more than a hundred years before William Smith applied the principle is well known ; that he was the first, for example, to describe the structure of ammonites, to discover a fossil foraminifer, and to apply the microscope to the study of fossil wood has also been noted. His account of different types of fossilisation—moulds, casts and petrifactions—is admirable. His speculations on the possibility of shifting poles, and whether England once lay "within the torrid zone" are of interest, but his insistence on the importance of "earthquakes" has sometimes led, perhaps rather unfairly, to his being dismissed as a 'catastrophist' ; his term "earthquake" clearly covered long continued crustal movements. "Many places by degrees are made submarine," he wrote, and "many submarine regions must become dry land, and many other lands will be overflown, and these variations being slow and by degrees will leave very lasting remarks . . ." (written about 1686 ; Posthumous Works, p. 347). The agencies at work on the face of the earth, though they "may have been much greater and more powerful" in the past, were "still of the same kind" (1694, p. 449).

Nor, in his advocacy of earth-movements, did Hooke overlook the weathering, denuding and levelling action of streams and rivers, tides and currents, rain and wind (1668 ; pp. 312–316). "Many changes," he wrote in 1694, "may have happened to the earth, of which we can have no written history or accounts. And to me it seems very absurd to conclude, that from the beginning things have continued in the same state that we now find them, since we find everything to change and vary in our own remembrance" (p. 450). Finally, in the latest "discourse of the causes of earthquakes", dated 1699, he wrote that the earth "is in a state of progression from one degree of perfection to that of another degree, which may be termed of perfection for as much as it is the progress and operation of nature ; and at the same time it may be conceived in a progress to corruption and dissolution in as much as it is continually changed from its preceding state".

Hooke was, in brief, far in advance of any other geologist of the seventeenth century, not excepting the acute Dane, Steno, and it may even be

remarked that the standard of his drawings (for example, of ammonites) is not always equalled at the present day. Some of his work was quoted by eighteenth century geological writers, and doubtless helped to prepare the ground for the great advances at the close of that century. But we do not even know whether William Smith had read the "Discourses of Earthquakes", and there is no sign that Hooke's evolutionary views were appreciated.

Cosmic Rays and the Origin of Species*

By Dr. H. Hamshaw Thomas, M.B.E., F.R.S.

WHEN we turn to consider wild plants in Nature, two lines of inquiry present themselves : (1) the comparison of the number of plant species in warm mountain and lowland regions, and (2) the question of endemic species.

It would be interesting to compare the floras of regions where, owing to altitude and latitude, the cosmic ray fall is great, but the conditions are favourable for plant growth, with regions having similar climatic conditions at low altitudes; but the data now available scarcely allow this to be done. There can be, however, no doubt that the floras of mountain regions in the tropics and warm temperate zones are much richer in species than the lowland areas. Thus according to Standley[20], the known flora of the tiny republic of Costa Rica contains more than 6,000 species of vascular plants, approximately the same number as in the whole of the south-eastern United States, although its area is less than half of the area of Florida and it contains mountain ranges not yet explored by botanists. Its mountains rise to more than 11,000 ft., and more than half its area lies above 3,000 ft. Its flora is especially rich in orchids, nearly 1,000 species having been recorded; they appear to reach their best development at about 6,000 ft. When Hemsley described the flora of Mexico and Central America, he stated that the species of angiosperms in this region outnumbered those in the whole of North America by some 2,200. No doubt the habitats in these tropical mountain regions are very varied, but it may be questioned as to whether the immense richness of species can be explained in this way. Costa Rica is an interesting case because it is a fairly recent mountain area, and was most probably submerged in late Eocene and Oligocene times[21], while the very high percentage of endemics suggests that its flora cannot be regarded as merely due to the spread of species from the north and south.

It would be interesting to know more about the relative numbers of forms at different altitudes in widespread genera. The genus *Primula* might be quoted in support of my ideas, for while the Vernales section is very widespread in Europe and northern Asia, mainly at low altitudes, it contains only about nineteen species; but many of the other sections which live on high mountains are very much richer in species and endemic forms; for example, the Petiolares with sixty-six species, the Nivales with sixty-one[22]. In all, there seems to be about 330 species of mountain primulas. Almost all the other alpine genera of the Primulaceæ are much richer in species than the genera of the plains.

The discussion of endemic species and genera raises many difficulties which cannot be solved at present. There can be no doubt that many endemics are survivors of races which were once widespread, for example, *Matonia*, *Cupressus macrocarpa*[23] and *Neviusia*. On the other hand, it seems fairly certain that plants like the tetraploid subspecies and varieties of *Biscutella lævigata*[24], and several of the European alpine species of *Soldanella* and *Primula* are of comparatively recent origin. Probably as time goes on and endemic species receive more exact attention, we shall be in a position to distinguish new forms from relics. Cockayne in his survey of the flora of New Zealand divides up the numerous endemic plants of the region into groups according to their affinities, and concludes that the endemics closely related to other New Zealand species, and which may be considered of comparatively recent origin, make up 43 per cent of the whole flora and 58 per cent of the total number of its endemics[25]. The alpine flora of New Zealand numbers 945 species as against 998 species in the lowlands; 597 species belong to the high mountains, and of these no less than 94 per cent are endemic[25]. Many of the lowland plants are also endemic, but Cockayne considers that this group consists largely of descendants of an ancient palæotropic stock, often not perfectly attuned to the present-day climate.

* *Continued from p. 53.*

In a recent address, Jepson[26] directed attention to the endemics of California. In this province some 2,000 species (forty per cent of the spermatophytes and pteridophytes) are endemic, representing both indigenous and relict forms, and, as he remarks, this fact calls for explanation. He states that the more important areas of marked endemism are the San Bernardino Mountains, the Sierra Nevada Mountains, the Lassen-Shasta region, the 'Klamath Mountains' in the geological sense, the North Coast Ranges, the Inner Coast Ranges and the Santa Barbara Islands. He considers it certain that the most abundant production of new forms is associated with successive uplift and subsidence of fault blocks, and notes that the operative physical and edaphic factors have affected species very unequally or in some cases not at all. Some Gramineæ and Compositæ have been raised from levels of about 1,000 ft. to 6,000 ft. or higher without apparent morphological change. Such facts seem to me to be more explicable on the view that variations are produced by radiation than on any hypothesis of climatic effect.

According to my suggestions we should expect to find endemics mainly in regions where the climate is sufficiently temperate to allow plant growth now or in Tertiary times at really high altitudes, and it is therefore interesting to note that according to Willis[27] endemics chiefly occur from about 48° N. to 50° S.; he also states that they are found within these limits on all important mountain chains above 4,500 ft. Very many of the islands noted for their endemics possess high mountain peaks, and some large areas like the Cape region of South Africa, which are so rich in distinct forms, are of high average altitude. It is a commonplace that endemic forms are characteristic of isolated areas, but though isolation may explain the persistence of forms it does not explain their origin.

Finally, one may notice that our present knowledge of the history of plant evolution seems to show that the appearance of new genera and species did not take place gradually and regularly, but in a series of steps, the world's flora becoming richer and richer in forms. Many of the important changes in the fossil floras are definitely associated with periods of mountain building or uplift. For example, a great period of uplift took place in western North America during the Upper Cretaceous, when the Laramide folding is thought to have raised mountain blocks to a height of 20,000 ft. Since this was a warm period when a rich vegetation flourished in the arctic part of North America, the Laramide orogeny must have raised many plant species to a very high altitude and at this altitude some may have survived and mutated. Not long afterwards, we find that the number of genera and species found in the fossil floras of the United States (Wilcox group) has greatly increased, eighty-three genera and a large number of species appearing which are unknown from Cretaceous floras[28]. So far as we know, there was no distinct climatic difference and no marked difference in the habitat factors between the Upper Cretaceous and Lower Eocene floras of south-eastern North America. Undoubtedly new geographical conditions and new routes of migration were opened up, but this does not explain how so many new forms originated.

We thus have several different reasons for the hypothesis that the origin of new species may be connected with plant growth at high altitudes, where the intensity of cosmic rays and showers is high, while at the same time we know that some of the aquatic and marsh plants growing at sea-level have varied very little in many millions of years. It is quite possible that the production of new forms on mountains has no connexion with cosmic radiation but may be due to other factors such as temperature fluctuations, but there is as yet no definite evidence that mutations are produced in this way, and also there must be many lowland areas where comparable temperature fluctuations occur. In many of the problems of evolution we can do nothing more than collect evidence and weigh possibilities, but in the present connexion it should be possible to test the ideas now put forward by direct experiment. Let us hope that at some future time it may be possible to carry out culture experiments under suitable conditions at a very high altitude, and to demonstrate whether or not cosmic radiation is significant in the origin of species. In the meantime, my tentative hypothesis may possibly add fresh interest to the work of those who are studying the high mountain floras of the tropics.

[20] Standley, P. C., "Orchid Collecting in Central America", Rept. Smithsonian Institution for 1924, p. 367, Washington (1925).

[21] Pirsson, L. V., and Schuchert, C., "Text-book of Geology", p. 916, New York (1915).

[22] Wright Smith, W., "Some Aspects of the Bearing of Cytology on Taxonomy", *Proc. Linn. Soc.*, 151 (1932–33).

[23] Seward, A. C., "Selections from the Story of Plant Migration revealed by Fossils", *Science Progress*, **30**, 193 (1935).

[24] Manton, I., "The Problem of *Biscutella laevigata*, L.", *Z. induktive Abstammungs- und Vererbungslehre*, **67**, 41 (1934).

[25] Cockayne, L., "The Vegetation of New Zealand". "Die Vegetation der Erde", **14**, 1st ed., Leipzig (1921).

[26] Jepson, W. L., "Centers of Plant Endemism in California in Relation to Geological History", Proc. Sixth Internat. Bot. Congress, Amsterdam, **2**, 82 (1935).

[27] Willis, J. C., "Age and Area", p. 148, Cambridge (1922).

[28] Berry, E. W., "Revision of the Lower Eocene Wilcox Flora of the Southeastern States", *U.S. Geol. Survey Prof. Paper*, 156 (1930).

Obituary

Dr. V. K. Ting

THE death of Dr. V. K. Ting on January 5 in hospital at Changsha, at the age of forty-eight years, removes the second of the three distinguished honorary directors of Cenozoic research in China, which was set up by the late Prof. Davidson Black with funds provided by the Rockefeller Foundation of New York, when the fundamental importance of the fossil bed found at Choukoutien was demonstrated. The Chinese Press has emphasised the fact that the death of this courageous and learned man is a national loss.

Dr. Ting was not only an enlightened pioneer who exerted great influence in promoting the development of science and its applications, but he was also keenly interested in doing what he could to promote peaceful relations between Great Britain and China. In the days when the restoration to China of the control of Hankow was under consideration, he went to Nanking to propose to his Government a scheme which would satisfy both British and Chinese demands, and was distressed when, after apparently reaching a satisfactory solution of the problem, the announcement was made in the House of Commons that Great Britain had given up Hankow. In spite of this action, which looked like a rebuff to him, he still retained his intense friendliness to the nation which had, in the persons of Prof. Davidson Black and Prof. J. W. Gregory, under whose influence he went to Glasgow, revealed its confidence in him. When, after much delay, the British Government decided to apply the Boxer Indemnity Fund to the same sort of purpose, the promotion of science and education, as the United States under the guidance of President Theodore Roosevelt had done, Dr. Ting was one of the Chinese advisors chosen by Sir Austen Chamberlain to help with his counsel.

After preliminary studies in Peiping, where he enjoyed the friendship of Dr. A. Grabau, who is professor of palæontology in the National University, Ting proceeded to Cambridge for study and then went to the University of Glasgow, where he was a devoted follower of Prof. J. W. Gregory, and obtained his B.Sc. He then undertook post-graduate research in the University of Freiburg and obtained his doctorate for it. Returning to China with the prestige of his German doctorate and much experience, he became active in shaping policy in the Ministry of Agriculture and Commerce, especially in promoting the development of mining. With this object, he and his friend, Wong Wen-Hao, recommended the Ministry to invite to China Dr. J. Gunnar Andersson, formerly director of the Swedish Geological Survey. Readers of NATURE are already familiar with the startling events which resulted from his inspired guidance in the fields of both palæontology and archæology. It was obvious that some medium for publication of the rich harvest of results accumulating from the researches of Prof. Davidson Black, Drs. Andersson, Ting and Wong was needed, and in co-operation with his distinguished colleagues, Dr. Ting founded *Palæontologia Sinica* with funds provided by Mr. Ivan Krueger. This journal played an essential part in the development of science in China, and particularly in making *Sinanthropus* known and appreciated.

While the growing Geological Survey under Dr. Wong's able direction was mainly concerned with the creation of palæontological knowledge, Dr. Ting never lost sight of the significance of mining for the industrial welfare of China, and he specially devoted himself to the study of mining, until eventually he met his death from coal-gas poisoning in the course of inspection of a mine in Hunan. How thoroughly he carried on this work is revealed by the fact that one of his friends, Mr. Sotsu King, an enthusiastic scientific amateur, founded a special institute for fuel research in Peiping, and equipped it for every kind of modern research on fuel problems. This is merely one example of how the late Dr. Ting used his knowledge and charm in the promotion of scientific progress.

The chief disaster created by the death of Dr. Ting is due to the removal of an essential link in the body of wise men, such as Dr. Hu Shih, Dr. Wong Wen-Hao and others who exert a vast and important influence by restraining the over-hasty adoption of the intoxicating elements of Western culture by an Oriental people. In the intellectual society of Peiping and the important work it is doing, the loss of Dr. Ting will be severely felt. Special sympathy must be extended to the students of the National University of Peiping who sit at the feet of Prof. Grabau, whose co-operation with Dr. Ting afforded an ideally wise guidance.

Miss Marian Frost

THE death on December 27 of Miss Marian Frost, chief librarian and curator of the Public Library, Art Gallery and Museum at Worthing, at fifty-nine years of age, means that a delightful personality will be greatly missed by a large number of her friends and admirers of both sexes.

On her own initiative in 1902 Miss Frost communicated with Mr. Andrew Carnegie, and obtained his personal promise to assist Worthing in the way of a Public Library, and he granted £5,000 towards this. She was appointed chief librarian in 1896, and has since taken a prominent part in the educational and social life of Worthing. A fluent speaker, with a thorough knowledge of library and museum work, she was in great demand at the various conferences and other functions with which she became so

intimately associated. The Library Association, the Museums Association, and the British Association saw her regularly at their annual meetings, and few dinners or other social events were complete without her presence and addresses.

Miss Frost was the first woman librarian to have a complete staff of women, and her methods and work have been described in a number of technical publications. She organised periodical art exhibitions in the magnificent art gallery under the same roof, and paid special attention to Sussex, the exhibits having a Sussex interest either from the point of view of the picture, or the artist. She became personally acquainted with some of the principal artists and men of science in Great Britain, and was very successful in inducing many of them to lecture at the Museum or to open exhibitions. The number of well-known names appearing on her syllabuses during the past twenty-five years is indeed surprising.

In the museum Miss Frost obtained the help of naturalists, geologists and archæologists, and besides having a fine collection of local neolithic, Bronze Age, and Saxon remains (some of altogether exceptional importance), she was successful in getting together a series of Sussex minerals and fossils; a particularly good collection of birds in their natural surroundings; marine life, and so on.

Miss Frost founded the Worthing Archæological Society, which undertakes archæological research, and prints valuable reports. On behalf of the Carnegie Trustees she recently visited Toronto for the Museums Association, and only last year received one of the first diplomas of the Museums Association.

T. S.

WE regret to announce the following deaths:

Dr. R. G. Canti, a pioneer in the application of cinematography to microscopy, on January 8, aged fifty-two years.

Dr. Howard McClenhan, since 1925 secretary of the Franklin Institute and formerly professor of physics in Princeton University, on December 17, aged sixty-three years.

Prof. Lafayette Benedict Mendel, member of the U.S. National Academy of Sciences and of the Council on Pharmacy and Chemistry of the American Medical Association, and a pioneer in the study of nutrition in the United States, aged sixty-three years.

News and Views

Nationalism and International Science

DR. HANS HOYER, of the Leverkusen–I. G. Werk, referring to the facetious note from a correspondent published in NATURE of January 4, p. 28, says that no one in Germany proposes to adopt new words for 'mikroskop' or 'binokular'; and that in any event the word coined by our correspondent was an impossible German construction. We may point out that in the note in NATURE of December 28, 1935, p. 1021, on the proposed new German scientific words, we recorded that the Editor of the *Chemiker Zeitung* was opposed to the adoption of such an innovation as *Kleinsehwerkzeug* for *Mikroskop*. Another correspondent, writing upon the same subject, says, "I have travelled much in Germany during the past three years, and I consider it my duty to draw your attention to the fact that eighty to ninety per cent of German scientists have no great sympathy with certain doctrines of their Government and with those of ten to twenty per cent of their Nazi colleagues. . . . I hope you understand that only my great interest in your unique journal, NATURE, and in the promotion of international co-operation, has induced me to write this letter. Never write 'Germany' or 'German scientists', but something like 'a small, but unfortunately powerful, group of German scientists'. Hundreds and hundreds of German scientists have during the past few years risked more for their Jewish colleagues, etc., than is known in England".

