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What's in a Name?

DURING the early days of September the section on Nomenclature of the International Congress of Zoology has discussed at Padua, with live interest and some acrimony, if we may judge from our recollection of the meetings three years ago at Budapest, questions about the naming of animals; and at the same time the British Association for the Advancement of Science has devoted two presidential addresses to a kindred problem. Clearly here is a matter which demands consideration.

It is a happy coincidence that two leading official authorities in the systematic classification of animals and plants, Dr. W. T. Calman, keeper of zoology in the British Natural History Museum, and Dr. A. W. Hill, director of the Royal Botanic Gardens, Kew, should each from his own point of view direct attention to the problems of taxonomy. Although one address supplements the other, both experts meet on common ground in deploring the fact that there is a strong tendency to deprecate the value of taxonomy and to ignore its claims to a fair share of the attentions of scientific workers. "The anatomist, the physiologist, the field naturalist, the student of one or other of the innumerable specialisations of biological science, has always been inclined to regard with distaste, if not with contempt, the work of those whose business it is to denominate, classify and catalogue the infinite variety of living things", says Dr. Calman; and Dr. Hill, echoing the same idea, laments that "we seem somewhat to have failed to attract a sufficiency of able recruits".

What's in a name, that the task of naming should be shunned by potential workers? Names are not what they were. When Linnæus put on a firm footing the binomial system of designating species, he catalogued about 4370 animals. Now the number of described species has been estimated at something in the neighbourhood of three-quarters of a million. The botanists show even less sign of vegetating in this fruitful field, for the recently issued seventh supplement of the "Index Kewensis" contained some 33,000 new specific names. This does not mean that the variety of plant and animal life on the earth is increasing at this extraordinary rate, but it does mean that the technique of naming has become more delicate, that finer distinctions are drawn between species—in other words, that the species of to-day is a different thing from the species of the Linnæan conception.

The result is obvious in the recent developments of nomenclature. In the animal world the old Linnæan binomial is giving way before a trinomial designation, and geographical races are backed by varieties. Botanists have their own specific finesse: their Linnæons are supplemented by Jordanons, the 'compound species' by the 'micro-species' (the latter the units of which the former is made up), and 'hybrid swarms' complicate the story. Now a name should be more than a simple appellation; it should be a symbol of a relationship, and the scheme of names should indicate the system of natural evolution. Whether the new manner of naming properly interprets the variety of form in the plant and animal worlds is a matter which we shall examine in due course, but it has had two harmful effects upon the progress of knowledge. Its complexities and its almost super-meticulous discriminations have put to flight the amateur naturalist, whose kind has in the past taken so great a part in the advance of British science, and it has created groups of specialists, who, retreating within the protective shell of their specialism, tend to see the world of life with narrow vision and to be satisfied with the creation of 'species' irrespective of environment or any other vital influence. Many new species founded upon minute differences and created for single specimens extracted from the herbarium or the museum stores, are cases in point.

The degree of segregation of function to which specialisation has been carried in other branches of science as well as in the taxonomic is a sign of the times. As Dr. Calman puts it, "the Poet of the Breakfast Table, laughing gently at the narrow specialism of the Scarabee, can scarcely have foreseen the day when a university in his own country would have upon its teaching staff an officer named in the university calendar as a 'Drosophilist'". This general movement often ignores the basic necessity of taxonomy, yet it becomes clearer and clearer that specific structure is linked with specific habits and functions, so that the foundation of sound description in whatever line is proper determination of species.

Has the science of classification, then, reached the stage of perfected description of species? It is often said by workers in other fields that the business of naming is a back number; that except in a few odd corners, the inhabitants of the earth have been sufficiently catalogued. The straits to which some systematists are put to define their species, and the perpetual creation and demolition of so-called new forms, give colour to the complaint. If naming is to tell anything of the history of the evolution of forms, it is indeed apparent that in some respects it must revise its methods, or perhaps one should rather say, check the exuberance of some of its devotees. It must be realised that the minute description of all the structural features of an individual or group of individuals is not the definition of a species. The single museum or herbarium specimen, divorced from the story of its habitat and growth, should be regarded as a new type only in extreme cases. Above all, study must be pushed from the laboratory into the field, and analyses of the range of variation normal in an individual, of temporary modifications in form induced by peculiarities of soil, climate, or environment generally, must build a sounder basis for descriptions of phylogenetic significance.

When all this has been done, there may still be something lacking. It has been assumed from the time of Linnæus that form defines the animal or plant. But this convention ignores the many-sidedness of the living organism, and there may be living characters which reveal specific grouping. If we are not prepared to admit physiological species as well as morphological species, at any rate we must admit that stable and well-defined characteristics may elude morphological analysis. Dr. Hill gives some interesting illustrations of the blind spot in morphology. The botanist is unable to separate two forms of the leguminous *Butea frondosa*, but the Indian lac insect feeds on one and will not touch the other. The South African Pentzias are widely distributed on the plains; but while some are eaten greedily by sheep, others are entirely avoided, and still others, usually left untouched, cause unmistakable symptoms of nervous depression when grazed. Yet no morphological difference of any value can be detected between these three forms. In another direction the common mistletoe illustrates the same problem. There is a form of mistletoe which grows on deciduous trees, another associated with fir trees, and another with pine trees; but the seeds of the pine form will not grow on fir or on apple trees, nor will the others sprout except on their own type of host. Morphological identity may conceal physiological diversity. It is significant that morphology alone cannot necessarily solve the problem of relationships. Physiology and chemistry must join hands with structural analysis before the ultimate variations or adaptations can be interpreted.