WE are, of course, glad to know that the great majority of men of science in Germany share the views of scientific workers in other countries as to the right of intellectual freedom and the wrong done by actions which curtail it. We are ourselves solely concerned with the advancement of science, without distinction of country or race. Whatever the feeling of most men of science in Germany upon existing national policy towards 'non-Aryans', the fact remains that the progress of science must suffer by the exile of large numbers of scientific workers, many of them of world-wide reputation. It is far from our wish or intention to say anything derogatory in regard to German scientific work and achievement, but surely the official spirit cannot at present make any claim to be working for the international co-operation which most scientific workers desire to promote. When responsible men of science can express such narrow views as those literally reported on pp. 93–94 of this issue, in connexion with the recent dedication of the Philipp Lenard Institute at Heidelberg, the only possible conclusion is that they no longer believe in the internationalism of science—or, at any rate, think it inexpedient to give public utterance to this principle. They may not be representative of scientific opinion generally in Germany, but when expressions of a more liberal character are made by leading investigators in that country, we shall be glad to make them known to their colleagues elsewhere.

Prof. H. Kimura: Royal Astronomical Society Medallist

THE Gold Medal of the Royal Astronomical Society has been awarded to Prof. H. Kimura, director of the International Latitude Observatory, Mizusawa, Japan, since 1899, for his valuable work on the variation of latitude. When the scheme for international co-operation was decided upon, the observing programme was drawn up by Prof. Kimura. From the very first year's observations he pointed out that the observed change of latitude at the different stations gave large residuals when analysed in the form $x \cos \lambda + y \sin \lambda$ where λ is the longitude, but that these were greatly reduced when a common term known as the Z term was introduced. The existence of this term with an annual period has been verified by later observations, although its origin has not been fully cleared up. When the International Astronomical Union took over the discussion of the international observations from the Central Bureau at Potsdam, Prof. Kimura was naturally placed in charge of it, with the work of reducing and co-ordinating the observations made at the different stations. Under his direction the work has increased considerably, and he was to a large extent instrumental in securing the restarting of the latitude station at Gaithersburg and the starting of a new station at Kitab (in place of the former station at Tschardjui) on the northern parallel, in addition to the commencement of regular observations in the southern hemisphere at La Plata and Adelaide and at a station near the equator in Java.

Unemployment among Professional Workers

A RECENT report of the International Labour Office indicates that, during the last two years, unemployment among professional workers has continued to increase, and that there is scarcely a country or a profession which has not been acutely affected. In Poland, estimates in March 1935 of the director of the Vocational Re-training Institute for Professional Workers showed that about 170,000 out of 570,000 professional workers in that country (including salaried employees) were without employment. In Switzerland at the beginning of 1935, the number of technical workers (engineers, chemists, etc.) registered with the employment offices was 6,000, while the number of non-registered unemployed was estimated to be at least 1,000; the total, 7,000, represents more than 30 per cent of the professional workers in Switzerland. Between 1913 and 1932 the increase in the number of students, which varied from 30 to 3 per cent, greatly exceeded the increase in the population of the world. Thus in Germany and in the United States of America, the number of inhabitants per student fell in that period from 866 to 506 and 237 to 127, respectively. In Holland, the ratio similarly fell from 1,229 to 636. It is considered that in Germany 10,000 university graduates are needed each year to fill vacant posts, but between 1925 and 1933, the average number of persons leaving the universities was 25,000 a year. From these figures, it is easy to see why the estimated number of unemployed university graduates in Germany was so high as 50,000 in 1933.

THE position with regard to the medical profession is similar. Germany requires about 1,800–2,000 new medical men each year, but the universities will supply about 4,000–5,000 medical graduates each year until 1938. Similarly, about 1,000 young dentists will, for some time to come, compete each year for 250 possible appointments, and the number of persons qualifying every year as pharmacists for the next four years will be twice as great as the demand. In the United States in 1932, only about 3,000 posts were available for 5,000 young doctors leaving the medical schools, while Dr. E. Cohen, discussing this subject in the *Chemische Weekblad* (**32**, 574 (1935)), pointed out that while Holland and the Dutch Indies could normally only offer about 40 posts a year for qualified chemists, hundreds were completing university courses in chemistry. The International Labour Office inquiry indicates that in some professions a certain amount of unemployment is due to the evolution of technical methods and change independent of the present industrial depression, and that in certain professions and countries a considerable amount of professional unemployment existed prior to the present depression.

Development of the Indian Paint Industry

IN a recent article entitled "Some Lines of Development of the Indian Paint Industry" (*Current Science*, November 1935), N. Srinivasan deals with the possibilities of developing the paint and certain allied industries in India. There is, of course, already quite a considerable paint-manufacturing industry in India, partly Indian owned and partly in the hands of branch English firms, but it is contended that insufficient use is made of the raw materials available in India, notably barytes (in Madras and Alwar), lead and zinc ore (in Burma), titaniferous ore (in Travancore) and earth colours. The appeal continues for manufacture in India of the whole range of chemical pigments—the artificial oxides of iron, lead chromes, Prussian blues, Brunswick greens, ultramarine and organic lake colours. In due course, some of these operations may be carried out economically and profitably in India, but it should be pointed out that it is a far cry from a barytes mine to a successful lithopone plant; and to suggest, speaking of manufacturing titanium pigment, that only "enterprise is needed for starting a large modern plant with careful scientific control and intelligent commercial direction" indicates failure to appreciate the extent and manner in which this class of manufacturing operation is tied in with, and can only be considered as a part of, the heavy chemical industry.

A REVIEW is then given of the principal types of paints which might be made in India, and concludes that the modern synthetic and nitrocellulose finishes are likely to be too expensive for the Indian market, and that present effort should be directed to the manufacture of simple linseed oil types, provided they are "quick setting". The particular interest of Mr. Srinivasan is a linseed oil emulsion paint, made up with a protein size extracted from indigenous

vegetable sources and probably something like the mucilage extracted from Irish moss. However, paint made in this way might very well suit Indian conditions, and it would be interesting to know more about the actual tests on paints made up with this material and their keeping qualities. Mention is also made of the prospects of growing tung trees in India.

Thames Valley Rainfall

SOME interesting facts and figures relative to the recent rainfall and floods in the Thames Valley were given by Lord Desborough, chairman of the Thames Conservancy Board, at the meeting of the Board on January 13. In the course of his observations, Lord Desborough said that, following the drought which began in July 1933 and continued into August 1935, last year was the wettest year since 1924. The total rainfall, as determined from the twelve stations in the Thames catchment area, was 33·9 inches, that is, 5·66 inches above the standard annual average and greater even than that of the year 1894, which was the year notable for the unprecedented volume of a flood, recorded at Teddington as 20,000 million gallons during a 24-hour day in the month of November. On August 12 last, the flow was only 261,300,000 gallons, the lowest ever recorded on a single day. During the recent heavy rains, the flow at Teddington had reached 9,000 million gallons on January 3, as compared with 2,407 million gallons which was the standard daily average for the month of January. On January 13, the flow had fallen to 6,000 million gallons, which was still 1,500 million gallons above the figure at which the river ran bank high. Lord Desborough thinks the public can look forward with some confidence to a good supply of water next summer from the springs and tributaries, despite the fact that since the drought of 1933 there is still a deficiency of 4·27 inches in the rainfall, a fact which shows the severity of the drought. He alluded to various schemes which have been mooted for dealing with floods in the Thames and other areas, and stated that a scheme brought out in 1914 for dealing with the Thames floods was estimated to cost £3,000,000. The authorities concerned said they would prefer the floods. The cost at the present time would be about double that amount. As regards the construction of reservoirs to contain the surplus flow, the Queen Mary Reservoir of the Metropolitan Water Board, the largest they have, cost £2,000,000 and holds 6,600,000,000 gallons—only about one day's flow under such conditions as have recently prevailed.

Wireless Equipment on the *Queen Mary*

ACCORDING to an article in *World Radio* of January 10, the 75,000 ton Cunard–White Star liner, the *Queen Mary*, will possess wireless equipment in keeping with the high reputation she has already acquired as a modern trans-Atlantic express liner. The transmitting and receiving rooms are on the boat deck and separated by a distance of about 250 feet. The four transmitters are operated remotely from the receiving end, which acts as the control room for the whole of the ship's radio equipment. This room contains eight operating positions, the radio-telephone exchange and the emergency installation; and it is in direct telephone connexion with the bridge and all other important positions in the ship. The various services to be undertaken by the *Queen Mary* while at sea will involve the use of thirty-two wave-lengths, eleven of which are for short-wave telegraphy, nine for radio-telephony, seven for long-wave and five for medium-wave telegraphy. By co-operation with the British Post Office and the International Telephone and Telegraph Corporation of New York, two-way radio-telephone conversation to practically any part of the world will be possible at any time; and two independent conversations may take place simultaneously with the aid of the usual devices for ensuring secrecy. This service will be available from any one of the five hundred state-rooms, each of which is fitted with a bedside telephone, while for passengers in all classes, numerous telephone booths in various parts of the ship will be available. In addition to the apparatus for normal radio communication, a music- and speech-amplifying installation is provided for the simultaneous relaying of three different programmes in the public rooms through thirty-eight loud-speakers. An extensive library of gramophone records of all types will be carried in the ship to supplement the orchestral music and broadcasting programmes normally provided.

Australian National Research Council

DEFINITE proposals for a radical modification of the Australian National Research Council have been drafted for submission to its members and to those of the Australian and New Zealand Association for the Advancement of Science. Though constituted under the ægis of the latter body in 1921, the Research Council has hitherto functioned quite independently of it. It is now proposed that the A.N.Z.A.A.S. should institute a limited fellowship, the original fellows to be past and present presidents, general treasurers and general secretaries of itself and of the A.N.R.C., together with presidents and past presidents of sections and not more than fifty others selected for special qualifications, giving a total of between 120 and 150. Subsequent elections would be made annually by the fellows, with adequate safeguards to ensure the maintenance of a high standard. The fellows of the Association resident in Australia would then be appointed a Committee with the title "Australian National Research Council" and with duties similar to those of the body at present carrying that name. The new Council would take over the assets of the existing one, and the A.N.Z.A.A.S. would place at its disposal for research and other purposes a sum not exceeding one half of the subscriptions of fellows and annual members.

THIS plan, if adopted, will bring about a very desirable intimate contact between the Research Council and the Association, which in itself is a loose federation of practically all the scientific societies and institutions in Australia and New Zealand. The

Association will, it is hoped, be further strengthened by the institution of regular annual membership in addition to the present ordinary (biennial) membership. Another suggestion is that the Research Council shall arrange for the publication of a monthly scientific journal. The ultimate decision on the plan will rest with the A.N.Z.A.A.S. at its Auckland meeting in January 1937.

Physicists at Stuttgart

THE double number of the *Physikalische Zeitschrift* of December 1 devotes 185 of its pages to reports of the papers and discussions at the meeting of German physicists at Stuttgart in September last. More than half the fifty-seven papers read dealt with the electrical conductivity of non-metallic materials, cosmic rays and atomic nuclei. In each of these subjects, the opening papers consisted of reports on the present position of our knowledge, which enabled the audience to appreciate more completely the points made by subsequent speakers. Prof. F. Hund of Leipzig outlined the 'energy band' theory of conduction so far as it concerns the movement of electrons in non-metallic conductors. This leads to a conductivity proportional to $e^{-B/T}$ where B is a constant and T the absolute temperature, which Dr. W. Meyer of Berlin showed is only a first approximation to the actual facts. Prof. P. M. S. Blackett gave a summary of our knowledge of the dependence of the number of cosmic rays incident at a point on the earth's surface, on the latitude and longitude of the point, the time of day, the direction of incidence and the thickness of absorbing layer surrounding the recorder. Prof. C. F. von Weizsacker of Leipzig showed the progress made in determining the forces which hold together the protons and neutrons of the atomic nucleus.

Misuse of Forest and Soil Resources

THE rather wide title "The Use and Misuse of Land" is given to a report by Dr. R. M. Gorrie of the Indian Forest Service, published in the *Oxford Forestry Memoirs* No. 19 (Oxford: Clarendon Press, 1935). As a Leverhulme research fellow, Dr. Gorrie spent four months in the United States, his subject being "The Correlation of Erosion Damage and Grazing in Forest Lands". He states that the present report deals, in addition, with the wider implications of the misuse and abuse of forest land. Dr. Gorrie has considerable experience of the overgrazing and other abuses to which the land of the outer hills of the Punjab has for long been subjected. Few will disagree with his assertion that "Much of the land classified as 'forest' in the arid tropics and the semi-tropics in British dominions and possessions is incapable of producing crops of commercial timber, but is of considerable social value for grazing, flood control, water conservation, or game management, which would justify some form of working plan being prepared and operated with these values in view". Thirty years ago this policy was being ardently advocated by far-sighted forest officers, and large areas of land in the British Empire and outside it would have been saved for useful economic purposes had the administrators of the day understood the real value of the forest in tropical and semi-tropical regions. The United States is not the only country which has misused its forest and soil resources; parts of India, East and West Africa and Australia are presenting similar problems to the administrator. Various bodies in the United States, including the Federal Forest Service, are, and have been for some years, giving attention to the position to which land values have been reduced. Dr. Gorrie's report draws some valuable parallels with Indian conditions.

British Empire Naturalists' Association in Gloucestershire

THE council of the British Empire Naturalists' Association has decided to make the North Cotswolds the subject for its 1936 field-meeting and holiday, which will take place on June 13–27; most of the local arrangements will be made by the North Cotswold Branch of the B.E.N.A., of which Mrs. A. B. Lane is honorary secretary. Though with little out of the ordinary in the way of birds and mammals, the area is especially rich in flora. It contains one of the two British haunts of the adder's tongue spearwort, *Ranunculus ophioglossifolius*, which has been safeguarded by the generosity of the Cotswold Naturalists' Field Club. Other rare plants in the flora include the lizard orchid, which was recorded from Birdlip in east Gloucestershire; the rare green-berried 'virescens' variety of elder by the side of the Chelt near College Road, Cheltenham; the great earth-nut, *Carum bulbocastanum*, in a cornfield near Cheltenham, previously thought only an eastern county plant; one of the rare vetches, *Lathyrus tuberosus*, previously thought to be confined to eastern counties, but now recorded from near Cirencester; and three stations for the rare cotton grass, *Eriophorum latifolium*. The flora of the area also includes grass-of-Parnassus, wintergreen, pasque-flower, lily-of-the-valley, fritillary (including an albino form that persists near Elmore), herb Paris, deadly nightshade, meadow-saffron and the two sundews. Regarding fauna, the hobby and hoopoe are much rarer than formerly, but specimens of these occur on migration most years; hawfinches nest in many woods in large numbers, and it will be interesting to see if any of the crossbills, immigrants from the Continent last year, remain to this year.

'Singling' of Double Track Lines

THE Great Southern Railways of Ireland have singled 220 miles of double track railway, that is, trains can travel in both directions along each track. It has been found that many of these double track lines which have never been worked to full traffic capacity can be operated as single tracks with little or no reduction from the flow of full traffic. This method of working has led to a very special and improved method of signalling which is described in a paper by Mr. H. Birchenhough, read to the London Students' Section of the Institution of Electrical Engineers on November 27. Permission to occupy a section of the line is given to the driver

of the train by means of a token which he carries through the section. In Great Britain, tablets, staffs and keys are used as tokens, but the ball token is often used elsewhere. Every single track section equipped for token operation has installed at each end of the section a token instrument containing a supply of tokens. By means of a wire the two instruments are electrically connected and so interlocked that only one token at a time can be inserted, thus ensuring absolute safety. The tokens used in adjacent sections are of different type, and this provides an additional safeguard. When single line sections have outlying sidings or branch lines into which trains can be moved, it is sometimes necessary, and during operation it may be desirable, to clear the section for traffic ; in this case a subsidiary instrument is placed at the siding into which the section token can be placed after the section has been cleared and the siding points reset for the main line.

Reworking Gold Mines

THE high price of gold has had the effect of causing rapid development of the gold mining industry. In many mines it has been found highly profitable to re-treat old tailings and to mine a much larger proportion of low grade ore. This is illustrated by the Champion Reef Mine situated in Mysore, one of the principal goldfields of India. The finding of ancient workings led to the discovery of the field in 1882. The ancients with crude appliances got to a depth of about 200 ft. When they raised the ore they heated it and threw cold water on it, rendering it friable so that the gold could be extracted by hitting it with a piece of hard rock. The water that accumulates at the bottom of the mine must have been baled out by large gangs of workmen carrying it in vessels. An account of an electric winder for this mine is given in the *G.E.C.* (*General Electric Co.*) *Journal* of November. It is capable of hoisting a load of 5,300 lb. of ore from a vertical depth of 3,633 ft. with a rope speed of 1,910 ft. a minute. The winding motor is rated at 1,150 horse-power. Very complete safety arrangements are made to safeguard the working of the winder. Compared with the steam engine it replaced, a substantial saving has been effected in hoisting costs. The saving is at the rate of £8,000 a year and this compares very favourably with the total all-in costs of the new electric winder, which was less than £28,000.

Medical Uses of Radium

IN a report issued by the Medical Research Council (Special Rep. Series, No. 204. London : H.M. Stationery Office. 1s. net), an account is given of the research work done during 1934 with radium and radium emanation distributed to selected centres in Great Britain and Ireland, and it continues the accounts given in the twelve previous similar reports. In the earlier pages, the experimental work carried out at the Imperial College of Science and elsewhere is summarised. Then follow the clinical reports upon the treatment of various forms of cancer and also of some non-malignant conditions. In addition, statistical data are given relating to the after-histories of patients treated in previous years for cancer of the breast, uterus, rectum, mouth and adjacent structures. These data are somewhat depressing, for they show a large mortality ; for example, of 169 cases of cancer of the rectum treated in the six years, 1925–30, only 21 are now living. It must be remembered, however, that most of the cases were at an advanced stage, and the data are also incomplete in that they do not indicate the number of patients who may have died as a result of disease other than an extension or recurrence of the cancer.