These points need not be laboured. They make

evident, however, that taxonomy has not yet reached the final analysis. It is not a back number, but in a new spirit it demands from many angles fresh study of characters and groupings. There are still problems to be solved, interesting in themselves, of service in the advance of pure knowledge, and of vital economic value; and the solution of these problems demands not only the best knowledge of the schools, but also the ingenuity of fertile and unhampered minds.

At home and abroad more scientific research workers are required, and more posts adequately endowed for them to occupy. The addresses of the presidents of the Zoological and Botanical Sections of the British Association ought to stimulate interest and recruitment in a branch of scientific work which for the moment and for no very good reason has fallen somewhat out of favour.

Haloes.

Probleme der kosmischen Physik. Herausgegeben von Prof. Dr. Christian Jensen und Prof. Dr. Arnold Schwassman. Band 12: *Die Haloerscheinungen.* Von Prof. Dr. Rudolf Meyer. Pp. viii + 168 + 2 Tafeln. (Hamburg: Henri Grand, 1929.) 11 gold marks.

THOSE who are interested in the optical phenomena of the earth's atmosphere have reason to be grateful to the editors of this valuable series of monographs, for, at no long interval after "Die Dämmerungserscheinungen", has appeared this volume dealing with the luminous rings, arcs, and patches, always beautiful and sometimes remarkably impressive, which are due to refraction and reflection of light by ice crystals suspended in the atmosphere. That these phenomena, which usually receive the general designation of halo, were due to ice crystals was suggested more than two centuries ago, and though the classical memoir by Bravais in 1847 admirably surveyed the knowledge of the time and, for certain phenomena, elaborated explanations which have required no essential modification, there are a number of matters which remain obscure at the present day. The halo of 22° and the associated parhelia (mock suns or sundogs) are the most frequently observed of halo phenomena and are well known to even the casual observer; but there are several other less common manifestations, the occurrence or form of some of which depends on the altitude of the sun (or moon), and there is as yet no unanimity of opinion as to the precise mode of origin of certain forms. On the other hand, the general theory of haloes indicates the possibility of other and as yet unrecorded forms.

The first principal section of the volume under notice is devoted to a general description of the chief halo forms (reference being made to some of the remarkable 'halo-complexes' which have been observed) and to a discussion of observational data, from polar as well as from other latitudes, with intent to reveal the frequency of occurrence of individual or associated forms of halo, and the geographical, annual, daily, and secular variation in frequency. It may be noted in passing that haloes occur more frequently than may be generally suspected, there being on the average one observation about every three days at places in middle latitudes. Certain observational series appear to indicate that there may be a restricted inverse relationship between the frequency of haloes and that of sunspots, but the evidence from other series is conflicting. It is very evident that the non-comparability of sets of observations is responsible for the inconclusive or divergent results of several of the statistical studies which have been made from time to time. The observational data are not published according to a uniform scheme, and the observations are made with varying degrees of intensiveness, the waxing and waning of individual or general interest in the phenomena being reflected in the observations.

The first section of the work concludes with a discussion of the relationships with cloud and cloudiness, and with the general weather situation. There is some evidence that in Holland the ordinary mock suns and the circum-zenithal arc, both of which are attributed to crystals floating with the principal axis vertical, occur definitely more frequently behind than in front of a depression: that is, presumably more frequently in old than in new cirrus cloud. The age-long belief in the value of haloes as prognostics of stormy or cold weather seems to receive no support when subjected to critical investigation, but it must be admitted that the number of really critical investigations of this matter is insufficient.

Hexagonal ice crystals of elementary form—columnar or laminar prisms, alone or in association, and with or without pyramidal caps—are regarded as the refracting and reflecting agents necessary to the production of haloes, and it is obvious that all physical circumstances which in any way determine the form and behaviour of ice crystals in the atmosphere, usually at the cirrus level, are relevant to any complete study of the phenomena. The dependence of form of crystal on temperature and on the rate of crystallisation; the size of effective

crystals; the nature of the motion of the crystals through the air; the effect of the quantities of crystals present; the brightness and polarisation of haloes; diffraction effects; the optical properties of ice; and the all-important rôle of refraction at minimum deviation, are treated in the second section, which deals with the general foundations of halo theory. By the very nature of the problem it is extremely seldom that any direct observation is possible on the form, size, and character of motion of ice crystals which produce a given halo. Much of our knowledge of these matters has been acquired indirectly and by analogy. Experiments with models in the form of typical ice crystals have shown that in general they tend to fall in such a way that the resistance to motion is a maximum. This, an important point in the explanation of the production of certain forms of halo, is in direct opposition to the assumption made by earlier workers. Emphasis is laid on the desirability of investigation of the physical factors determining the form and equilibrium setting of ice crystals, of the question of oscillation as distinct from rotation of crystals, and on the need for quantitative observations on the brightness and polarisation of haloes.

Nearly one-half of the volume is occupied with the discussion of the several forms—the haloes of 22° and 46°, the various arcs of contact associated with these haloes, the various parhelia, the parhelic circle, the circum-zenithal and horizontal arcs, the anthelion, the paranthelia, sun pillars, and others. A detailed survey is given of the circumstances of production of individual forms, of their characteristics and variations, and of the views of the chief workers in this field of inquiry. In this section, as elsewhere, mathematical expressions are not derived or quoted, but where necessary the results of such analysis are quoted and compared with observational data, and there are diagrams both of halo forms and of the paths of light rays through ice crystals. Certain unusual haloes are noticed, but the author does not mention that some ten years ago Besson showed that the very rarely observed haloes of about 8°, 17°, 19°, 24°, and 32° radius may all be attributed to a crystal with pyramidal ends, the pyramidal faces being inclined at 25° 14′ to the principal axis; and that, a little later and independently, Humphreys made the same suggestion but gave, from the results of X-ray analysis of ice, 24° 51′ as the value of the angle.

Useful recommendations on the technique of observation, both visual and photographic, are contained in the final chapter. There is a numbered bibliography of about 250 entries and the reference numbers are employed liberally throughout the text.

The author is heartily to be congratulated for giving us, within rather less space than is occupied by the corresponding section of "Meteorologische Optik" by Pernter and Exner, so complete an account of haloes; for keeping in the forefront the general and particular problems involved, and for succeeding so admirably in his aim to produce a book which will appeal to those outside a small circle of specialists in the subject. One regrets that there is no work in the English language with which Dr. Meyer's monograph may be appropriately compared. H. W. L. A.

The Art of Geological Map-making.

Methods in Geological Surveying. By Dr. Edward Greenly and Dr. Howel Williams. Pp. xvi + 420. (London: Thomas Murby and Co.; New York: D. Van Nostrand Co., 1930.) 17*s.* 6*d.* net.

THE authors tell us that one of the earliest, if not the first, to suggest the making of a geological map in Britain was one John Aubrey, who lived in the seventeenth century. We are also told that he was described by a contemporary as "a shiftless person, roving and magotie-headed, and sometimes little better than crazed"; whether because or in spite of his suggestion is not stated. One knows, however, that, even in these enlightened days, geological surveyors are often not recognised as such. Their hammerings and apparently aimless wanderings cause wonderment and comment, the latter sometimes caustic.

It seems that, in Great Britain, the functions and, in fact, the very existence of a Geological Survey are not so widely known as is desirable, at least to the general public. The appearance of a book which, among other things, directs attention to this branch of scientific activity is therefore welcome.

The senior author, Dr. Edward Greenly, received his early training as a member of the Scottish staff of the Geological Survey of Great Britain. Afterwards he pursued his detailed survey of Anglesey for twenty-four years, with results well known. Dr. Howel Williams, in addition to his work in Wales, has taken part in pioneer surveying in the United States. Their combined experience well fits them for the task they have undertaken.

The manual is intended for those desiring to know how geological maps are made, and is not concerned with their interpretation. The authors maintain as the principal aim of geological mapping that it should be an end in itself rather than a means

to an end. To us this point of view seems a little over-stressed. Surely the production of a map, however important, must always be a corollary to the geological survey undertaken first of all to gain knowledge, be it scientific or economic, of the geology of a country.

While primarily intended for the use of those who have the advantage of large-scale topographical maps, the book also deals with pioneer and reconnaissance mapping.

Part I. is devoted to introductory and historical matters only. Though full of interest, it is somewhat surprising to find that it occupies one-third of the text. That this is so is less astonishing when, for example, we discover that two and a half pages are solely occupied with the etymology of one word—'chart'. In addition to the evolution of geological cartography, the history and methods of construction of topographical maps are discussed here.

There is much in Part I. to repay the general as well as the geological reader, especially in these days of motoring and cheap maps. Few give a thought to the care and labour involved in their production. It cannot, however, be maintained that much of Part I. is essential to the stated objects of the book.

Part II. consists of a detailed exposition of the methods of mapping employed by the authors and others in Great Britain and elsewhere. It includes notes on the preparation and care of maps, note taking, specimen collecting, and other incidentals. In addition, there are chapters on the use of surveying instruments. The methods elaborated seem to be thoroughly sound, and we cannot offer any major criticisms. Each individual mapper will incorporate his own idiosyncrasies in his own maps, but if he bases his field work on the system here advised he will not go far wrong.

Appendix I. includes an explanation of the frontispiece. This is a poorly reproduced facsimile of one of Dr. Greenly's field maps. Apart from poor reproduction, we should have expected something better after reading the text.

There are also three tables of useful mathematical constants, and the book concludes with an extensive bibliography.

The difficulties of geological surveying are summed up in the statement that while a topographical surveyor maps what he sees, the geologist, as often as not, must map what he cannot see. The authors therefore recommend caution at all times, and attention to detail. They rightly insist that on field maps observations should in all cases be distinguished from inference. There is a not inconsiderable number of geologists who are in the habit of indulging in sporadic bouts of field work, more for the purpose of obtaining results for publication than with any idea of producing a worth-while map. Considerations of time may militate against their acquiring the knowledge of field technique that can only come from prolonged work in the field. To them especially, and also to students in general, the counsel of perfection expounded by the authors is specially recommended.

"Methods in Geological Surveying" contains much that is discursive. If limited to matter essential to its scope, it might have been reduced very considerably in size and, more important, in price. Then, however, there would have been left only the bare bones of a text-book. As it stands the book is eminently readable, and may, we think, be perused with pleasure and profit by all geologists.

Bacterial Housekeeping.

Bacterial Metabolism. By Marjory Stephenson. (Monographs on Biochemistry.) Pp. xii + 320. (London, New York and Toronto: Longmans, Green and Co., Ltd., 1930.) 18*s.* net.

THE chemical action of bacteria (and other micro-organisms) has always aroused great interest for two reasons. The weight of material which undergoes change frequently stands in striking disproportion to the weight of the organisms which provoke the change, and the products, in contrast to the few simple end substances formed by the oxidation of food materials in the animal body, are diverse in kind and often complex in nature. The clue to the explanation of these phenomena lies in the fact that bacteria and many other micro-organisms possess, in addition to the aerobic mode of life in which food materials are oxidised by the aid of atmospheric oxygen, the faculty of acquiring the special compounds requisite for growth and the energy for both growth and maintenance by an anaerobic process. In this atmospheric oxygen is not involved, since it consists in producing a rearrangement of the atoms of the food materials so that the resulting compounds, often of a highly complex nature, contain less energy than those from which they have been formed. This process, known generally as fermentation, results, as was first pointed out by Lavoisier, in the transference of oxygen and hydrogen from one atom to another in such a way that one part of the molecule becomes oxidised and another reduced,

the bonds between the carbon atoms being often simultaneously broken, so that a number of smaller molecules are produced.