Vital Statistics for the Year 1934

WE have received the Registrar-General's Statistical Review of England and Wales for the Year 1934 (Tables. Part 1. Medical. London : H.M. Stationery Office. 6*s*. net). The estimated population for the mid-year was 40,467,000, females exceeding males by nearly a million and a half. Data are given for the last ten years, and in the case of diabetes and pernicious anæmia, the medical treatment of which has made great progress in the last few years, the death-rates per million living were respectively 110 and 65 in 1924, and 160 and 59 in 1934. The death-rate from pernicious anæmia has, therefore, declined, but not that from diabetes, which now appears to be more particularly fatal among elderly females. The death-rate from cancer and tumours was per million 1,363 in 1924 and 1,635 in 1934, the increase being more marked in the male sex. Motor-vehicles accounted for 7,156 deaths, of which nearly one third occurred at the age 20–30 years.

National Institute of Industrial Psychology

IN the fifteenth Annual Report of the National Institute of Industrial Psychology, the problem of vocational guidance is given prior place, and evidence is produced of the increasing recognition by bodies concerned with the placing of young people of the desirability of using scientific knowledge when advising them, instead of leaving the choice to chance or the vagaries of people ignorant of the problem. Recent developments indicate a growing interest in this aspect of the Institute's work. In addition, investigations have been continued for a number of firms into problems concerned with factory and office organisation, selection of staff, marketing and the standardisation of tests. Lectures have been given in different towns in order to interest and inform industrialists about the importance of the workers of the machines as well as of the machines. The Report concludes with an account of the Institute's financial position.

Register of Tuberculosis-free Herds

THE first "Register of Attested Herds" under the Tuberculosis (Attested Herds) Schemes for England and Wales and for Scotland has been issued jointly by the Ministry of Agriculture and Fisheries, London, and Department of Agriculture for Scotland, Edinburgh. The issue of a certificate of attestation is

evidence that the owner of the herd has taken steps to eradicate tuberculosis from the herd and that, as a result of a tuberculin test made by a veterinary inspector of the Department concerned, the herd has been found to be free from tuberculosis. The present register comprises thirty-one herds in England and Wales, and twenty-seven herds in Scotland, attested up to August 31, and includes names and addresses, general description of breeds, and numbers in the herd. Further issues will be made from time to time, and copies may be obtained from the offices of the two departments at London and Edinburgh.

Medical Services in the British Colonies

THE fifth annual issue of the "Medical and Sanitary Reports from British Colonies, Protectorates and Dependencies for 1933" (*Trop. Diseases Bull.*, 32, Sup. Nov. 1935. H. Harold Scott. 7*s.* 6*d.* net) gives an account of the activities of fifty-five medical services within the British Colonial Empire. Medical departments are making their contribution towards the general economic advancement of native communities by providing medical facilities for preventing and curing disease, and by developing health services and training for natives. The table of vital statistics appended is most useful, but shows the lack of reliable data for many parts of the Colonial Empire.

Bibliography of Seismology

WE have received the last two numbers (for April–September 1935) of the *Bibliography of Seismology* compiled by Mr. E. A. Hodgson and issued by the Dominion Observatory of Ottawa (*Publications*, 12 (1935)). The number of memoirs included (234) is about the same as usual ; but there is a tendency to omit abstracts except of those works that are not very accessible. One useful change is that lists are given of the notes on earthquakes and allied subjects that have appeared in NATURE and in the Science News Letter (U.S.A.) and also of the articles in the *Bulletin* of the Seismological Society of America.

Announcements

M. RAMON, assistant director of the Pasteur Institute, Paris, has been elected member of the French Veterinary Academy in the Section of Zootechnics and Animal Industry.

THE German Society of the History of Medicine, Science and Technology has elected Dr. Arthur Meiner, J. A. Barth, C. Kabitzsch, H. Meusser and L. Voss to honorary membership in recognition of their services to the history of science.

THE British Chemical Plant Exhibition, organised by the British Chemical Plant Manufacturers' Association, will be held in the Central Hall, Westminster, London, S.W.1, on June 22–27. The Exhibition is being arranged in connexion with the International Chemical Engineering Congress of the World Power Conference. A research exhibition is also being organised by the Department of Scientific and Industrial Research. Further information can be obtained from the Secretary, British Chemical Plant Manufacturers' Association, 166 Piccadilly, London, W.1.

THE following appointments have recently been made by the Secretary of State for the Colonies : W. Pulfrey to be assistant geologist, Kenya ; H. Service to be geologist, Gold Coast ; J. A. Craig (principal agricultural officer, Kelantan) to be agricultural education and research officer, Department of Agriculture, Palestine ; W. M. Robertson (senior assistant conservator of forests, Nigeria) to be conservator of forests, Sierra Leone ; G. N. Sale (conservator of forests, Mauritius) to be conservator of forests, Palestine ; N. W. Eades (superintendent of education) to be assistant field geologist, Tanganyika ; A. F. Nichols (agricultural assistant, St. Lucia) to be assistant director of agriculture, Seychelles ; L. H. Saunders (stockman, Veterinary Department, Nigeria) to be agricultural superintendent, Gambia.

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

A principal of the Rochdale Municipal Technical School—The Education Secretary, Technical School, Rochdale (Jan. 21).

A mechanical engineer to the Safety in Mines Research Board—The Under-Secretary for Mines, Establishment Branch, Mines Department, Dean Stanley Street, Millbank, S.W.1 (Jan. 25).

Two lecturers in mechanical engineering in the Portsmouth Municipal College—The Registrar (Jan. 25).

A district lecturer in agriculture and an assistant lecturer in agricultural economics in the University of Leeds—The Registrar (Jan. 28).

An engineering assistant (III) at the Building Research Station, Garston—The Establishment Officer, Department of Scientific and Industrial Research, 16 Old Queen Street, Westminster, S.W.1 (Jan. 29).

A horticultural instructor for West Norfolk—The Horticultural Superintendent, 30 Cattle Market Street, Norwich (Jan. 31).

A teacher of electrical engineering and mathematics in the Watford Technical and Art Institute—The Principal (Jan. 31).

A junior assistant in the Library of the Science Museum, South Kensington, S.W.7—The Director (Feb. 1).

A director of antiquities in the Colonial Service, Cyprus—The Director of Recruitment (Colonial Service), 2 Richmond Terrace, Whitehall, London, S.W.1 (Feb. 15).

A professor of pathology in the University of Sydney—The Secretary of the Universities Bureau of the British Empire, 88A Gower Street, W.C.1 (April 15).

Examiners for the Aeronautical Inspection Directorate—The Secretary, S.2.D., Air Ministry, Adastral House, Kingsway, W.C.2.

Letters to the Editor

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

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 112.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Absorption of γ-Rays Excited in Cadmium by Slow Neutrons

FLEISCHMANN[1] and Rassetti[2] have investigated the absorption of γ-rays excited in various elements by slow neutrons, and found quantum energies ranging from 2×10^6 to 5×10^6 e.v. When, however, γ-rays originate in a process of neutron fixation leading to the formation of a stable element, as, for example, in the case of cadmium, one would expect from mass-spectroscopic data essentially higher energies of the order of 10×10^6 e.v.

We have made some experiments on γ-rays excited by neutrons in cadmium. The counter, of aluminium 0·2 mm. in thickness, was placed along the axis of a large cylindrical block of paraffin wax of 25 cm. diameter and 10 cm. height with a cylindrical hole of 14 cm. diameter, at 38 cm. distance from a beryllium-radon source enclosed in sufficient amount of lead to reduce the number of counts to a suitable value. The cadmium was investigated in the form of cylindrical sheets of varying thicknesses and 83 mm. diameter. In order to establish the effect due to slow neutrons, counts were made alternatively (*a*) when cadmium was separated from paraffin wax by a layer of borax about 3 gm./cm.^{2} and (*b*) a layer of lime of equivalent mass.

Using a source of about 30 millicuries, the effect due to γ-rays of cadmium amounted to some twenty impulses per minute. To our great surprise we found that this effect was practically independent of the thickness of cadmium in the range 0·1–1 mm. and even decreased when thicker sheets were used. Although the slow neutrons are nearly completely absorbed in the first 0·1 mm. of cadmium, one would expect a large increase of the observed effect due to the progressive building up of an equilibrium between photons and Compton electrons (and possibly pair formation). We concluded that cadmium radiation contains an unusually large fraction of a very soft component.

We investigated this point more closely by placing thin sheets of lead, iron or aluminium between the cadmium and the counter. In experiments of this kind, due attention must be given to the fact that the secondary electronic (or pair) emission is dependent on the nature of the absorber, being larger in elements of higher atomic number. All experiments were made using neutrons filtered alternatively (*a*) through borax and (*b*) through lime. With a given cadmium radiator and a given absorber, the difference between (*a*) and (*b*) represents the effect due to γ-rays excited in cadmium by slow neutrons. The results are collected in the following table.

Effect due to unscreened γ-radiation of cadmium = 100

Absorber	Iron				Lead	Aluminium
Thickness in gm./cm.^{2}	0·5	1·5	2·5	3·5	1·15	0·55
Transmitted radiation	82·6	85·4	65	64·6	73	61·3

It can be seen that the effect falls rapidly in the first few millimetres of the absorbing substance to nearly half its initial value. It remains afterwards approximately constant. This remaining effect represents the hard component of the cadmium radiation. We found that its half-value thickness in lead is very near 15 mm., which would correspond to an absorption coefficient of some 0·5 cm.$^{-1}$. In order to deduce from absorption measurements the value of the quantum energy of γ-rays, one would have to measure the absorption also in a light element; but that could not easily be done in our arrangement.

One might interpret the soft component as a β-radiation accompanying the formation of a radioactive element in cadmium. Special experiments have shown that this element, if it exists, would have a half-time period of less than one second. No β-radioactivity of such short period being known, we think that the soft radiation is a secondary corpuscular emission of *high energy* accompanying the production of γ-rays.

Owing to the high quantum energy of the γ-rays, this corpuscular radiation cannot be due to an inner conversion of a photo-electric type. One must imagine that when absorbing material is successively added, the initial corpuscular emission is first absorbed and then the progressive building up of the saturated Compton emission (and pair formation) occurs. The results show that both emissions are of the same order of magnitude, which would mean in the hypothesis of inner photo-electric conversion that we have about one β-ray for 100 photons. This is much larger than can be expected[3] for γ-rays of energy certainly higher than 2×10^6 e.v. We think therefore that the initial effect is due to an inner mechanism of pair formation. According to the theory given by Jaeger and Hulme[4], the number of pairs is less than 0·0015 for one photon of 3×10^6 e.v. energy. The energy of cadmium γ-rays must therefore

be essentially higher, perhaps of the order of 10×10^6 e.v.

Similar results have been obtained in the case of mercury irradiated by slow neutrons.

H. HERSZFINKIEL.
L. WERTENSTEIN.

Mirosław Kernbaum
Radiological Laboratory,
Warsaw Society of Sciences.
Dec. 9.

[1] *Z. Phys.*, **97**, 242 (1935) and **47**, 265 (1935).
[2] *Z. Phys.*, **97**, 64 (1935).
[3] cf. Hulme, *Proc. Roy. Soc.*, A, **138**, 643 (1932) and Taylor and Mott, *Proc. Roy. Soc.*, A, **138**, 665 (1932).
[4] Jaeger and Hulme, *Proc. Roy. Soc.*, A, **148**, 708 (1935).

Selective Scattering of Slow Neutrons

SEVERAL investigators have made measurements on the scattering of slow neutrons by paraffin wax, in general, however, confining themselves to one particular method of detection of the slow neutrons, namely, the β-ray activity induced in a rhodium detector[1]. Further knowledge can be gained by the use of detectors of different elements.

A radon-beryllium source of fast neutrons was placed inside, and 8 cm. below the top surface of, a large block of paraffin wax. Thin specimens of copper (0·3 gm./cm.²), silver (0·08 gm./cm.²) and iodine (0·15 gm./cm.²) were placed in turn on this top surface and could be backed with a further thin layer of wax. The arrangement resembles one already used in the experiments of Amaldi and others[1]. The β-ray activity induced in any specimen was compared for various thicknesses of the backing layer. To ensure that the measurements dealt only with those neutrons which had suffered one or more collisions in the large block, a small correction was applied in respect of the activity induced in the absence of the block of wax, the source, specimen and backing layer remaining fixed. Fig. 1 shows the results obtained.

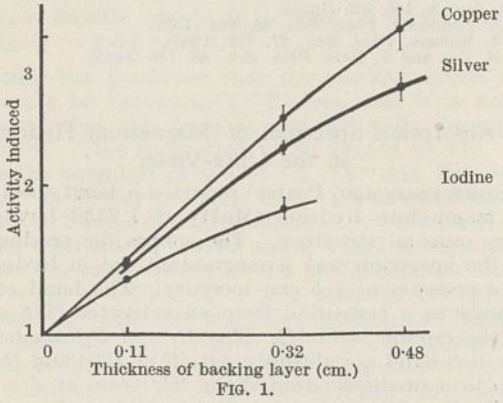


FIG. 1.

The increase in activity is due to the scattering back of slow neutrons from the backing layer and is seen to vary from element to element. Let us consider the two extreme cases, copper and iodine. Two explanations, not mutually exclusive, are possible. The neutrons absorbed by iodine either are not scattered back by the wax in such large numbers as those absorbed by copper, or are scattered back with less favourable velocities. The second explanation can apply only if the neutrons in question have velocities greater than those of thermal agitation, for no change in the velocity distribution can occur when thermal neutrons are scattered by matter at the same temperature. The first explanation, which I think the more important, implies a difference between the mean free paths in wax of the two sets of neutrons and hence a corresponding difference between their energies. How great this difference must be will depend upon how rapid is the variation of scattering cross-section with velocity. A theory of the interaction of slow neutrons (those with energies of less than 10,000 e.v.) with matter, developed by Amaldi and others[1] and by Bethe[2], has shown that whereas the cross-section of any nucleus for absorption is a function both of the nucleus and of the velocity of the neutron, the cross-section for scattering is independent of the velocity, being a function of the nucleus only. Were we to assume the correctness both of this interpretation of the present results and of the theory of scattering, we could say that a fair proportion of the neutrons absorbed by iodine in this experiment must have energies greater than 10,000 e.v.

Whether this theory be correct or not (and there are grave reasons to doubt its validity with respect to absorption[3]), either explanation of the present experiment shows that many of the neutrons absorbed by iodine have velocities different from those effective for copper. Since these latter are known to be very largely of thermal velocities, it seems that the neutrons absorbed by iodine and responsible for its strong selective absorption[4] are of velocities greater than thermal. This fits in well with the relatively small effect of the temperature of the neutrons upon their absorption into the iodine nucleus.

The supply of radon, given by the Radium Committee of the Medical Research Council, was kindly arranged by Prof. S. Russ.

J. R. TILLMAN.

Imperial College of Science
and Technology,
London, S.W.7.
Dec. 20.

[1] Amaldi and others, *Proc. Roy. Soc.*, A, **149**, 531 (1935).
[2] Bethe, *Phys. Rev.*, **47**, 747 (1935).
[3] Dunning and others, *Phys. Rev.*, **48**, 275 (1935). Szilard, NATURE, **136**, 950 (1935). Moon and Tillman, *Proc. Roy. Soc.*, A, **153**, 476 (1936).
[4] Tillman and Moon, NATURE, **136**, 66 (1935).

Yellow Rock Salt from Hall in Tirol

SINCE the fundamental researches of H. Siedentopf on the constitution of blue rock salt, the work done in this Institute and in the laboratories in Göttingen (R. W. Pohl), Halle (A. Smekal) and Berlin (O. Hahn) has gone far to prove that the natural blue rock salt owes its colour to some radiation, most likely of radioactive origin. An argument sometimes brought forward against this view was based on the fact that the primary colouring of rock salt by radiation is yellow, a colour not found in natural rock salt, such yellow salt as exists being coloured not by radiation, but by the presence of iron or hydrocarbons.

The purpose of this note is to direct attention to a discovery by O. Schauberger[1], an engineer of the Austrian Salt Mines, who has found a natural yellow rock salt in Hall in Tirol, with all the characteristics of the primary radiation colouring. Through the courtesy of the authorities in charge of the Austrian Salt Mines, we have been able to investigate

the properties of this interesting salt. As O. Schauberger had already stated, the yellow colour fades very quickly in daylight and also on heating. The absorption spectrum is the same as for rock salt coloured artificially by radium rays. Like the latter, the salt from Hall shows thermoluminescence. On exposure to radium rays, it colours especially quickly, and the artificial colour, too, is very sensitive to light. After plastic deformation, it shows very little tendency to recrystallise; this, too, would favour the natural colouring[2].

With the discovery of the yellow salt of Hall in Tirol the 'missing link' in the formation of the blue rock salt seems to be found; indeed, in the salt mine of Hall, blue rock salt occurs occasionally with the yellow[3].

K. PRZIBRAM.

Institut für Radiumforschung,
Wien.
Dec. 21.

[1] O. Schauberger, *Berg- und Hüttenmännisches Jahrbuch*, **80**, No. 3/4 (1935), in the press.
[2] K. Przibram, *Wien. Anz.*, Nov. 3 (1932).
[3] For further particulars see K. Przibram and O. Schauberger, *Wien. Anz.*, Dec. 12 (1935).