Peculiar interest also attaches to the autotrophic bacteria, which, as the author points out, are, like green plants, independent of other living beings and are, moreover, independent of the energy of light, since they are able to utilise the energy liberated by oxidation of various inorganic materials (for example, sulphur or a ferrous salt) for the conversion of carbon dioxide into assimilable carbon compounds.

The present work is one for which biochemists have long been waiting and it will be received with gratitude. The predominant interest attached to bacteria as the prime causes of disease has overshadowed the study of their general physiology, and, as the author says in her preface, it is indeed "time that an attempt should be made to arrange the scattered data in order to appraise our knowledge of bacteria as living organisms".

This has been very effectively accomplished, and the successive chapters, which cover the whole field of bacterial metabolism, all show evidence of diligent search and wise selection.

As might be expected, the chapter on respiration is of particular interest and presents an extremely interesting picture of the work of the Cambridge School, in which the author of the book has herself taken such an important part.

It has, of course, not been found possible to deal with equal thoroughness with all the subjects discovered; thus the section on the death-rate, in which reference is made to the large subject of disinfection, might usefully have been expanded.

An appendix is provided dealing with practical methods, and the work concludes with a most valuable bibliography, extending to thirty pages.

ARTHUR HARDEN.

The Comparative Anatomy of the Brain.

The Evolution of the Nervous System in Invertebrates, Vertebrates and Man. By Dr. C. U. Ariëns Kappers. Pp. vii + 335. (Haarlem: De Erven F. Bohn, 1929.) 8·75 g.

WHEN the International Brain Commission met in 1905 at the Royal Society's rooms in London, it recommended the establishment of a central institute for brain research in each of the countries represented. While most of the representatives regarded this resolution as the expression of a pious wish not likely to be realised, the Royal Academy of Sciences in Amsterdam set to work to found such an institute as the Brain Commission recommended and placed Dr. Ariëns Kappers in charge.

It is no exaggeration to claim that this enlightened course made Amsterdam the chief centre for the investigation of the comparative anatomy of the brain, not merely for Holland but also for the whole world. During the War, the issue of three large volumes on the comparative anatomy of the nervous system in vertebrates and invertebrates by Dr. Ariëns Kappers and Dr. Drooglever Fortuyn, providing as they did the most impressive collection of data yet made available on this subject, revealed the great significance of the work accomplished during the first ten years of the Brain Institute's work, and set the seal of success upon the Royal Amsterdam Academy's enterprise.

The first half of the valuable book that has just been issued in English may be regarded as a concise and generously illustrated summary of the large treatise, brought up-to-date. Like all Dr. Ariëns Kappers's writings, it is a simple and lucid statement of the present state of knowledge, in which the often conflicting views of different workers are fairly and fully stated, along with the solid background of Dr. Kappers's own observations. It is a general survey of the facts relating to the nervous system as a whole in invertebrates and vertebrates, and especially the comparative anatomy of the cerebral cortex, striatum, thalamus, cerebellum, medulla oblongata and spinal cord, together with a useful account of the evolution of what Dr. Kappers calls the 'metabolic tissue' of the central nervous system.

This section of the book will be of particular value to students of comparative anatomy and psychology in providing them with a brief and easily understood survey of the whole field of comparative neurology.

The latter part of the book is a comprehensive survey of the literature, and Dr. Ariëns Kappers's original observations, on what he calls the anthropology of the brain, "written in the hope that it may increase the interest in this much neglected field and stimulate further research". It gives a succinct and well-illustrated account, with an excellent bibliography, of the work which has been accomplished in the study of endocranial casts of the extinct members of the human family and of the actual brains of the various living races of mankind.

The volume is a most useful book of reference, with an exceptionally full index.

G. ELLIOT SMITH.

Our Bookshelf.

Northern Rocky Mountain Trees and Shrubs. By Dr. J. E. Kirkwood. Pp. xvii + 340 + 35 plates. (Stanford University, Calif.: Stanford University Press; London: Oxford University Press, 1930.) 35*s.* net.

DR. JOSEPH EDWARD KIRKWOOD, the author of this work, made a life study of the flora of the northern Rocky Mountains, but, unfortunately, he died suddenly in August 1928, whilst the present book was in course of preparation. The title indicates the scope of the work, and the region included embraces the country from the Yellowstone Park, north and north-west through Montana and Idaho and the Canadian Rockies, covering the various ranges and the closely adjacent plains. The limitation of area naturally excludes from this work many of the well-known trees and shrubs of western North America, but in an introduction describing the area and the peculiar distribution of various genera and species, we find that 79 genera and 248 species are found in the region under notice. The introduction is ended by a key to the 27 families concerned. *Salix* is the most prolific genus in species, for some 51 are described.