Nuclear Mechanical and Magnetic Moments of K^{39}

THE separation of the hyperfine structure doublets of the resonance lines of potassium was measured by us[1] by observation of the absorption of an atomic beam, and from these measurements the separation, $\Delta\nu$, of the two hyperfine structure levels of the term $4S_{\frac{1}{2}}$ of K^{39} was found to be 0·0152 cm.$^{-1}$. If the value of the nuclear spin were known, the magnetic moment could be calculated from the above value of $\Delta\nu$ by means of Goudsmid's[2] formula. In order to find the spin, it is necessary to determine accurately the intensity ratio of the hyperfine structure doublets; this, however, could not be done, it being possible only to state that the component of shorter wave-length appeared to be stronger.

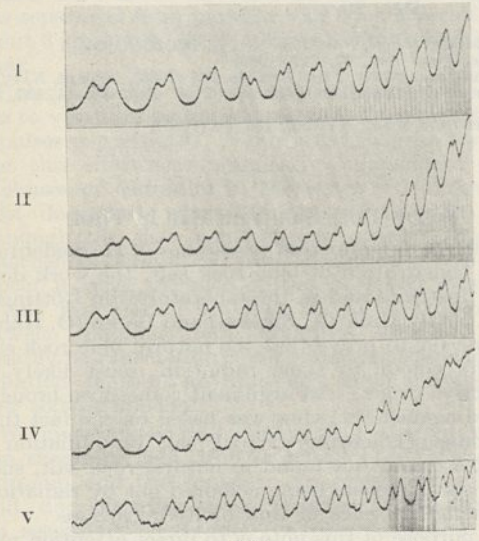


FIG. 1.

Later, Millman[3] determined the nuclear spin of K^{39} by the deflection of a beam of neutral atoms in a weak non-homogeneous magnetic field; he found the value 3/2 for the spin, and 0·0152 cm.$^{-1}$ for $\Delta\nu$, in very good agreement with our spectroscopic determination; the value 3/2 was rendered more certain by this agreement, any other value of I requiring a different value for $\Delta\nu$. Another determination of $\Delta\nu$ using the method of the deflection of an atomic beam in a magnetic field was made by Fox and Rabi[4], giving the value 0·0154 cm.$^{-1}$.

From these determinations, it is possible to calculate the magnitude but not the sign of the nuclear magnetic moment; but our observation on the intensities indicates a negative sign. It was thought desirable to ascertain these intensities more definitely, and accordingly photometer curves were made of the plates with the Zeiss photometer in the Chemical Laboratory, University College, London, by kind permission of Prof. F. G. Donnan. These are shown in Fig. 1.

Curves I, II and III show the absorption in the line $4S_{1/2}$–$4^2P_{3/2}$, I and II corresponding to a temperature of 290° of the potassium and III to 260°. In all these curves, it is quite clear that the component of shorter wave-length (on the right) is the stronger. Curves IV and V represent the absorption of the line $4S_{1/2}$–$4^2P_{1/2}$ and were made simultaneously with curves I and II. The difference in intensity is not nearly so marked, but again the shorter wave-length component is the stronger. The apparently smaller difference in intensities is probably due to the total absorption being weaker; for it can be seen that in the line $4S_{1/2}$–$4^2P_{3/2}$ the apparent difference in intensities is much smaller in III, where the density of potassium, and consequently the total absorption, is less than in I and II.

It is thus definitely established that the magnetic moment of the nucleus of K^{39} is negative, the hyperfine structure levels of the term $4S_{1/2}$ being inverted. Using Goudsmid's formula and taking $\Delta\nu$ as being 0·0152 cm.$^{-1}$, the value is − 0·39 nuclear magnetons.

D. A. JACKSON.
H. KUHN.

Clarendon Laboratory,
Oxford.
Dec. 8.

[1] D. A. Jackson and H. Kuhn, NATURE, **134**, 25 (1934); and *Proc. Roy. Soc.*, A, **148**, 335 (1935).
[2] S. Goudsmid, *Phys. Rev.*, **43**, 636 (1933).
[3] S. Millman, *Phys. Rev.*, **47**, 739 (1935).
[4] M. Fox and F. Rabi, *Phys. Rev.*, **48**, 746 (1935).

Absorption Spectrum of Magnesium Hydride in the Ultra-Violet

SOME years ago, Pearse[1] reported a band spectrum in magnesium hydride (MgH) at λ 2430 having a very unusual structure. The source for production of the spectrum was a magnesium arc in hydrogen at a pressure of 1–5 cm. mercury. The band corresponds to a transition from an activated $^2\Pi^*$ state to the ground level $^2\Sigma$. The R- and P-branches in the 0–0 band are abruptly cut off at $R(9)$ and $P(11)$, due to a predissociation of the $^2\Pi^*$ state at $J = 10$, while the Q-branch proceeds to higher J-numbers in a normal way.

In the following investigation, the spectrum of MgH was studied in absorption. Magnesium metal was heated to 1,400° C. in a vacuum furnace, which was filled with hydrogen to a pressure of about 60 cm. When the continuous light from a hydrogen discharge tube passed through the vapour, two absorption bands appeared in the ultra-violet part of the spectrum. One of these bands was Pearse's band at λ 2430, the other corresponds to a transition

from the ground-level $^2\Sigma$ to a hitherto unknown activated state in MgH.

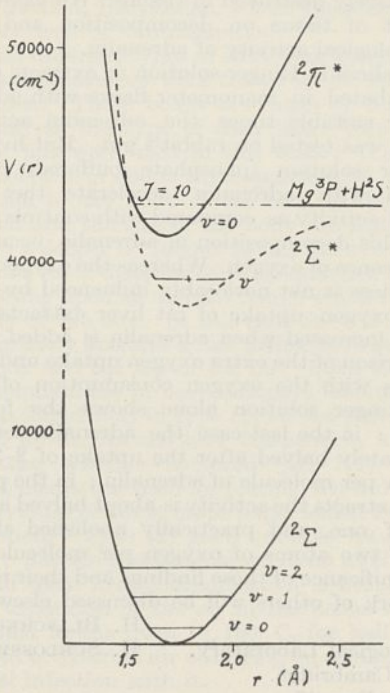


FIG. 1.

The new band consists of only R- and P-branches. Contrary to Pearse's band, this band is degraded to the red, and the R-branch forms a head at λ 2590. The last P-lines are broadened and show frequency disturbances. By means of the combination differences $R(J-1) - P(J+1)$, it can be shown that the band must be related to the ground-level $^2\Sigma$ as mentioned above. The upper state is a $^2\Sigma^*$ state, with the following constants:

$\nu_0 = 38{,}495$ cm.$^{-1}$, $B_v = 5{\cdot}44$, $r_v = 1{\cdot}79$ and $D_v = -2{\cdot}58 \times 10^{-5}$.

Kronig has predicted that the predissociation of $^2\Pi^*$ must be caused by a $^2\Sigma$-term, and it is now suggested that this term is identical with the new $^2\Sigma^*$-level. This suggestion is illustrated in Fig. 1, where the potential curves of $^2\Sigma$, $^2\Sigma^*$ and $^2\Pi^*$ are drawn. It is very probable that $^2\Sigma^*$, in conformity to the D, $^2\Sigma$-term of CaH, dissociates into a normal H and an activated ^3P metal atom, which is supposed to have the same energy as the predissociation limit at $J = 10$, $v = 0$ of $^2\Pi^*$. The essential transition between $^2\Sigma^*$ and $2\Pi^*$ will then, in this case (MgH), take place at the interior part of the potential curves, where they are in contact with each other.

In addition to the R- and P-lines, which are present in the emission spectrum of Pearse's band, some new lines are recorded in absorption, which are related to higher rotational terms in $^2\Pi^*$. These lines are also somewhat diffuse.

A complete description of these phenomena will be published shortly.

B. GRUNDSTRÖM.

Laboratory of Physics,
University, Stockholm.
Nov. 28.

[1] *Proc. Roy. Soc.*, *A*, **122**, 422; 1928.

A Method of Determining the State of Degeneration of a Gas

VARIOUS investigators have tried[1] to find an experimental method by which to determine if gases like hydrogen and helium are degenerated or not at very low temperatures[2]. All attempts of this kind have hitherto been unsuccessful. The principal difficulty results from the fact that the technique of the experimental methods used (measurements of the specific heats or the velocity of sound) do not permit of measurements at very low pressures where the van der Waals' forces have no influence.

We believe we have found an experimental method which will give without ambiguity a solution of the problem of degeneracy of these gases. This method is partially based on the following idea, which was put forward so long ago as 1881 by Stokes[3]. In the classical kinetic theory of gases, the following formula has been established for the coefficient of viscosity η: $\eta = \frac{1}{3}\rho\bar{c}.l_0$, where ρ is the density, $\bar{c}$ the mean velocity and l_0 the mean free path. As l_0 is proportional to ρ^{-1}, it follows that in the classical theory η is independent of pressure. But when the dimensions of the apparatus are such that the mean free path of the gas molecules does not exceed a certain value, η must become a linear function of the density. It should also be noted that from the direction of this straight line, $\bar{c}$ can be calculated without difficulty.

I made such experiments with one of my students, Mrs. A. Claes. These measurements will be published shortly in more detail. The viscosity of oxygen gas is measured at 293°, 90° and 72° K. From these experiments, the ratio of the direction coefficients of the three straight lines are calculated and it is found that the ratios correspond respectively within a few per cent with $(293/90)^{1/2}$ and $(90/72)^{1/2}$. This is in agreement with the classical value of $\bar{c} = 2(2kT/\pi m)^{1/2}$.

In order to detect if degeneracy occurs at very low temperatures, preparations are being made for similar measurements with helium gas at liquid hydrogen and at liquid helium temperatures; and an attempt will also be made to make the experiments more accurate. The ratio found between the mean velocities will enable us to conclude whether degeneracy exists or not.

A. VAN ITTERBEEK.

Physical Laboratory,
Louvain.
Dec. 16.

[1] W. Meissner, *Phys. Z.*, **29**, 897 (1928). W. H. Keesom and A. Van Itterbeek, *Proc. Amst.*, **34**, 996 (1931), Comm. Leiden No. 276*d*. M. Sôto, *Tôhoku Univ. Sci. and Tech. Reports*, **24**, 26 (1935).
[2] A. Einstein, *Berl. Ber.*, 261 (1924); 3 and 18 (1925). E. Fermi, *Atti Lincei* (6), **3**, 145 (1926). *Z. Phys.*, **36**, 902 (1926).
[3] G. G. Stokes, *Phil. Trans.*, **2**, 435 (1881).

Interrelationship of Vitamins

THE successful study of vitamins depends to a large extent upon the production of uncomplicated symptoms in experimental animals which can be cured by purified preparations of the vitamin in question. However, the cure of certain symptoms even with crystalline preparations does not necessarily mean that the deficiency was due to a lack of the factor fed. We have recently encountered such conditions in our laboratory and wish to describe one such relationship briefly.

Typical symptoms due to vitamin B_4 deficiency in rats have been described by Reader[1], but many workers have experienced considerable difficulty in

producing these symptoms. This is undoubtedly due to the fact that a highly purified synthetic diet is used which may be low in constituents of the vitamin B complex not yet recognised. Deficiencies other than vitamins B_1, B_2, and B_4 in purified chick rations are readily evident. When using diets known to be low in vitamin B_1 for rats, characteristic vitamin B_4 deficiencies occurred. The results were most striking in the case of our ration 240 A[2], which is an autoclaved natural grain ration. If rats are placed on this ration on weaning they do not show polyneuritis within two weeks, which is so characteristic of chicks reared on the same diet, but they fail to grow after two weeks and remain very constant in weight for a number of weeks. When they have been on the ration four to six weeks, typical B_4 avitaminosis occurs. The back is hunched, their jowls protrude, they walk high on their rear legs and show a wobbly gait. In some rats typical polyneuritis may appear two to four weeks later. Few workers seem to have recognised the distinctly different symptoms in the two types of deficiency. Guerrant and Dutcher[3] recognise different symptoms in the rats which succumb early and those that survive longer.

If the rats showing vitamin B_4 deficiency symptoms are given vitamin B_1 (Ohdake concentrate) the symptoms gradually disappear, but the animals do not show the dramatic response obtained in animals with uncomplicated polyneuritis. This fact might lead to the conclusion that vitamin B_1 also cures paralysis in rats. However, we believe that another explanation is more plausible. The autoclaved ration produces a chronic vitamin B_1 deficiency including a rather severe anorexia, but the animal makes a terrific struggle to counteract polyneuritis. This is done partly by reducing its food intake, since this will reduce the accumulation of carbohydrate intermediate products, and partly by consumption of fæces. It is practically impossible to prevent coprophagy. According to present ideas, the yeast[4] in the digestive tract would supply some vitamin B_1 but very little vitamin B_4. The basal ration contains some vitamin B_4, but the decreased food consumption reduces the intake of this factor below the minimum requirement and vitamin B_4 deficiency results. When vitamin B_1 is fed, it does not cure the paralysis, but relieves the anorexia, and food consumption increases to a level which supplies sufficient vitamin B_4.

We feel that these facts introduce some interesting questions in vitamin studies. First, synthetic diets used for vitamin B_1 studies must be amply supplied with vitamin B_4, especially if only growth is used as the criterion of potency. Secondly, the improved growth obtained by certain workers by adding large amounts of B_1 to rats on a B_1 low diet may be due to the additional effect of traces of B_4 present as an impurity in the B_1 preparations. Thirdly, greater attention must be given to the interrelationship of vitamins both in the laboratory and in clinical practice.

C. A. ELVEHJEM.
AARON ARNOLD.

Department of Agricultural Chemistry,
University of Wisconsin,
Madison, Wisconsin.

[1] Reader, V., *Biochem. J.*, **24**, 1827 (1930).
[2] Kline, O. L., Keenan, J. A., Elvehjem, C. A., Hart, E. B., *J. Biol. Chem.*, **99**, 295 (1932).
[3] Guerrant, N. B., and Dutcher, R. A., *J. Nutr.*, **8**, 397 (1934).
[4] Guerrant, N. B., Dutcher, R. A., and Tomey, L. F., *J. Biol. Chem.*, **110**, 233 (1935).

Decomposition of Adrenalin in Tissues

PHARMACOLOGICAL evidence suggests that adrenalin is actively destroyed in tissues. We have studied the effect of tissue on decomposition and loss of pharmacological activity of adrenalin.

Tissue slices in Ringer solution or extracts of tissue were incubated in manometer flasks with adrenalin, and after suitable times the adrenalin activity of the fluids was tested on rabbit's gut. Rat liver slices in Ringer solution (phosphate buffered, *p*H 7·3) incubated with adrenalin accelerate the loss of adrenalin activity as compared with controls without tissue. This decomposition of adrenalin occurs only in the presence of oxygen. Whereas the oxygen uptake of liver slices is not noticeably influenced by adrenalin, the oxygen uptake of rat liver extracts is considerably increased when adrenalin is added.

Comparison of the extra oxygen uptake under these conditions with the oxygen consumption of adrenalin in Ringer solution alone shows the following difference: in the last case the adrenalin activity is approximately halved after the uptake of 2–3 atoms of oxygen per molecule of adrenalin; in the presence of tissue extracts the activity is about halved after the uptake of one, and practically abolished after the uptake of two atoms of oxygen per molecule.

The significance of these findings and their relations to the work of others will be discussed elsewhere.

H. BLASCHKO.
H. SCHLOSSMANN.

Physiological Laboratory,
Cambridge.
Dec. 17.

Contamination in Petri Dish Boxes

IN the course of investigations carried out on the influence of bacteria and fungi on flour kept under storage conditions, considerable difficulties were encountered by repeated contamination of the Petri dishes used for spore counts by 'spreaders' such as *Bacillus dendroides*. Fig. 1 shows an example of the type of contamination that was obtained. The presence of these 'spreaders' necessarily vitiates counts on such contaminated plates.

FIG. 1.

Tests were made to discover the cause of this contamination and at which point it occurred, and it was eventually found that the metal boxes used for sterilising Petri dishes were at fault. The atmosphere in the St. Albans laboratories is heavily contaminated with bacteria and fungi owing to the

amount of flour dust in the air, and on this account control experiments have been carried out at the Microbiological Department, Rothamsted Experimental Station, Harpenden, where the atmosphere is relatively free of contamination.

Several different types of sterilising boxes obtained from various sources were tested at St. Albans and Harpenden. These boxes are made of copper, and differ only in the type of their lids. Two principal types of lids were used in this work: (1) in which the lid, which is about three-quarters of an inch in depth, fits to the body of the box, so that the top of the lid and the rim of the body are flush, and (2) in which a deeper lid (about 2½ in.) fits over the body of the box for a distance of three-quarters of an inch only, resting upon an annular flange which runs round the body of the box. In this case there is a space of approximately one and a half inches between the rim of the box and the top of the lid. Both these types are in common use in bacteriological laboratories.

It was found that in type (1) all the plates became infected at St. Albans and Harpenden, and it did not matter whether bacterial (*p*H 7·2) or fungal (*p*H 4·8) media was used for plating, nor did wrapping the individual plates in crepe paper lessen the amount of infection. Type (2) gave variable results at St. Albans; but the plates remained clean at Harpenden. It would seem that contamination is brought about by the expansion of the air in the boxes when they are heated in the oven to 160° C. for half an hour, an inrush of external air occurring on cooling bringing bacterial infection with it.

These results show that the sterilising boxes now employed in bacteriological laboratories, especially in places where the atmosphere is at all likely to be contaminated, must be carefully tested before any confidence can be placed in the sterility of the plates. In the circumstances, it became necessary to devise other types of sterilising boxes to overcome this difficulty. The following devices were found effective: the lid of the box should be three inches in depth and must fit closely throughout its whole length to the body of the box, the rim of the body being flush with the top of the lid. Another type that was found effective is similar to the last in depth and shape of lid, but the lid is surrounded by an outside flange which leaves an air space of one eighth of an inch between the lid and the body of the box. This space is tightly packed with cotton wool as an extra precaution. Using either of these types, clean plates have invariably been obtained.

E. BARTON-WRIGHT.

Research Association of
British Flour-Millers,
St. Albans, Herts.

D. WARD CUTLER.
LETTICE M. CRUMP.

General Microbiological Department,
Rothamsted Experiment Station,
Harpenden, Herts.

A New Alkaloid of Ergot

IN addition to ergometrinine[1] which we recently described, we have now isolated from ergot a new crystalline alkaloid which is very sparingly soluble in water. It has phenolic properties and the high specific optical rotation, $[\alpha]_{5461}^{20°} = +522°$ (*c* in chloroform = 1). It decomposes at about 228° with formation of a black tar, and, like ergotinine, which it superficially resembles, it is sparingly soluble in methyl alcohol. It crystallises from a number of solvents, but from aqueous acetone it crystallises particularly well in long stout prisms. It gives the typical colour reactions of the known ergot alkaloids.

Analyses of the crystalline base have given consistent data which indicate the formula $C_{30}H_{35}O_5N_5$, but as we have so far been unable to prepare crystalline salts for confirmatory analysis the formula is suggested with some reserve. In order to prevent possible later unnecessary complications in nomenclature, we prefer for the present to defer naming the alkaloid until more is known concerning its relationship to other ergot alkaloids.

S. SMITH.
G. M. TIMMIS.

Wellcome Chemical Works,
Dartford.
Dec. 30.

[1] NATURE, **136**, 259 (1935).

Recent Research on Cancer

IN the article in NATURE of December 28 entitled "Recent Research on Cancer" there appears a misinterpretation of the results of our experiments. Perhaps the best way of clarifying the position is to summarise our results to date.

We have not been successful, in a single instance, in inducing cancer of the stomach, or of the tongue, in rats infected with *G. neoplasticum* whether fed on "a full and healthy diet", on white bread only (as in Fibiger's experiments) or on any other variation which we have tried.

Our results give no indication whatever "that diet may influence the occurrence of malignant disease". If compelled to give a conclusion on this point we would say that our experiments suggest that diet does not "influence the occurrence of malignant disease".

It would appear that the origin of the misunderstanding is to be found in the summary given at the beginning of the twelfth annual report of the British Empire Cancer Campaign itself, which, by inference, suggests that, with the aid of an incorrect diet, the parasite is capable of inducing cancer in rats. This we have not shown.

A clear understanding of the present position can best be obtained by reading our own full account given on page 87 of the above report and by referring to "Spiroptera Cancer and Diet Deficiency"[1].

R. D. PASSEY.
A. LEESE.
J. C. KNOX.

Department of Experimental Pathology
and Cancer Research,
School of Medicine,
Leeds.
Jan. 1.

[1] R. D. Passey, A. Leese and J. C. Knox, *J. Path. and Bact.*, **40**, 198 (1935).

Effect of Visible Rays on Bacterial Growth

I NOTE with great interest that experimental work is being done to investigate the effect of *visible* rays on bacterial growth. During a course of lectures I gave at the Royal Institution in 1911, I showed specimens of *B. prodigiosus* which I had subcultivated for several generations in a narrow band of spectral light having a maximum at 620 mμ, which exhibited very marked red pigment formation, and similar cultures grown in light of 550 mμ and 450 mμ, which

were respectively yellow and white. I also gave details of the accelerated production of wood alcohol and other fermentation products by irradiating the culture flasks with rays of selected wave-length in the visible spectrum.

I believe that while ultra-violet and infra-red light have almost unlimited physiological uses, a systematic study of the *visible* spectrum will reveal many narrow regions useful for promoting or inhibiting bacterial growth.

T. THORNE BAKER.

Dufaycolor Research Laboratory,
New York City, N.Y.
Nov. 27.

IT should be remembered, in connexion with the work to which Mr. Thorne Baker refers, that the first communication upon this subject was published in NATURE of July 12, 1877 (16, p. 218) under the title "The Influence of Light upon the Development of Bacteria". The authors were Dr. (now Sir Arthur) Downes and T. P. Blunt, and a paper by them entitled "The Influence of Light upon Bioplasm" was read before the Royal Society in the following year. The experiments described were chiefly concerned with the effect of *visible* light upon various organisms.—Editor, NATURE.

A Curious After-Effect of Lightning

AN interesting observation was made during a thunderstorm which took place over Johannesburg on December 5. The storm, which was accompanied by rain, was the severest experienced for some years.

During the height of the storm, a particularly bright flash struck the ground about a hundred yards away; the flash appeared to be approximately a foot wide and to last for at least a second. After the flash had died away, there remained a string of bright luminous beads in the path of the flash. The beads, of which there were twenty or thirty, appeared to be about a quarter of the width of the flash, that is, say, three inches in diameter. The distance between the beads, which appeared to be nearly constant, seemed about two feet. They remained visible for approximately half a second; during this time they gave no indication of any movement.

Measurements were afterwards made to endeavour to check the above dimensions; they appear to be of the right order.

D. G. BEADLE.

Transvaal Chamber of Mines,
Johannesburg.
Dec. 11.

Points from Foregoing Letters

CONTRARY to expectation, the amount of γ-rays excited in cadmium by neutron bombardment is found by H. Herszfinkiel and Prof. L. Wertenstein to be independent of the thickness of cadmium traversed (between 0·1 mm. and 1 mm.) and even to decrease at greater thickness. From these and further experiments, using screens of lead, iron and aluminium, they conclude that the energy of cadmium γ-rays must be of the order of 10 million electron volts; this agrees with the value deduced from mass-spectrographic data rather than with that obtained by previous investigators from absorption experiments.

J. R. Tillman points out that the results of experiments on the scattering of slow neutrons depend on the method of detection of the neutrons. He finds that the beta-ray activity induced in iodine, silver and copper by neutrons (slowed down by paraffin wax) is increased *by different amounts* when the metals are backed with a further layer of paraffin. The results show that radioactivity in iodine is induced by neutrons which have velocities greater than those effective in copper, and probably greater than velocities corresponding to the temperature of the system.

Prof. K. Przibram directs attention to the discovery by O. Schauberger of a yellow light-sensitive rock salt from Hall in Tirol, showing all the characteristics of primary colouring by radiation. This yellow salt is the link, hitherto missing, in the formation of natural blue rock salt.

Photometric curves, giving the intensity of the hyperfine structure doublets of the resonance lines of potassium (of atomic mass 39), are submitted by D. A. Jackson and H. Kuhn. The component of shorter wave-length is the stronger in every case, from which it is deduced that the magnetic moment of the nucleus of K^{39} is negative.

The absorption spectrum of magnesium hydride in the ultra-violet has been studied by B. Grundstrŏm by heating the metal in hydrogen at 1,400° C. In addition to the band observed by means of the arc spectrum by Pearse at λ 2430, the author describes another band which he explains in terms of electron configuration and quantum mechanics, ascribing it to a transition from the ground-level $^2\Sigma$ to a hitherto unknown activated state.

A new method of measuring the particular type of deviation from the gas laws known as 'degeneracy', at very low pressure where the van der Waals' forces (due to interaction between the particles) have no influence, is indicated by Prof. A. van Itterbeek. The method consists in determining the viscosity of the gas at different temperatures and calculating therefrom the mean velocity of the molecules according to Stokes's formula. This has been done with oxygen at 293°, 90° and 72° K.; the value obtained for the mean velocity agrees with that deduced from classical theory.

If a particular factor cures certain symptoms, it does not necessarily follow that the disease was originally due to lack of that factor. C. A. Elvehjem and Aaron Arnold find that rats showing vitamin B_4 deficiency symptoms may be relieved by vitamin B_1. This is apparently due to the fact that the B_1 vitamin enables them to eat more of the purified synthetic diet, which contains sufficient vitamin B_4 as impurity to be effective.

Rat liver tissue is found by H. Blaschko and H. Schlossmann to use up adrenalin in the presence of oxygen. In the case of liver tissue extracts, the activity of adrenalin is halved after the uptake of one atom of oxygen, and practically abolished after the uptake of two atoms of oxygen per molecule of adrenalin.

Research Items

Chinese Mesolithic Industry

EARLY in 1935 a party of geologists, which included P. Teilhard de Chardin and Dr. W. C. Pei, while engaged in a survey of the Cenozoic formations of Kwangsi on behalf of the Geological Survey of China, discovered in the caves of the area a definite type of cultural deposits, which in the absence of any pottery, or of even incompletely polished celts, are to be regarded as belonging to a typically mesolithic cultural stage, though clearly similar to the 'Bacsonian' (early Neolithic) of Indo-China. The conditions of stratification and palæontological content have already been described by P. Teilhard de Chardin (*Bull. Geol. Soc. China*, 14, No. 2). The artefacts are now described by Dr. W. C. Pei (*ibid.*, No. 3). They are derived from caves, of which three are situated in the south of the province almost at the border of Indo-China, and one in the north, this distribution pointing to a wide extension of this culture over a large part of southern China. The artefacts included grinding stones, perforated stones—the perforation being by pitting, not drilling—hammer-stones, side- and end-scrapers, and weights. A doubtful worked tip of deer antler and a much worked terminal piece of tine were also found. The most interesting specimens were an elaborately decorated grinding stone of green slate, polished on one side by use and on the other decorated by incised parallel bands, and a core scraper, a pyramidal artefact in green slate made from a rolled implement of much older and possibly palæolithic date. One hammer-stone showed evidence of having been painted with hæmatite and afterwards used. The affinity of this Kwangsi mesolithic industry with the Bacsonian of Indo-China is evidently a subject for future investigation.

Canadian Folk-song and European Cultural Origins

AN unexpected source of evidence bearing upon certain aspects of European cultural development has been brought to light in the study of Canadian folk-songs by Mr. Marius Barbeau ("Folk-Songs of Old Quebec", National Museum of Canada, *Bull.* 75, *Anthrop. Ser. No.* 16). It was long thought that E. Gagnon's "Chansons populaires du Canada" had exhausted local tradition; but during the last fifteen years renewed search, with the assistance of a few collaborators, has brought to light 6,700 versions of songs from Quebec, the Maritime Provinces and New England, where there are many immigrants from Canada. Of these songs, ninety per cent are French in origin and retain their traditional character, the remaining ten per cent being a purely Canadian product. The true folk-songs, forming the bulk of the repertory, were introduced between 1608 and 1673. Others, more recent, but in the true folk-song vein, were brought in after 1680 as marching and college songs by soldiers, priests and teachers. The true folk-songs came with the settlers from Normandy and the Loire valley. They do not belong to the troubadour tradition, which is aristocratic and in the dialect of *oc*, but are probably a survival of the obscure literary upheaval, free from Latin influence, which took place in the Loire valley and the north, and found popular expression in the *jongleurs*. It inherited and conserved the older traditions of the land, presumably as the heir of the ancient Druids and the Celtic culture that had undergone a mutation, but had not altogether ceased to exist. Although the *jongleurs* had died out, and there is no reference to them in the New World, these old folk-songs of Canada, more numerous and better preserved than in France, thus represent an ancient stratum of French literature never wholly submerged by neo-Latin influences from the south.

Ram Sarcophagus from Southern India

IN February 1935, a terracotta sarcophagus in the form of a ram was unearthed at Sankavaram, a small village in the Chuddapah District of Madras, and has since been transferred to the Madras Government Museum. In an account of the find (*Current Science*, November 1935) Mr. M. D. Raghavan states that the skeletal remains place it beyond doubt that the interment was human. The only other known funerary vessel in animal form from southern India is a small elephantoid urn from the banks of the Tungabhadra River. In the present example, the trunk of the ram is so modelled that the lower part supported by the legs served as the receptacle for the bones. The upper part, made in two pieces, has a clearly modelled head, the curling horns being emphasised, but the ears omitted. There is an aperture at the apex of a well-arched neck. About half way from the top of the front section a hole is placed symmetrically on either side. The back portion is well rounded to simulate the hinder portion of the animal, but lacks a tail. The figure is elaborately decorated with impressed rope-work ornament, suggesting the trappings of an animal equipped for riding. Two pieces of iron, a spear-head and a fragment of a knife or sickle were inside the sarcophagus, and an interesting series of pottery was associated with it, a squat type of vessel with shield shape back, and shallow all black pans predominating. The pans are highly polished and bear spiral marking inside. In primitive thought the ram is often looked upon as an embodiment of the soul of the dead, and in the early Indian faith the ram deity was invoked as Naigamêsha to obtain a son, though in the medical treatises, Naigamêsha as a ram-faced demon causes children's diseases. Association of the two ideas may have suggested the use of the ram-faced form as a request that the deceased might through Naigamêsha's influence be born back on earth.

Source of Infection in Puerperal Fever

IT is generally recognised that strains of the micro-organism known as the 'hæmolytic streptococcus' are the principal agents in the causation of puerperal or 'child-bed' fever. Evidence at present available goes to show that these puerperal strains are rarely, if ever, present in the genital tract at the beginning of labour, and it must be assumed, therefore, that they are introduced from some extra-genital source during labour or soon afterwards. What this source

may be is the subject of an investigation by Dora C. Colebrook, the results of which have just been published (Medical Research Council, *Spec. Rep. Series*, No. 205. London: H.M. Stationery Office. 1*s*. 6*d*. net). Of 67 infected puerperal women investigated, an extra-genital strain of streptococcus identical with the infecting strain was identified in 48 of the patients (76 per cent). These were isolated from the respiratory tract—throat and nose—of the patient (24 times), or of an attendant or member of the household, once from a septic focus of the skin of the patient herself, and once from the skin of a child. The types of infecting hæmolytic streptococci found were those commonly met with in tonsillitis, middle ear disease and scarlet fever. It is estimated that could infection with these organisms be eliminated, the deaths of nearly 600 parturient women in England and Wales might be avoided annually, as well as the non-fatal illness of at least 2,300 women.

Some Insects of Oceania

RECENT publications (1935) of the Bernice P. Bishop Museum, Honolulu, comprise several papers on some insects of Oceania. Dr. Herbert Osborn, in Bulletin 134, contributes an account of the Cicadellidæ or leafhoppers of Hawaii. This paper is based upon nearly three thousand specimens of the family, and it appears that the great majority of the species belong to the genus *Nesophrosyne*, which is limited to the Hawaiian Islands. The members of this genus are found more particularly upon trees and shrubs or woody plants. The species occur in all the main islands of the Hawaiian group. Some, such as *N. perkinsi*, are found on at least four of the islands, while others, like *N. lineata*, *angulifera* and *bicolorata*, are known from a single island only. Among other genera, *Nesophryne* is confined to Kauai Island. Among Occasional Papers of the Museum, vol. 11, is a check list of the ants of Oceania, by Prof. W. M. Wheeler. Some 560 forms (339 species, 108 subspecies and 113 varieties) are enumerated. All the subfamilies of the Formicidæ are represented, excepting the Dorylinæ and Leptanillinæ. The greatest interest is attached to those genera and subgenera which, so far as known, occur only in the Pacific Islands. Their taxonomic affinities seem to indicate that they are remnants of the ancient Tertiary and Pretertiary ant fauna which is still well represented in Australia and Papua. Dr. Karl Friederichs lists the Embioptera of Oceania. No embiids are known in New Zealand, and only undeterminable larvæ have been found so far in Papua. The other islands of Oceania have, so far as is known, no endemic species. In some of them two species occur, one Asiatic and the other tropicopolitan, but probably of African origin. A new beetle of the family Lathridiidæ, *Mumfordia monticola*, is described by Mr. E. C. Zimmerman from Tahiti. The family is represented in Oceania, outside New Zealand, by thirteen species only, and six of these are either widely distributed or cosmopolitan.

New Mexican Crabs

MR. STEVE A. GLASSELL, in his paper "New or Little Known Crabs from the Pacific Coast of Northern Mexico" (*Proc. San Diego Soc. Nat. Hist.*, 8, No. 14; 1935), describes several new and interesting Brachyura, most of which were collected by himself. Notes on colour and habits make these descriptions valuable. A new species of *Polonyx*, *P. quadriungulatus*, is found commensal with an annelid in tubes on an eel-grass mud flat. Each tube containing a crab was about a yard long and an inch in diameter. *Pinnotheres clavapedatus*, n. sp., is found commensal with the boring mollusc *Lithophaga attenuata*, taken at a depth of fifteen fathoms. More than two hundred females and five males were taken. Another *Pinnotheres* lives in the mantle cavity of a small oyster attached to rocks or mangrove roots, and a new species of *Dissodactylus* was found on the ventral exterior surface of several echinoids. When attached to an *Encope*, "it is usually placed in the proximal portion of the posterior interambulacral lunula. From this position to a point near the peristome or periproct of the echinoid the crab clears the actinal spines, thus forming for itself a roadway but little wider than its outstretched ambulatory legs". Another species of the same genus may occupy the same echinoid together with this one, but ranges over the entire ventral surface. Other crabs described include new *Pinnixias* inhabiting annelid tubes or living with lug-worms and sea cucumbers.