Beginning with Pinaceæ, the various families with their genera and species are then passed in review. A family description is first given with a key to the genera, then follows a description of a particular genus with keys to the species and good specific descriptions, with excellent illustrations of shoot, leaf, flower, fruit, and seeds. Some eighty-seven figures of this description are included in the 340 pages to which the book runs, whilst there are thirty-five full-plate photographs. The descriptions are in non-technical language and should not create difficulties for the person who has little or no botanical knowledge, but in some quarters difficulties may arise through the splitting up of genera. Thus, for the well-known shrub *Spiræa discolor* Pursh, the name of *Holodiscus ariæfolius* Greene is used. The generic name of *Neillia* gives place to *Opulaster*; *Rubus parviflorus* Nutt. is described as *Bossekia parviflora* Greene, and *Spiræa millefolium* Torr. as *Chamæbatiaria millefolium* Maxim. Where this division of genera occurs it would have been an advantage had the well-known names been bracketed with the ones used.

A Study of the Induction Motor. By Dr. F. T. Chapman. Pp. xvi + 289. (London: Chapman and Hall, Ltd., 1930.) 21*s.* net.

THE induction motor is one of the most useful mechanical slaves that man has ever invented. It is deserving, therefore, of the most careful study, and engineers will welcome a good exposition of the theory. They will find it in this book. Dr. Chapman was the designer of alternating current machinery to Messrs. Greenwood and Battey of Leeds. He was afterwards senior lecturer and superintendent of the testing department at Faraday House, London. He is now an inspector of technical colleges for the Board of Education. His experience therefore qualifies him in every way for writing a treatise on electric motors, and in particular of the induction motor, of which he has always made a special study.

The book contains a great deal of original matter now published for the first time. The student will welcome the author's method of finding the fundamental equations and developing the circle diagram on the assumption that the motor may be replaced by a stator and rotor made from magnetic material of infinite permeability, the air gap being bounded with smooth unbroken surfaces. Afterwards the length of the air gap used in the formulæ is corrected in order to take into account the presence of slot openings and the saturation of the iron.

The author shows that the theory can be readily developed by simply using algebra and geometry. Those who think that there is something specially powerful in vector algebra, which the reviewer does not, can easily convert Dr. Chapman's proofs into that form. Several firms make electric motors only, four or five of which are required for every cine-sonoro (talkie). This book will be of great use for designers.

Photographic Printing Processes. By Capt. Owen Wheeler. Pp. xvi + 260 + 6 plates. (London: Chapman and Hall, Ltd., 1930.) 8*s.* 6*d.* net.

THE average amateur is generally content to confine himself to the practice of one or two photographic printing processes. He is not aware of the many other processes, varied in nature and giving beautiful results, which will repay his attention; to some extent the same is true of the professional photographer. To both these classes this book should make an appeal. Capt. Wheeler embodies largely his own extended experience in the description of processes ranging from print-out, through bromide, carbon and carbro, gum-bichromate and its variants, dye-printing, etc., to colour printing. The details given are such that it should be easy for novices in a particular process to go straight ahead and acquire proficiency. The scientific principles involved are not discussed, and only the simplest chemical terminology is used.

Rasa-Jala-Nidhi: or Ocean of Indian Chemistry, Medicine and Alchemy. Vol. 3. Compiled in Sanskrit by Bhudeb Mookerjee. With English translation by the Author. Pp. xxxvi + 390. (Calcutta: The Author, 41A Grey Street; London: Luzac and Co., or Arthur Probsthain, 1930.) 6 rupees.

MR. MOOKERJI is a medical practitioner who is publishing a series of volumes on the pharmacopœia of drugs prepared from minerals, based on ancient sources. His work is of interest to students of Indian chemistry and medicine, although it is sometimes without apparent logical arrangement and contains a great number of names of plants and materials transcribed without the elucidation necessary for European readers. The present volume deals with the metals, gems, alkalis, salts, poisons, oils, and fermented liquors. The Sanskrit text is given, followed after each section by an English translation.

Letters to the Editor.

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

The Observation of the Opposition of Eros.

IN *Astronomische Nachrichten*, No. 5722, is published an article "Zur Beobachtung der Eros-Opposition", by Prof. Hartmann, in which certain recommendations are made to those who will be co-operating on the observations of Eros around the forthcoming opposition.

As chairman of the Solar Parallax Commission of the International Astronomical Union, I desire to state that some of these recommendations cannot receive the support of the Commission. Prof. Hartmann recommends that observations should be limited to the period 1931, Jan. 1 to Feb. 26, and that they should be secured at intervals of four days throughout this period, except that from Jan. 25 to Feb. 6—when the parallax of Eros has practically its maximum value—observations should be secured daily. Southern observers are recommended to obtain daily observations, in addition, on Mar. 14–18, when Eros is near a stationary point. He further recommends that observations should be secured at large east and west hour angles only, and states that observations on the meridian, between a northern and southern observatory in co-operation, are not to be recommended in view of the possibility of observations being frequently secured at one of the co-operating observatories and not at the other. He considers that the advantages of the co-operative and practically simultaneous observations—elimination of the errors of positions of comparison stars and of the ephemeris of Eros—do not outweigh the loss of weight in parallax factor as compared with observations by the east-west method.

The co-operative programme of observations has for its purpose the accurate determination of (1) the solar parallax, (2) the mass of the moon and other related constants. In so far as (1) is concerned, limitation of observations to the period recommended by Prof. Hartmann would undoubtedly provide adequate weight for the derivation of the solar parallax, if weather conditions were satisfactory throughout the period.

It must be remembered, however, that observing conditions at this time of year at most places in the northern hemisphere are not generally satisfactory, and that long spells of cloudy or unsettled weather are possible. By the end of February Eros will have moved too far south to be accessible to most of the co-operating observatories in the northern hemisphere, and if observations have been unduly interfered with by bad weather, it will then be too late to obtain additional material. From this point of view, it is desirable that northern observatories should secure observations before Jan. 1. From the middle of November the parallax of the planet is greater than 20″, increasing to nearly 40″ at the end of December; observations during this period can add appreciable weight to the derivation of the solar parallax. Observers in the southern hemisphere are more fortunate in that Eros is first accessible when its parallax is near its maximum value, and the extent to which observations need be continued as the parallax decreases will be conditioned by the weight of the material already accumulated.