Californian Pectens

MR. LEO GEORGE HERTLEIN, in a paper entitled "The Recent Pectinidae" (*Proc. California Acad. Sci.*, fourth series, 21, No. 25, Sept. 1935), describes eleven species of pecten from the Galapagos Islands collected by the Templeton Crocker Expedition of the California Academy of Sciences, 1932. One of these is a new species, *Pecten* (*Chlamys*) *lowei*, found also in the Gulf of California. This is very similar to some of the fossil pectens from the Miocene in California, Porto Rico and other localities, but with slightly different sculpture. It also somewhat resembles the European *Pecten varians*. All the species are characterised mainly by the ribs and their sculpture, but notes on colour are also given.

Seasonal Changes in Starch and Fat in Woody Trees

OBSERVATIONS upon five deciduous and two evergreen species under Japanese conditions have recently been reported by O. Ishibe (*Mem. Coll. Sci., Kyoto Imp. Univ.*, B, 11, No. 1 (1935)). The two maxima and minima of starch recorded both by British and American observers are again recorded for starch and though, in this case as in previous work, the conclusions are based on qualitative microchemical data, they must now be regarded as fairly well established. The deciduous trees showed a starch maximum at leaf-fall and a minimum in the growing season as also does the evergreen, *Quercus glauca*, but in *Pinus densiflora* the spring maximum in the stems occurs much later and at a time when growth is in progress. This is attributed to the continued photosynthetic activity of the evergreen leaves. The report of changes in fat content is also based upon qualitative microchemical observations (using Sudan III); these suggest that the changes in fat are independent of the changes in starch content. The fat content of the root is small, and remains almost constant throughout the year in most species.

The Boulder Dam

THE great Boulder Dam on the Colorado River is the subject of an illustrated article by Mr. G. B. Barbour in the *Geographical Journal* of December. The river, after leaving the Grand Canyon, crosses an area in which it flows alternately in gorges and open basins. Here in Black Canyon on the borders

of Nevada and Arizona, where the river enters on its last pronounced southward reach, the dam is being built which eventually will impound two years' entire flow of the river, amounting to ten billion gallons, and supply a generating plant with a capacity of 1,835,000 horse-power. The dam will be 726 ft. above the bed rock, and will raise the water-level 584 ft.; it will be 1,180 ft. in length along its crest. Before the dam was begun, the Colorado was diverted into four 50 ft. tunnels at points upstream from the site. When all was ready for diversion, the canyon walls below the tunnel entrances were blasted, thus forming coffer dams above the dam-site. The project was begun in 1933, and should be finished in 1937. It may be noted that it has employed 3,500 men, housed in the temporary Boulder City. For irrigation, California and Arizona will benefit most, the former especially by an eighty-mile canal from lower down which will carry water to the Imperial Valley. The total land in all States to be irrigated will be some two million acres. Cheap electric power will be available at Los Angeles, 250 miles away, and other cities.

Measurement of Water Passing Through a Net

WITH a very fine silk townet, as used for obtaining plankton samples from the sea, the quantity of water filtered depends upon several factors; for example, the distance the net is drawn through the water, the speed at which it is towed, the extent to which the meshes become clogged, the amount of use the net has had, and whether or not it has been wet for some time before a station is worked. Where quantitative data are required for purposes of comparison, these variables can be overcome by using a net having a meter which measures the quantity of water passing into and through it. Such a net has been constructed by Mr. H. W. Harvey, of the Marine Biological Laboratory, Plymouth (*J. Con. Internat. Explor. Mer*, 10, No. 2, 179–184 (1935)). During two and a half years of regular use, the apparatus has worked satisfactorily and produced valuable results.

Accurate Measurement of Temperature

THE Cambridge Instrument Co., Ltd., has just issued a pamphlet (price 1*s*. 6*d*.) which should be of value to all users of temperature-measuring appliances. It gives a concise survey of the methods of measuring temperature, and defines the field of application of the various types of pyrometers, thus enabling the user to select the instrument best adapted to his requirements. It is interesting to note that recent developments in the manufacture of the mercury-in-steel thermometer have made possible the employment of mercury vapour instead of liquid mercury. In this way temperatures between 350° C. and 800° C. may be measured. It is stated that the purification of platinum and its alloys has made such progress during the past few years that in order to maintain a constancy in the values given by the modern thermo-couple as compared with those of a few years ago, the rhodium content of the thermo-couple has been slightly increased. The modern standard couple is now platinum versus platinum 13 per cent rhodium instead of the original Le Chatelier of platinum versus platinum alloyed with 10 per cent of rhodium. An account is given of total radiation and optical pyrometers and due regard is paid to the limitations imposed by departure from 'full radiator' conditions. In the abridged specification of temperature measuring instruments manufactured by this firm, we note a wide range of surface pyrometers adapted to meet the most diverse requirements of industry. The specification also contains a description of electrical thermometers specially designed for medical work. Tables are given for the comparison of the centigrade and Fahrenheit scales, the E.M.F.'s of thermo-couples, standard temperatures of the international scale and divergence between true and apparent temperatures with pyrometers sighted upon different materials in the open.

Polymerisation as Applied to Petrol Production

AT the annual meeting of the American Petroleum Institute at Los Angeles, it was claimed that with the aid of polymerisation, potential sources of motor-fuel in that country had been increased by twenty-five per cent, according to Science Service of Washington, D.C. The effect of polymerisation is to combine waste refinery gases in such a way as to unite two or more molecules to form polymers suitable for the production of gasolene, benzol, toluol and/or xylol. This process has also been successfully applied to natural gas, and from this source alone three billion gallons, or one-fifth of the American annual consumption of gasolene, can be obtained without in any way curtailing the supply of natural gas required for domestic and industrial uses.

Production of Lubricating Oils from Coal Products

ON December 12, a paper on production of lubricating oils from coal products was read before members of the Institute of Fuel. The authors, Messrs. F. C. Hall, W. R. Wiggins and A. W. Nash, contend that, while a great deal of attention has recently been paid to the production of motor fuels from coal, insufficient has been given to the possibility of obtaining lubricants from the same source. The chemical nature of coal renders it improbable that high-grade lubricating oils can be obtained directly by coal distillation, but various coal products might be used for the synthesis of such lubricants. Indirectly, lubricating oils can probably be obtained from coal by at least five different, indirect methods: namely, by the non-catalytic polymerisation of hydrocarbons; the catalytic polymerisation of olefines; the dechlorination of chlorinated hydrocarbons; the condensation of olefinic with aromatic hydrocarbons; and the condensation of alkyl chlorides obtained by the chlorination of coal products with aromatic hydrocarbons. The authors, having examined each of these methods in detail, have reached the conclusion that high-grade lubricating oils with viscosity characteristics comparable with those of certain commercial petroleum lubricants can be produced from ethylene by the use of modified catalytic methods. Further, using a metallic aluminium catalyst, they claim to be able to produce, by the condensation of aromatic hydrocarbons with chlorinated paraffins, oils the viscosity indexes and oxidation stability of which are superior to those of commercial products. It seems practicable, therefore, that gaseous olefines and paraffinic and aromatic hydrocarbons obtained in various coal treatment processes can be utilised for the production of lubricating oils. Admittedly consumption of such oils is substantially less than that of motor spirit, but even so it amounts to some 115 million gallons a year, and any new processes for its production should be given support, so far as is economically practicable.

Prize Awards for 1935 of the Paris Academy of Sciences

AT the public annual meeting of the Paris Academy of Sciences on December 16, the prizes and grants for the year 1935 were announced as follows :

Mathematics.—The Francœur Prize to André Weil, for his work in algebra.

Mechanics.—The Montyon Prize to Pierre Dupin, for his work on the mechanics of fluids ; the Poncelet Prize to Auguste Lafay, for the whole of his work in mechanics ; the Henri Bazin Foundation to Adrien Foch, for his experimental researches in hydraulics.

Astronomy.—The Lalande Prize to Lucien d'Azambuja, for the whole of his work ; the Damoiseau Prize, in equal parts, between Guy Reiss and André Patry, for the whole of their work ; the Benjamin Valz Prize to Raymond Tremblot, for the whole of his work ; the Pierre Guzman Prize, in equal parts, between Jules Baillaud, André Danjon and Armand Lambert, for the whole of their work ; the G. de Pontécoulant Prize to Georges Durand, for the whole of his work ; the La Caille Prize to Raoul Goudey, for his studies relating to the intensity of gravity.

Geography.—The Gay Prize to Louis Feyler, for his exploration in the Tchad Ténéré ; the Tchihatchef Foundation to Edmond Saurin, for an important study on the stratigraphy and tectonics of the south of Annam ; the Alexandre Givry Prize to Joseph Volmat, for his exploratory work on the coasts of France and the application of aerial photography to hydrographic surveys.

Navigation.—The Ministère de la Marine Prize to André Pommelet, for his work on naval construction ; the Plumey Prize to Marcel Rouchet, for his work relating to the fatigue of metals.

Physics.—The Gaston Planté Prize to Marcel Pauthenier, for his work in the field of electricity ; the Hébert Prize to Jean Fallou, for his work in electricity, especially for his book "Les réseaux de transmission d'énergie "; the Henri de Parville Prize to Jean Mercier, for his work on electric oscillations ; the Hughes Prize to Louis Néel, for his work on magnetism ; the Pierson-Perrin Prize to Pierre Auger, for the whole of his work ; the Clément Félix Foundation to Charles Dietsch, for the continuation of researches on continuous currents of great intensity.

Chemistry.—The Montyon Prize (Unhealthy Trades) between René Fabre (2,500 francs), for the whole of his work in toxicology, and Lucien Leroux (1,500 francs), for his work on arsenic ; the Jecker Prize to Marcel Godchot, for his work in organic chemistry ; the Cahours Foundation to Félix Trombe, for his researches on the isolation of the rare earths in the metallic state ; the Houzeau Prize to Edmond Vellinger, for numerous physico-chemical measurements on organic compounds and biological substances.

Mineralogy and Geology.—The Delesse Prize to Antonin Lanquine, for his geological work in Provence ; the Fontannes Prize to Jean Viret, for his work on the palæontology of the vertebrates ; the Victor Raulin Prize to Georges Lecointre, for his geological work on Morocco and Touraine ; the Joseph Labbé Prize to Louis Glangeaud, for his geological work.

Botany.—The Desmazières Prize to Pierre Dangeard, for his "Traite d'Algologie" ; the Montagne Prize to Charles Killian, for his work as a whole ; the Jean Thore Prize to Robert Douin, for his contribution to the "Flore illustré de France" ; the de Coincy Prize to Marie-Victorin, for his "Flore Laurentienne" ; the Jean de Ruez de Lavison Prize to Robert Echevin, for his work relating to the metabolism of nitrogen, phosphorus and sulphur in the dead leaves of ligneous plants.

Rural Economy.—The Paul Marguerite de la Charlonie Prize to Albert Demolon, for his researches on the chemistry of soils.

Anatomy and Zoology.—The Cuvier Prize to Paul Marais de Beauchamp, for his varied researches on the invertebrates ; the Savigny Foundation to Marc André, for the continuation of work on the Arachnids.

Medicine and Surgery.—Montyon Prizes to Antoine Catanei (2,500 francs), for his studies on mycoses, Stefan Nicolau (2,500 francs), for his work on hydrophobia, Michel Salmon and Jacques Dor (2,500 francs), for their book "Artères des muscles, des membres et du tronc" ; honourable mentions (1,500 francs) to Germaine Amoreux, René Lançon and Seymour Nemours-Auguste ; citations to Raoul Palmer, Pierre Princeteau and Henri Fischer, and to Pierre Uhry ; the Barbier Prize to René Moricard, for his memoir "Proliférine sexuelle femelle. Contribution à l'étude de la fonction de la folliculine" ; the Bréant Prize to Serge Metalnikov, for his memoir on the role of the nervous system and of the biological and physical factors in immunity ; the Godard Prize to Robert Raynaud, for his book on the functional antagonism between the ovarian hormones and the mechanism of folliculinic abortion ; the Chaussier Prize between Henri Bierry and Francis Rathery (8,000 francs), for their introduction to the physiology of the sugars, and Léon Dérobert, for his work entitled "De la carbonisation de la peau et de ses annexes (poils, ongles et dents)" ; the Mège Prize to Louis Chauvois, for his book on the circulation of the blood ; the Bellion Prize to Marc Klein, for his memoir on the yellow body in pregnancy ; the Baron Larrey Prize to Robert Tournier-Lasserve, for his memoir on the health service of the army ; the Jean Dagnan-Bouveret Prize, in equal parts, between René Ledoux-Lebard, for his manual of clinical radiodiagnosis, and Pierre Duval, Jean Charles Roux and Henri Béclère, for their memoir on the clinical radiology of the alimentary canal.

Cancer and Tuberculosis.—The Roy-Vaucouloux Foundation to Jean Loiseleur, for his researches on biological physics and chemistry and their application to the study of cancer ; the Louise Darracq Prize between Albert Peyron (3,000 francs), for the whole of his work on cancer, Jean Montpellier (1,500 francs), for his work on tumours, and Georges Piraud (1,500 francs), for his book on the notochord and its tumours ; the Henriette Régnier Foundation to Roger Laporte, for his work on tuberculosis.

Physiology.—The Montyon Prize to Antoine Jullien, for his physiological researches and his book on practical physiology ; the Pourat Prize to Jules

Carles; the Philipeaux Prize to Serge Tchakhotine, for his studies on the methods and problems of cellular microexperimentation.

Statistics.—The Montyon Prize to Robert Gibrat, for his work in mathematical statistics.

History and Philosophy of the Sciences.—The Binoux Prize to George Sarton, for his three volumes, "Introduction to the History of Science, up to the time of Roger Bacon". A prize of 1,000 francs to Henri L. Brugmans, for his book, "Le séjour de Christian Huygens à Paris suivi de son Journal de voyage à Paris et à Londres".

Works of Science.—The Henri de Parville Prize between Jean Villey, for his publications on applied thermodynamics, and Georges Darmois, for his book on statistics and its applications; the Jules and Louis Jeanbernat et Barthelemy de Ferrari Doria Prize to Marcel Abeloos, for his book on regeneration and the problems of morphogenesis.

Medals.—The Berthelot Medals to René Fabre and Edmond Vellinger.

General Prizes.—The Prize founded by the State to Auguste Loubière, for his researches in the comparative anatomy of plants and in palæobotany; the Bordin Prize to Henri Cartan, for his work in mathematical analysis: the Lallemand Prize to Pierre Mollaret, for his researches on Friedreich's disease and its homologue in the dog; the Serres Prize to Paul Wintrebert, for his work in embryology; the Maujean Prize to Maurice Edme Courtois Suffit and Edouard Zedet, for their book "Lutte contre les intoxications dans la fabrication des poudres et explosifs"; the Petit d'Ormoy Prize (Mathematical Sciences) to Maurice Fréchet, for the whole of his mathematical work; the Petit d'Ormoy Prize (Natural Sciences) to René Maire, for his work on the flora of northern Africa; the Saintour Prize to Jean Jacques Trillat, for his work on the application of X-rays and electronic diffraction to the study of the structure of organic materials; the Lonchampt Prize to Augustin Damiens, for his work on bromine in animals and plants; the Henry Wilde Prize to Paul Bertrand, Pierre Pruvost, Paul Corsin and Gérard Waterlot, for their study of the coal formations of the Sarre and Lorraine; the Gustave Roux Prize to Henri Nouvel, for his researches on the cytology, physiology and biology of the Dicyemidæ; the Thorlet Prize to Paul Dorveaux; the Marquet Prize to Pierre Chevenard, for his metallurgical researches.

Prizes of the Grandes Ecoles.—The Laplace Prize to François Mialaret; the L. E. Rivot Prize to François Mialaret, Albert Denis, Jean Courbon and Jacques Boué.

General Foundations for Scientific Researches.—The Hirn Foundation to Georges Giraud, for his mathematical work; the Henri Becquerel Foundation to Mlle. Yvette Cauchois, for her researches on the spectrography of the X- and γ-rays; the Mme. Victor Noury Foundation to Jean Delsarte (3,000 francs), for his work in mathematical analysis, Jean Wyart (2,500 francs), for his work on the constitution of the zeolites, Ferdinand Angel (2,000 francs), for his description of the herpetological fauna of western Africa, Georges Deflandre (2,000 francs), for his work on the Protists, especially the Flagellates, preserved in flint, Jean Lecomte (2,000 francs), for his researches on the infra-red spectrum; the Charles Frémont Foundation to André Paillot, for his work in applied entomology; the Lannelongue Foundation to Mme. Gabriel Cusco.

The Loutreuil Foundation

The Academy has considered forty-three applications for grants from this fund and has allocated awards as follows:

(1) Researches on Fixed Problems.—Pierre Viala and Paul Marsais (2,000 francs), for the study of the best methods for combatting the enemies of the vine, especially mildew; Maurice Pierre (3,000 francs), for researches on the mechanism of vomiting; Armand Tapernoux and Robert Vuillaume (2,000 francs), for their work on diastatic hydrolysis in the organism, the active principles of linseed cake and on the action of amines in the organism; Jean Sendrail and Robert Lasserre (3,000 francs), for the study of castration in Solipods; Charles Hervieux (3,000 francs), for his researches on the passage into sweat of indoxylic chromogens, resulting from putrefaction in the intestine in domestic animals; James Dantzer (2,000 francs), for his study of elasticity and tests for wear in textile threads; André Aron (2,000 francs), for his researches on thin metallic films; Vladimir Frolow (2,000 francs), for his hydrological researches in the valley of the Loire; Pierre Jolibois (5,000 francs), for his studies on the electrolysis of saline solutions under high electromotive forces; Raoul Lecoq (2,000 francs), for his researches on vitamins; Louis Leprince-Ringuet and Pierre Auger (5,000 francs), for their studies of cosmic rays carried out at the Jungfraujoch Observatory; Pierre Allorge (10,000 francs), as a contribution to an expedition to the French Antilles for the study of Cryptogams in these islands; George Waterlot (3,000 francs), for prehistoric and ethnographic studies in Mauritania, Senegal, French Sudan, French and Portuguese Guinea.

(2) The Purchase of Laboratory Material.—Léon Guillet (4,000 francs), for the purchase of a micro-machine for tests on the strength of materials; Institut national agronomique (7,000 francs), for the erection of a greenhouse; Casimir Monteil (5,000 francs), for the purchase of a Diesel motor; Pierre Fremy (5,000 francs), to complete the laboratory material for his researches on Algæ; André Paillot (4,000 francs), for procuring microscopical apparatus necessary for his researches on the normal and pathological histology and anatomy of insects.

(3) Publications.—Fédération française des Sociétés de sciences naturelles (5,000 francs), as a contribution to the publication of the "Faune de France"; Joseph Monestier (3,000 francs), for printing a memoir on Ammonites; Remy Perrier (3,000 francs), for assisting the publication of his "Faune de France" with illustrated synoptic tables; Marc Simonet (2,000 francs), for the reproduction in water colour of a collection of *Iris*; Société des Amis d'André Marie Ampère (4,000 francs), for assisting the publication of the journal and correspondence of Ampère on the occasion of his centenary; Comité de Physique du Globe des colonies (10,000 francs), for the publication of the "Annales de Physique du Globe de la France d'outre-mer".

(4) Grants to Libraries.—Ecole Polytechnique (6,000 francs), Ecole nationale vétérinaire d'Alfort (6,000 francs), Ecole nationale vétérinaire de Lyon (3,000 francs), Institut national agronomique (3,000 francs), Société française des Electriciens (1,000 francs).

Water Pollution and Purification*

THE subject of water, its sources, properties, behaviour under various conditions, uses, etc., is of interest to everyone; and as the work of the Water Pollution Research Board touches on every aspect of these questions, the annual reports of this body are of prime importance.

Droughty weather during the past three years in Great Britain has brought the vital question of the conservation of good water to the fore, and the present report indicates that the Board is continuing its work of accumulating accurate information as to how this may best be done in co-operation with other bodies. Perhaps the most fruitful work of the Board results from its efforts not only to control and prevent the fouling of good water, but also to further the means of reclaiming water economically and expeditiously, which has been fouled by industrial or domestic use.

The report shows that work of this character goes on steadily, and ultimately must produce most far-reaching benefits to the community. For example, the ever-present difficulties and losses in industry due to the hardness of water are of universal concern; and for some years now, the Board has directed detailed researches into the question of water softening. More particularly this work has been directed to the investigation of the base-exchange or zeolite process of water-softening; and a most useful review of the work already accomplished together with further results is given. "The process utilises the property of base exchange possessed by certain hydrated alumino silicates." The properties of materials, whether of mineral or synthetic origin, are discussed; their limitations as softening agents, liability to disintegration, etc., are indicated; and it is very evident from the information given that considerable care is necessary in installing and manipulating such a plant.

A table is given showing the "Base-Exchange Value and Weights per Cubic Foot of Representative Commercial Materials" including mineral non-porous and porous (both dry) and also synthetic material (damp as delivered). "With equal weights as the basis the exchange value of the synthetic material was $2\frac{1}{2}$ times that of the porous mineral, and five times that of the non-porous mineral." Much detailed information respecting the behaviour of the materials with different kinds of waters is contained in this part of the report, and a note of caution is sounded when it is stated that "Relative costs and other factors must also be taken into account". A point of interest is that the synthetic products are gels, and are porous. Some of the synthetic materials employed in Great Britain are of British manufacture; but practically the whole of the natural and treated minerals are imported from outside the Empire.

Of great interest are the exchange properties of synthetic resins, established during the past year at the Chemical Research Laboratory at Teddington. Those prepared from certain phenols and tannins possess marked base-exchange properties. Certain of these resins are highly selective in their action, but others are capable of removing as much calcium and magnesium from hard water as an equal weight of the commercial water-softening materials with the highest base-exchange values. Other resins prepared from aromatic bases, such as aniline, possess the property of removing anions or acidic radicals from solution. Thus by filtering sea-water, first by particles of a tannin resin and then through particles of an anilin resin, and repeating the operation several times, most of the salt content of the sea-water is removed.

The Board continues its policy of establishing methods of overcoming the difficulties raised by the waste materials discharged from manufacturing operations, either by direct investigation or in co-operation with other bodies. In this respect the waste from a milk factory is dealt with. An activated sludge can be worked up which will produce a fairly satisfactory effluent, but the sludge so produced is very sensitive to small changes, and great care is needed in its manipulation.

An alternative method which promises well consists in the filtration of the milk waste through two bacteria beds arranged in series. The first filter retains most of the milk solids and the second filter delivers a final effluent of excellent quality. In order to avoid choking of the filters by the milk solids the order of the filters is alternated, say, after a fortnight, so that the secondary filter becomes the primary filter and vice versa. This procedure ensures that the two classes of materials present in the milk—those in suspension and colloidal condition, as fats, proteins, etc., on one hand, and those in solution as milk sugar, etc., on the other hand—shall be brought into the same biochemical picture. The result is that the fatty matter is largely destroyed and the condition of the slimy solids altered to brown particles which will pass through the filter. The filter method has amongst other advantages that of considerable stability, and it lends itself in consequence better to the rough and tumble of works practice.

Another important trade waste of very general interest, namely, gas works effluents, is dealt with in this report; a brief review is given of the work being done towards the solution of the problem of disposing of these wastes in a satisfactory manner by the gas industry itself, working through the Institution of Gas Engineers.

Particular interest is attached to this work, as it furnishes an excellent example of a great industry applying itself to the disposal in an orderly manner of the residues from manufacturing operations when economic returns have become doubtful or even negative. This method of approach permits the question to be dealt with from every aspect, and often enough results, as in this case, in modifications of manufacturing practice with benefit to all concerned, and simplification of the problem finally presented by the discharge of the waste liquors to the public sewers.

The Institution of Gas Engineers carries on the work involved through its "Liquor Effluents and Ammonia Committee", and this work has been in progress for a number of years. The Water Pollution

* Department of Scientific and Industrial Research. Report of the Water Pollution Research Board for the Year ended 30th June, 1935; with Report of the Director of Water Pollution Research. Pp. iii+51. (London: H.M. Stationery Office, 1935.) 1s. net.

Research Board is represented by its director, Dr. H. T. Calvert, and its secretary, Dr. A. Parker, on this Committee, so that there is active co-operation in this important matter.

An immense amount of detailed work is dealt with each year by Dr. A. Key, the research chemist to the Liquor Effluents Committee. Besides possible modifications in gas works practice which have been previously indicated, the annual report of this Committee deals in great detail with the effects of spent liquor on one hand and crude or ammoniacal liquor on the other, when mixed with sewage in various proportions, and the resulting mixed liquors dealt with by standard methods of biological oxidation, such as the activated sludge process or filtration through bacteria beds. Broadly, it may be said that the former process is more sensitive than the latter, that the average proportion of gas liquor to sewage in a town varies from 0·3 to 0·5 per cent by volume, that if the waste liquor is discharged at a level rate to the public sewers no serious difficulty arises at a well-designed sewage purification plant so long as spent liquor only is discharged. On the other hand, crude or ammoniacal liquor from gas works introduces difficulties which are not associated with spent liquor; and as the Institution of Gas Engineers is pursuing quite promising investigations on the recovery of the ammonia from crude liquor, it is very desirable from every point of view that these efforts shall be successful.

The Water Pollution Research Board continues its detailed investigations on activated sludge in relation to its action on various types of sewage, and also on various materials such as sugars—fructose, maltose, glucose, etc., amino acids, fatty acids, fats, suspensions of proteins, and so on. Certain experiments were carried out showing that physical factors play an independent part in the action of the activated sludge process, etc.

The investigations which the Board has carried out on the River Tees, and the present survey which is being made on the estuary of the River Mersey, are of fascinating interest, and are providing not only a mass of information of scientific character, but also material facts affecting a wide range of interests, nautical, fishing, manufacturing, sanitary, etc. One fact elucidated seems to illustrate the complexity of the problems arising, when it is stated that on comparing the relatively unpolluted Lough Foyle with the heavily polluted Mersey: "Samples of the mud from the Lough contained larger proportions of organic matter than the samples from the bank near Stanlow in the Mersey".

F. R. O'SHAUGHNESSY.

Mechanism of the Human Body

ODDLY enough, engineers have always enjoyed a thrill when shown the working mechanism of any bodily organ; the beating of an isolated heart taken from a tortoise, for example, arranged to circulate a suitable saline fluid, usually commands more admiration from an engineer than from a physiologist. It is not surprising, therefore, that the Institution of Mechanical Engineers should have invited a physiologist to deliver the Thomas Hawksley Lecture on November 29, and to present some of the more mechanical and physico-chemical processes taking place in the human body. Their selection, happily, fell upon Prof. A. V. Hill, Foulerton research professor of the Royal Society and a distinguished biophysicist.

The human body, as a whole, has often been likened to an internal combustion engine, for both ultimately depend on the transformation of chemical potential energy into heat and mechanical energy, and so the human body is as dependent on adequate food supply as is the engine on fuel. Dealing with the preservation and transport of food on sound engineering and biological lines, Prof. Hill stated that this is not enough, "for food must be supplied as well, and we are fools, if, on any moral, social, or political theory, we wilfully allow our population to remain below the level of health which science and engineering can provide". After dealing with problems common to physiology and engineering affecting deep diving, high flying, work at high temperatures and so on, he carried his hearers into the more intimate consideration of the processes occurring in two highly specialised tissues, muscle for the development of mechanical power, and nerve for high-speed conduction.

Prof. Hill described, with the authority of the leading experimenter in this branch, how the measurement of heat production in the various phases of muscle contraction have elucidated the energy transformations occurring; but he stated that "we need to know much more about the physical chemistry and the molecular structure of muscle before we can even begin to guess at the mechanism by which chemical energy is transformed directly into tension energy and mechanical work". Experiments on the mechanical efficiency of muscles give results dependent on the manner in which the muscles are employed: the mechanical efficiency in pedalling a bicycle, or in rowing a boat with sliding seat, under good conditions and not too fast, is about twenty per cent—perhaps twenty-five per cent as a maximum. Under most conditions, it is less, but it must be remembered that the accompanying heat dissipation serves the necessary purpose of maintaining body temperature. The power developed by a vigorous man in a steady condition of exercise may be as much as $\frac{3}{5}$ horse-power, while for maximum efforts of only a few seconds $1\frac{1}{2}$ horse-power may be attained.

During the consideration of the processes occurring in nerve, Prof. Hill dwelt on the difficult problem represented by the excitatory process in nerve. The application of radio-engineering to the problem has been productive in studying both electric excitation and the transmission of nerve impulses. When an electric current passes through a nerve from anode to cathode, a physico-chemical change occurs at the cathode which, if big enough, results in excitation. As soon as the current is broken, this cathode potential begins to disappear exponentially with time, proportionately to $e^{-t/k}$, where k is a time-constant

characteristic of the nerve. The quicker the reactions of a nerve the smaller will be the value of k; for human motor or sensory nerve, k is about 250 micro-seconds. Electrical studies of the excitation process and action potential, which is a constant accompaniment of a nerve impulse, are beginning to shed new light on the initiation of the nerve impulse, and physiologists with the aid of other engineering devices are looking forward to the solution of this problem, which they hope will turn out to be on a simple physico-chemical basis.

Science News a Century Ago

The Siamese Twins

LONDON MEDICAL GAZETTE, January 16, 1836, said: "This inseparable pair are now at Paris. M. Geoffroy de St. Hilaire congratulated the savans of the Academy of Sciences on the circumstance. Six years ago, he says, he applied in vain to the French Government to allow this 'teratological curiosity' to enter France. It may now be examined at leisure; and will be found deserving of attention, not only from the singular mode in which the individuals are united, but as presenting a specimen of a race of men little known to Europeans. M. Coste has visited these singular strangers, and raised rather a curious question about them, namely, at what epoch of intra-uterine life their union took place. He has satisfied himself that it occurred during the last days of the first month of pregnancy".

Darwin's Observations in New South Wales

THE beginning of 1836 found the *Beagle* on passage from New Zealand to Australia, and on January 12 the ship anchored in Sydney Cove, whence she sailed on January 30 to Tasmania. Darwin took the opportunity of making an excursion to Bathurst, 120 miles inland, where he arrived on January 20 after a four days' ride. In the course of his journey he passed parties of convicts working in chains, under the charge of sentries, and groups of aborigines whose skill with the spear he admired. He ascended the Blue Mountains, made notes on the vegetation and geology of the district, went kangaroo hunting and had the good fortune to see several of "the famous Ornithorhynchus paradoxus".

The rapid prosperity and future prospects of the colony puzzled Darwin. The country was unfit for canals, pasturage was thin and agriculture on account of the drought could never succeed on an extended scale. "I formerly imagined", he wrote, "that Australia would rise to be as grand and powerful a country as North America, but now it appears to me that such future grandeur is rather problematical". He was deeply interested in the state of society and the condition of the convicts, and though he admitted he had few opportunities of studying the latter, speaking of the use of Australia as a penal settlement, he said, "On the whole, as a place of punishment, the object is scarcely gained; as a real system of reform it has failed, as perhaps would every other place; but as a means of making men outwardly honest—of converting vagabonds, most useless in one hemisphere, into active citizens of another, and thus giving birth to a new and splendid country—a grand centre of civilization—it has succeeded to a degree perhaps unparalleled in history".

Death of Antoine-François de Férussac

ON January 21, 1836, the French soldier and naturalist, Antoine-François de Férussac, died at the age of forty-nine years. The son of Jean-Baptiste-Louis de Férussac (1745–1815), a colonel who had fought in the Revolutionary wars and had devoted his leisure to zoology, de Férussac was born at Lauzerte (Tarn-et-Garonne) on December 30, 1786. While undergoing military training in Paris, he attended the lectures of Cuvier, Lamarck and Latreille, and at the age of twenty read a paper on Crustacea to the Paris Academy of Sciences which was printed in the *Annales du Muséum*. His corps being sent to Germany, he took part in the battles of Jena and Austerlitz, and afterwards served in Silesia and Spain, returning home severely wounded. Though some years later he served in the National Guard, he was always devoted to the study of natural history, writing many papers and in 1819 completed and published his father's "Histoire naturelle, générale et particulière des mollusques terrestres et fluviatiles". In 1823 he founded the *Bulletin universal des sciences et de l'industrie*, which, in spite of Government assistance, he was only able to carry on for a few years.

Magazine of Popular Science

AN advertisement in *The Times* of January 23, 1836, said, "'The Magazine of Popular Science, and Journal of the Useful Arts', will be published on the 1st of February, and continued monthly, price 1*s*. 6*d*., edited under the direction of the Society for the Illustration and Encouragement of Practical Science, at the Adelaide-street Gallery, London. . . ."

The Railways of England and Wales

IN its issue of January 23, 1836, the *Athenæum* gave a review of the principal railways in England and Wales under the three headings: (1) those completed and in operation; (2) those not yet completed, but in progress of formation; and (3) those existing only in prospectuses and engineers' surveys. Altogether, about thirty railways were included in the review, which was accompanied by a map drawn by James Arrowsmith. After dealing with the railways themselves, the writer of the article said, "Having thus hastily noticed the principal railway schemes lately brought forward, a few observations in conclusion may not be misplaced. The magnitude of the sums already risked in this new class of speculation indicates a degree of private wealth and enterprise, such as no time or country but ours, we believe, has ever exhibited. . . . Little attention has yet been given to calculate the effects which must result from the establishment throughout the kingdom of great lines of intercourse traversed at a speed of twenty miles in the hour. It is a subject deserving the attention of all such as are studious of social and economic philosophy. The experiment is quite unprecedented and its effects will not be easy to estimate". The writer was not very sanguine regarding the immediate prosperity of some of the projects, but remarked: "There is also one consoling circumstance on the very extremity of railway speculation: the vast sums it is destined to swallow up will, at least, be consumed for the advantage of some one at *home*, and not sunk in the shafts and mountains of a foreign territory".