As regards (2), observations over as long a period as possible are required in order to cover a number of lunations and so enable the lunar equation term to be more satisfactorily disentangled from the errors of the ephemeris of Eros. In this connexion, the experience of Mr. Hinks on the discussion of the observations secured at the 1900–1901 opposition (when the maximum parallax was only 28″) may be recalled (*M.N.R.A.S.*, **70**, 63, 1909): "For the parallax determination the observations made after Christmas 1900 had very little weight. But, on the other hand, it will appear that the part of the series most valuable for the determination of the mass of the moon is the latter half, from the middle of December to the end of February. It is fortunate, therefore, that some observers persevered throughout the unfavourable months of January and February, 1901, after those whose main interest was the solar parallax had stopped work." Dr. Jackson (*M.N.R.A.S.*, **90**, 742, June 1930) has recently directed attention to the discordance between the observed and theoretical values of the constant of nutation and the importance in this connexion of a determination of the mass of the moon. It is hoped that all observers will plan their observations with the view of providing material for the determination of the mass of the moon as well as of the solar parallax.

With regard to the co-operative observations between northern and southern observatories, these are not being planned to the exclusion of observations at large hour angles, but will be in addition to them. Observations obtained at one observatory, when conditions are unfavourable at the other, need not be wasted, as such observations can be utilised in connexion with the derivation of the errors of the ephemeris of Eros and of the mass of the moon. On the other hand, the simultaneous observations at the two observatories are ideal for the derivation of the solar parallax, being entirely independent of errors of comparison star places and of the ephemeris of Eros.

H. SPENCER JONES
(Chairman, Solar Parallax Commission, I.A.U.).

Royal Observatory,
Cape of Good Hope,
Aug. 29.

A Simple Lecture Demonstration of Lattice-'Planes' in Two Dimensions.

STUDENTS frequently find some difficulty in picturing lattice-planes in X-ray crystallography, and in their elucidation, apart from isometric drawings and models of crystal forms and lattices, recourse is usually made to drawings of a two-dimensional lattice. I venture to hope that the following simple demonstration may be of service to those who have to lecture on this subject.

The device is an adaptation of the lecture-demonstration of optical diffraction patterns projected on a screen across the lecture theatre—a demonstration which is not so often shown as it deserves to be. By means of a condensing lens, the light from an arc is focused in front of a narrow slit, so that the length of the slit is filled with light, and a thin pencil of light passes beyond the slit to the diffracting object, placed (say) one foot away from the slit. In these circumstances, beautiful diffraction patterns of wires, straight-edges, needle-points, etc., can be readily observed by the audience on a screen placed several yards away. It is often advantageous to tilt the screen and so broaden the fringes.

If, in this arrangement, the diffracting object is replaced by an ordinary square-mesh wire gauze arranged normally to the incident light, it becomes

an effective lecture-demonstration of lattice-'planes' in two dimensions. Assuming one set of wires of the gauze to be vertical and parallel to the slit, only the vertical wires cast sharp shadows on the screen, the horizontal wires being ineffective because each point of the slit casts its own shadow, as it were, of each point of the gauze. We thus see on the screen a series of vertical line-shadows, with their accompanying diffraction patterns, often very beautiful, especially at distances of several yards. These vertical lines (Fig. 1) represent the (1·0)-rows ('planes') of the two-dimensional lattice, in which the points of intersection of the vertical and the horizontal wires are the *units* of the lattice. If we turn the slit through 45°, the diagonally elongated shadows of the units give rise to well-defined linear shadows on the screen, representative of the (1·1)-'planes' in the lattice (Fig. 2). For various intermediate positions of the slit, quite a number of such well-defined, inclined shadows of the units can readily be seen on the screen, running parallel to one another. Moreover, the intensity and distance apart of the shadows increase, almost without exception, with the number of units per unit length in the relevant 'plane'. Fig. 3 reproduces the pattern which corresponds to the (3·1)-'plane' of the gauze, and I have succeeded in photographing several others, but the three figures here shown will suffice to illustrate the generality and effectiveness of the demonstration.

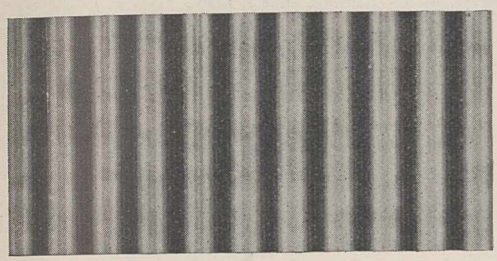


FIG. 1.—(1·0)-'Planes'.

Only the simpler figures are suitable for demonstration to a seated audience, but by viewing the screen close up, I have had no difficulty in observing and identifying the figures corresponding to the following 'planes': (1·0), (7·1), (6·1), (5·1), (4·1), (3·1), (2·1), (1·1), (3·2), (5·3), (4·3), (5·4), (6·5). Other weak figures have been observed, but not identified with certainty. For all the gauzes I have examined, the figure corresponding to the (2·1)-'plane' is exceptional in its behaviour. Instead of giving bold black shadows, it gives fine-line and weak shadows, correctly spaced, and generally accompanied by a weaker component on either side of each of the main shadows. I have not succeeded in explaining why the (2·1)-'plane' behaves in this way.

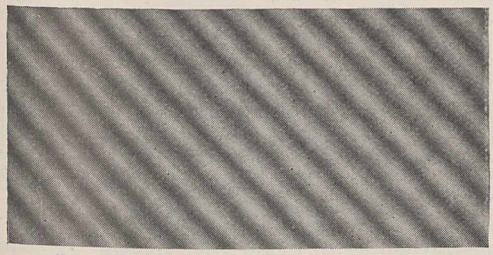


FIG. 2.—(1·1)-'Planes'.

The experiment can be performed with gauzes of different size of mesh, but the most satisfactory results have been obtained with a gauze with wires about 1/3 mm. thick, and of spacing about 1·3 mm. The spacing of such gauzes usually differs in perpendicular directions by several per cent, and with the one used in taking the photographs here reproduced the angle corresponding to the (1·1)-row was calculated to be 42° 35′ (instead of 45°); the actual amount through which the slit, mounted on a circular scale, had to be rotated from the vertical to obtain this figure most clearly was found to be 42° 39′—a very satisfactory agreement. Perforated zinc or copper gauze, with hexagonal pattern, can also be effectively used in the demonstration, and generally shows a periodicity in the patterns and intensities obtained, owing to the periodic grouping in the spacing of the perforations. Good results are also given by the use of positive or negative plates obtained by photographing point-row lattices or squared paper with prominent black lines on a white background, especially when a permanent set of 'grids' is required for demonstration purposes, as different types of lattice can readily be drawn and photographed. In general, however, ordinary square wire gauze is a convenient and ready-at-hand lattice, sufficient for most purposes.

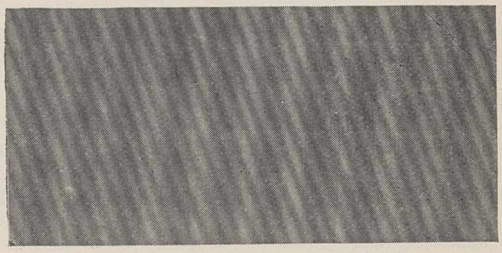


FIG. 3.—(3·1)-'Planes'.

The accompanying photographs were obtained by exposing bromide paper on the screen, placed about six feet beyond the gauze, and taking bromide paper positive contact prints of these negatives, using a 'Lumino-phor-Leuchtfolie' as the source of contact illumination.

In conclusion, it may be of interest to direct attention to an interesting optical effect obtained with squared paper—black lines on a white surface. On looking at this surface perpendicularly, and moving the eye to different parts of the surface, the intersections of the black lines appear to have white centres, and one gets an impression of two perpendicular sets of white diagonal lines over the surface—the (1·1)-'planes' of the lattice. The effect is more pronounced by observing the squared paper (card is preferable) at grazing incidence, and in the appropriate orientation of the card, when one has no difficulty in observing 'white lines' crossing the card in the directions of the (1·1)-, (2·1)-, and (3·1)-'planes'.

ROBERT W. LAWSON.

Physics Laboratory,
University of Sheffield,
Sept. 1.

Chromosome Behaviour of Triploid Œnothera.

IN two recent issues of NATURE, Darlington [1] and Gates [2] have entered into a discussion of synapsis in triploid Œnotheras. The root of controversy lies in the novel observation and interpretation of Catcheside [3] that a continuous ring of 21 chromosomes was formed in a triploid plant. Having been engaged for the past two years in an investigation dealing with the genetics and cytology of triploid Œnotheras, I

have naturally focused my attention on all published accounts of polyploidy, particularly those which deal with chromosome behaviour in triploids. At the suggestion and under the guidance of Prof. G. H. Shull I undertook the studies of triploid Œnotheras, the origin of which he has described in a recent paper.[4] Fifteen triploids were turned over to me in the fall of 1928 and their cytology was studied. I have since then made cytological analyses of buds of triploids in the summers of 1929 and 1930. The triploids studied in the last two years have all been derived from pure *Œ. Lamarckiana*. As the chromosome behaviour in triploid Œnotheras has become an issue of lively interest, I report here such observations as are pertinent to the fundamental point under discussion. My observations were based on paraffin sections stained with Heidenhain's iron-hæmatoxylin and on smear preparations of pollen mother cells stained with iron-Brazilin.[5] My microscopic preparations have been examined both by Prof. E. G. Conklin, under whose supervision I have acquired my cytological technique, and by Prof. Shull.

In microsporogenesis of triploids, it can be frequently observed that rows of pollen mother cells in different phases of mitosis occur in the same bud. Not infrequently also, pollen mother cells in various stages of cell divisions are found in a single anther segment. This condition enables one to trace with accuracy the various phases of meiosis. Microscopic slides, particularly the paraffin sections, are now available which show the stages from early presynizesis up to the reconstitution of daughter nuclei. I have observed that the threads issuing from the synizetic knot are single in Nature, as evidenced by the presence on them of a single row of chromomeres. In the second contraction stage the pachytene threads also remain single and later the chromosomes are formed as single segmented bodies invariably connected end to end, and undoubtedly conjugation has occurred in telosynaptic fashion. This arrangement of chromosomes is in many instances, especially the *Y*-shaped (trivalent) chromosomes, in agreement with the earlier account of Håkansson,[6] and it confirms some of the observations which were made by Darlington [1] on Catcheside's slides.