Societies and Academies

GENEVA

Society of Physics and Natural History, December 5. LÉON W. COLLET: The Jurassic-Cretaceous limit at the summit of Mont Ruan, 3,067 m. (Morcles stratum). The author shows that the limit between Jurassic and Cretaceous is marked by breccias due to the continental movements which gave rise to the Purbeck. LÉON W. COLLET and P. VAUGELAS: The geological profile of the Col de Bossetan (Alpes de Samoëns, Hte. Savoie). The authors have mapped in detail the Bossetan region on the Swiss-French boundary and give a new section. LÉON W. COLLET and AUGUSTIN LOMBARD: The geological profile of the Vallon de Vaugealle (Alpes de Sixt, Hte. Savoie). The authors give a new profile, based on recent detailed observations. ARNOLD LILLIE: The Tour d'Anzeinde and Laubhorn nappes in the internal Pre-Alps between the Arve and the Giffre. The author records the presence of these two nappes between the Arve and Giffre valleys. Hitherto they have been unknown west of Champéry. ARNOLD LILLIE: Slices of crystalline rocks in the internal Pre-Alps between the Arve and Giffre valleys. The author describes crystalline rocks which have been found, for the first time, with Ultrahelvetic flysch in this region. M. GYSIN: An attempt at the classification of the granites of the southern Katanga from a planimetric study of thin sections. The author has measured on Shand's planimetric stage the quantitative mineralogical composition of about sixty thin sections of granites. From the results of these measurements, he has grouped the Katanga granites in eight classes. Then, attributing to each mineral a determined chemical composition, he has calculated the average chemical composition of each of these eight classes of rock. G. TIERCY: The law of variation of θ or of β in a polytropic equilibrium of any class. It is a question of showing the equivalence of two equations of condition. P. ROSSIER: The analytical representation of the spectral sensibility of orthochromatic plates. The author compares a certain function of the sensibility with some experimental results and finds the results satisfactory. The maximum sensibility is very sharp, especially if yellow filters are used. R. GALOPIN: The chemical differentiation by the spot method of polished metallic minerals.

LENINGRAD

Academie des Sciences (*C.R.*, 3, No. 7, 1935). S. L. SOBOLEV: The problem of Cauchy in the space of functions. V. A. FOCK and M. I. PETRASHEN: Calculation of the self-consistent field with exchange for lithium. G. A. KRUTKOW: Brownian movement of a string. L. ISAKOV: A system of masses of light atoms deduced from nuclear reactions alone. L. J. KURTZ: Kinetics of the formation of layers on metallic anodes. (2) The layers of $PbCl_2$ on lead. A. H. ANDRES and M. S. NAVASHIN: A morphological analysis of chromosomes in man. Ten autosome pairs were distinguished and some differences in their lengths in various races observed. V. S. BUTKEVITCH and M. S. GAJEWSKAJA: A colorimetric method for the quantitative determination of glucose and lævulose by their osazone. V. S. SADIKOV and V. A. VADOVA: Autoclave splitting of protein by means of absolute methyl alcohol. M. I. SALTYKOVSKIJ: Determination of frost resistance of winter wheat and rye in grain. E. S. SAPRYGINA: Frost resistance of spring wheats. The effect of the length of the 'light' stage on the hardiness of wheats. J. M. RALL: Faunistic investigations (Mammalia) in the Volga-Ural sand regions. A. V. MARTYNOV: A find of *Thysanoptera* in the Permian deposits. *Permothrips longipennis*, gen. et sp.n., forming a new family, *Permothripidae*, n.

PRAGUE

Czech Academy of Sciences and Arts, January 11, 1935. J. MILBAUER: Kjeldahlisation of carbon disulphide.

March 8. J. MILBAUER: A case of negative photocatalysis. The course of the photochemical decomposition of a solution of *p*-toluene chlorimidsodium in the presence of small amounts of desensitisers was studied. Most of the desensitisers cause negative catalysis. IV. MÁLEK: *Bacterium typhi flavum*. F. PRANTL: New bryozoans from the Bráník *g*-alfa limestones.

April 5. J. HEYROVSKÝ: A sensitive polarographic test for the absence of rhenium in manganese salts. Traces of perrhenate cause a conspicuous catalytic polarographic effect, when the solution is buffered and treated by hydrogen sulphide. Thus the perrhenate is easily detected in 10^{-6} *M*. solution. Solutions of manganese salts do not show this effect. K. CEJP: Conjugate parasites from Bohemia. J. PETRBOK: Quaternian molluscs of Trenčin, Trenčianské Teplice and surroundings (Slovakia).

May 24. B. NĚMEC: Healing of wounds and regeneration of some stromata of *Polyporus*. FR. ZÁVIŠKA: Electromagnetic waves in cables with two insulated layers. V. JIRÁSEK: Contribution to the study of the anatomical characteristics of a section of a leaf blade of *Poa*, L., with special regard to *P. badensis*, Haenke. C. GÁLA: Some effects of dried coagulated epiderm on the biology of the flies *Drosophila melanogaster*, species wild and vestigial. B. HEJDA: Clinical significance of the estimation of phosphatase in blood serum. V. POSPÍŠIL: Measurement of the effect of light on Brownian particles by the passage method of Fürth. V. ŠKOLA: Decomposition of the mullite phase by heat.

October 18. J. MILBAUER: Solubility of sulphur dioxide in sulphuric acid. Since the available data are given only to 62° C., the solubility determinations were extended to 245° C. for concentrated sulphuric acid and to 100° C. for the chamber acid (50° Be). E. VOTOČEK and F. VALENTIN: Glucosylketimines, ternary compounds of sugar with ammonia and betadiketonic substances. B. HOSTINSKÝ and J. POTOČEK: Contribution to the theory of Markov chains. V. JARNÍK: Common Diophantine approximations. FR. NĚMEJC: Spores and leaf epidermis of *Noeggerathia foliosa*, Stbz. D. JACENTKOVSKÝ: Tachinæ of the meadows in the territory of the forests of Lednice. K. ŽEBERA: Conodonti and Scolecodonti from Barrandien.

November 15. K. KAVINA: Contribution to the histology and biology of *Boletus parasitus*, Bull. V. RYPÁČEK: Contribution to the experimental ecology of the lichen *Parmelia physodes*, (L.) Ach. K. ZANÁŠKA: Pythagorean number for an unlimited number of squares.

Forthcoming Events

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

Monday, January 20

UNIVERSITY COLLEGE, LONDON, at 5.—Dr. H. R. Ing: "The Chemical Structure of Drugs in Relation to their Physiological Action" (succeeding lectures on January 27, February 3, 10, 17 and 24).*

ENGINEERS' GERMAN CIRCLE, at 6.—(at the Institution of Mechanical Engineers, Storey's Gate, S.W.1).—Dr. Hans Oschatz: "Die Douerfestigkeit und ihre Ermittlung" (Fatigue Strength and its Determination).*

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Major E. H. M. Clifford: "The British Somaliland-Ethiopian Boundary".

Tuesday, January 21

UNIVERSITY COLLEGE, LONDON, at 5.—G. P. Wells: "Comparative Physiology".*

ROYAL INSTITUTION, at 5.15.—Prof. W. L. Bragg, F.R.S.: "Atomic Arrangement in Alloys" (succeeding lectures on January 28 and February 4 and 11).

EUGENICS SOCIETY, at 5.15.—(at the Linnean Society, Burlington House, W.1).—Dr. S. Zuckerman: "The Physiology of Fertility in Man and Monkey".

UNIVERSITY COLLEGE, LONDON, at 5.30.—Prof. C. G. Darwin: "Some Developments of the Modern Theory of Magnetism" (succeeding lectures on January 23 and 24).*

INSTITUTION OF CIVIL ENGINEERS, at 6.—Dr. R. E. Stradling, R. G. C. Batson and G. Bird: "Road Engineering Problems—Judging the Slippery Road".

Wednesday, January 22

ROYAL SOCIETY OF ARTS, at 8.—Sir Roy Robinson, O.B.E.: "Forestry in Great Britain".

BIRKBECK COLLEGE, at 8.15.—Sir Frederick Gowland Hopkins, O.M., F.R.S.: Foundation Oration.*

Friday, January 24

PHYSICAL SOCIETY, at 5.—Presidential Address.

ROYAL INSTITUTION, at 9.—Dr. C. E. K. Mees: "Sensitising Dyes and their Application to Scientific Photography".

Official Publications Received

Great Britain and Ireland

National Reform Movement. Pamphlet No. 1: N. R. M. Political and Economic Proposals, with a Brief Description of the Central Reserve Standard and Proposed Method of Financing Housing and Clearance of Slums. Pp. 16. (London: National Reform Movement.) 3*d*. [1312

University of Durham. Abstracts of Theses for Doctorates presented by Candidates who have received the Degrees in Convocation during the Academical Year 1934–35. Pp. 17. (Durham: The University.) [1712

Technical Publications of the International Tin Research and Development Council. Series A, No. 26: The Mechanical Properties of Tin-Base Alloys. By D. J. Macnaughtan and Prof. B. P. Haigh. Pp. 12+1 plate. Free. Series A, No. 27: The Electrodeposition of Bronze using Bronze Anodes. By S. Baier and D. J. Macnaughtan. Pp. 14+4 plates. Free. Series A, No. 28: The Electrodeposition of Bronze using Bi-metallic Anodes. By C. Béchard. Pp. 8. Free. (London: International Tin Research and Development Council.) [1812

The South-Eastern Naturalist and Antiquary: being the Fortieth Volume of Transactions of the South-Eastern Union of Scientific Societies, including the Proceedings at the Fortieth Annual Congress, held at Bournemouth, 1935. Edited by Capt. F. Dannreuther. Pp. lii+107+5 plates. (London: Hon. Librarian, 71 Rectory Place, S.E. 18.) To non-Members, 5*s*. net. [1812

The North of England Institute of Mining and Mechanical Engineers. Annual Report of the Council and Accounts for the Year 1934–1935; List of Council, Officers and Members for the Year 1935–1936, etc. Pp. xli. (Newcastle-on-Tyne: North of England Institute of Mining and Mechanical Engineers.) 5*s*. [1812

The Hannah Dairy Research Institute. Bulletin No. 6: An Inquiry into the Design, Operation and Efficiency of Pasteurising Plants. By Dr. A. W. Scott and Dr. Norman C. Wright. Pp. 72. (Kirkhill, Ayr: Hannah Dairy Research Institute.) [3012

Other Countries

Bernice P. Bishop Museum. Occasional Papers. Vol. 11, No. 1: Check List of the Brenthidæ of Oceania. By Richard Kleine. Pp. 16. Vol. 11, No. 2: Check List of the Rutelinæ (Coleoptera, Scarabæidæ) of Oceania. By Friedrich Ohaus. Pp. 9. Vol. 11, No. 3: Atyidæ of Southern Polynesia. By Charles Howard Edmondson. Pp. 19. Vol. 11, No. 4: New Palms from Fiji. By Max Burret. Pp. 14. Vol. 11, No. 5: Preliminary Notes on Sarcopygme, a New Rubiaceous Genus from Samoa. By W. A. Setchell and Erling Christophersen. Pp. 5. Vol. 11, No. 6: Notes on the Ethnology of Pukapuka. By Gordon Macgregor. Pp. 52. Vol. 11, No. 7: Check List of the Embiidæ (Embioptera) of Oceania. By Karl Friederichs. Pp. 4. Vol. 11, No. 8: Autonomy and Regeneration in Hawaiian Starfishes. By Charles Howard Edmondson. Pp. 20. Vol. 11, No. 9: A New Lathridiid from Tahiti (Coleoptera, Lathridiidæ). By Elwood C. Zimmerman. Pp. 7. Vol. 11, No. 10: Non-marine Invertebrate Fauna of the Marquesas (exclusive of Insects). By A. M. Adamson. Pp. 39. Vol. 11, No. 11: Check List of the Ants of Oceania. By William Morton Wheeler. Pp. 56. Vol. 11, No. 12: Contribution to the Demographic Study of Easter Island. By Dr. I. Drapkin. Pp. 9. Vol. 11, No. 13: Hawaiian Panicum, Metrosideros, Sanicula, Lobelia and Rollandia. By Harold St. John and Edward Y. Hosaka. Pp. 18. Vol. 11, No. 14: Additions to the Flora of Midway Islands. By Harold St. John. (Hawaiian Plant Studies, 3.) Pp. 4. (Honolulu: Bernice P. Bishop Museum.) [1712

Cornell University: Agricultural Experiment Station. Bulletin 628: An Economic Study of Grape Farms in Eastern United States. Part 2: Harvesting and Marketing. By G. P. Scoville. Pp. 46. Bulletin 630: Soil, Field-Crop, Pasture and Vegetable-Crop Management for Erie County, New York. Part 1: Soil and Field Crops, by A. F. Gustafson; Part 2: Pastures, by D. B. Johnstone-Wallace; Part 3: Vegetable Crops, by F. O. Underwood; Part 4: Soil Map and Soil-Type Descriptions, by C. S. Pearson, F. B. Howe and A. F. Gustafson. Pp. 120. Bulletin 633: Soils in relation to Fruit Growing in New York. Part 8: Tree Behavior on Important Soil Profiles in the Medine–Lyndonville–Carlton Area, Orleans County. By Joseph Oskamp. Pp. 22. Bulletin 634: Combinations of Corn and Soybeans for Silage. By R. G. Wiggans. Pp. 34. Bulletin 635: Weeds of New York. By W. C. Muenscher. Pp. 16. Bulletin 636: Disinfesting Soils by Electric Pasteurization. By A. G. Newhall and M. W. Nixon. Pp. 20. Memoir 176: Scab of Violet caused by Sphaceloma. By L. M. Massey and Anna E. Jenkins. Pp. 9+4 plates. Memoir 177: Aquatic Diptera. Part 2: Orthorrhapha–Brachycera and Cyclorrhapha. By O. A. Johannsen. Pp. 62+12 plates. Memoir 179: Quantitative Determination of Lactic Acid in Dairy Products. By H. C. Troy and Paul F. Sharp. Pp. 49. Memoir 180: A Summary of Linkage Studies in Maize. By R. A. Emerson, G. W. Beadle and A. C. Fraser. Pp. 83. (Ithaca, N.Y.: Cornell University.) [1712

Canada: Department of Mines: Mines Branch. Gold in Canada. By A. H. A. Robinson. (No. 769.) Pp. viii+127. (Ottawa: King's Printer.) [1812

League of Nations: Health Organisation. Report on the Physiological Bases of Nutrition by the Technical Commission appointed by the Health Committee. (Meeting held in London November 25th–29th, 1935.) (C.H. 1197.) Pp. 19. (Geneva: League of Nations.) [2012

Report of the Aeronautical Research Institute, Tôkyô Imperial University. No. 131: On the Effects of Cutting away the Trailing Edge on the Aerodynamic Characteristics of a Wing. By Tetusi Okamoto. Pp. 347–416. (Tôkyô: Kôgyô Tosho Kabushiki Kaisha.) 75 sen. [2112

Mémoires du Musée Royal d'Histoire Naturelle de Belgique. Mémoire No. 67: A Revision of the Echinoid Genus Echinocorys in the Senonian of Belgium. By Jerome S. Smiser. Pp. 52+2 plates. Mémoire No. 69: L'Aérolithe du Hainaut; étude spectrographique. Par Prof. R. Breckpot et M. Lecompte. Pp. 31+2 plates. Mémoire No. 70: Contribution à la connaissance de quelques Brachiopodes et Pélécypodes dévoniens. Par Eug. Maillieux. Pp. 42+4 plates. Mémoire No. 72: Additional Notes to my Monographs on the Free-living Marine Nemas of the Belgian Coast, 1 and 2. Written in collaboration with W. Adam and L. A. de Coninck, with some Remarks on the Ecology of Belgian Nemas. By J. H. Schuurmans Stekhoven, Jr. Pp. 36+5 plates. Hors Série. Résultats scientifiques du Voyage aux Indes orientales Néerlandaises de LL. AA. RR. le Prince et la Princesse Léopold de Belgique. Publiés par V. Van Straelen. Vol. 2, Fasc. 17: Gastéropodes marins. 1: Famille Terebridæ; 2: Famille Mitridæ. Par Ph. Dautzenberg. Pp. 208+3 plates. Vol. 3, Fasc. 17: Anomura (excluding Paguridea). By Isabella Gordon. Pp. 12. Vol. 4, Fasc. 11: Coleoptera 3. 1: Chrysomelidæ, by S. Maulik; 2: Curculionidæ, by Sir Guy A. K. Marshall; 3: Tenebrionidæ, by H. Gebien. Pp. 77+2 plates. Vol. 4, Fasc. 12: Lepidoptera 2. 1: Pyralidæ, by A. J. T. Janse; 2: Heterocera, by W. H. T. Tams. Pp. 64+11 plates. (Bruxelles: Musée Royal d'Histoire Naturelle.) [2112

Contributions of the Berkeley Astronomical Department (Students' Observatory), University of California. 2: Research Surveys of the Orbits and Perturbations of Minor Planets 1 to 1091, from 1801·0 to 1929·5. By A. O. Leuschner. (Publications of the Lick Observatory, Vol. 19.) Pp. xxi+519. (Berkeley, Calif.: University of California Press.) [3012

Catalogues, etc.

The Accurate Measurement of Temperature: with Abridged Specifications of Cambridge Temperature Measuring Instruments. (List No. 198.) Pp. 51. (London: Cambridge Instrument Co., Ltd.) 1*s*. 6*d*.

Special Offer of Books in New Condition at Greatly Reduced Prices. (Catalogue 467.) Pp. 12. (Cambridge: W. Heffer and Sons, Ltd.)

Calendar for 1936. (Newcastle-on-Tyne: C. A. Parsons and Co., Ltd.)

The Wild-Barfield Heat-Treatment Journal. Vol. 1, No. 7, December. Pp. 83–96+iv. (London: Wild-Barfield Electric Furnaces, Ltd.)

A Catalogue of Printed Books, Autographs, Deeds and Documents. (No. 513.) Pp. 100. (London: Bernard Quaritch, Ltd.)

The B.D.H. Barium Sulphate Soil Testing Outfit. Pp. 4. (London: The British Drug Houses, Ltd.)