In my triploids are shown two or more chains open or closed to form rings, *Y*-shaped trivalents, unpaired chromosomes, and single pairs of chromosomes in the form of rings. These ring pairs generally encircle the long axis of the chain. All prophase spiremes seem to be characterised by the presence of trivalents which are formed in various shapes, the predominating one being *Y*-shaped. The open chains are often branched at one end with from 1 to 2 chromosomes in a branch. In no case could it be observed or even inferred that the 21 chromosomes were all united in a single circle. Paraffin sections and uncut cells of smear preparations gave essentially identical results. The various types of chromosome rings and configurations persist in the formation of multipolar or bipolar spindles at meiotic metaphase. At metaphase plate they aline themselves in the characteristic zigzag manner of other Œnotheras, and the plate shows two or more circles or chains interlacing with one another. In anaphase the chromosomes seem to orient themselves at haphazard with respect to the poles to which they move. In this chromosome separation two members composing the trivalent move to one pole and the third to the other.

It is not within the scope of this short account to discuss the interpretations of the chromosomal configurations here described. Suffice it to put on record at this time that the chromosome associations, especially the trivalent forms, are quite characteristic of meiosis in Œnothera triploids. A fuller preliminary account of these investigations is appearing in the *American Naturalist*.

José M. Capinpin.

Biological Laboratory,
Princeton University,
Aug. 1.

[1] Darlington, C. D.: Nature, May 17, 1930.
[2] Gates, R. R.: Nature, June 7, 1930.
[3] Catcheside, D. G.: *Trans. Roy. Soc. Edin.*, **56**, part 2; 1930.
[4] Shull, G. H.: *Proc. Nat. Acad. of Sci.*, **15**; 1929.
[5] Capinpin, J. M.: *Science*, **72**; 1930.
[6] Håkansson, A.: *Hereditas*, **8**; 1926.

Moving Striations in Positive Column in Rare Gases.

It is now well known that the visually observed uniform positive column in rare gases is in reality discontinuous, consisting apparently of a series of uniformly spaced moving striations which travel from anode to cathode.

I have pointed out the following facts in connexion with this phenomenon:

1. The light emitted does not exhibit the Doppler effect even when observing the fastest flashes moving up to 10^6 cm./sec. at the lower pressures (*Proc. Camb. Phil. Soc.*, Jan. 1925).

2. At any particular gas pressure there are at least four types of 'flash' which change one to another in a definite manner (*Proc. Leeds Phil. Soc.*, 1930) with changing current, being all independent of external inductance and capacity.

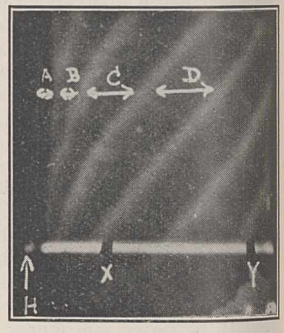


Fig. 1.

3. For one type of flash the velocity in the body of the tube is approximately proportional to the reciprocal of the pressure and is little dependent on current and tube potential (see, however, 2).

4. The current variations in the circuit are roughly about one per cent of the whole—an interesting wave form being associated with this current variation.

I have now formed the opinion that there is a good deal to be said for supposing this phenomenon to be due to a regular sequence of dark spaces travelling at constant speed in a uniform positive column away from the anode. It is clear that such a hypothesis would be in conformity with 1 and 4 above.

An additional experiment which I have just performed attempts to follow the 'flashes' right up to the cathode—which was a dull emitting lime-coated filament placed on the axis of a quartz tube.

The photograph here reproduced (Fig. 1) is of the discharge in argon. The intense white line *XY* is the uniform positive column photographed directly, punctuated at *X* and *Y* by two obstacles 10 cm. apart for reference purposes. On the left at *H* is an isolated button of light, the negative glow surrounding the cathode. The Faraday dark space is just to the right of *H*, the anode being out of sight on the extreme right.

Above *XY* is the photograph on the same plate of the same discharge viewed in a mirror rotating with axis parallel to the tube.

The inclined white streaks are the hitherto named moving striations. Their steepness is a measure of their speed. It will be observed that in the region

above XY—away from the external electrodes—their speed is constant, as shown by the constancy of D wherever taken in this region. Nearing the cathode, however, the separation shrinks to C, then to B, the striations approach closer to each other, lose speed, but, it is noticed, never cross the Faraday dark space, the edge of which they approach in an asymptotic manner. It is important to notice that at the instant one striation has merged its identity in the edge of the Faraday dark space its successor is a distance behind of B equal to A, the Faraday dark space width.

The following table shows the approximate equality of these two distances at different gas pressures :

Photograph number.	Faraday dark space length (A in photo).	Travelling dark space length (B in photo).	Travelling dark space length in body of tube (D in photo).	Pressure in Pirani gauge.
7	0·44	0·54	1·76	20·4
18	0·67	0·67	3·30	18·0
14	1·27	1·34	3·34	10·5
12	1·39	1·39	3·90	9·7

The numbers in the pressure column are the voltmeter balance readings in the usual Pirani gauge circuit and are only included to indicate the trend of pressures employed.

R. WHIDDINGTON.
Physics Laboratories,
University of Leeds, Aug. 30.

Aucuba or Yellow Mosaic of the Tomato: A Note on Metabolism.

THE metabolism of tomato plants infected with aucuba mosaic disease is being studied at the Cheshunt Experimental Station, and a number of interesting results have been obtained. The following appear to be fairly well established under the conditions of our experiments :

1. In the early stages of infection, the removal of starch from the leaves of a plant placed in the dark is greatly accelerated except at the points of infection, which show a marked local inhibition of starch removal, often surrounded as a transient phase by a zone of accelerated removal. At this stage starch formation in the light does not appear to be affected. The local inhibition is followed at a later stage, often about fourteen days, by the removal of starch over a larger area of the inoculated leaf, slight yellowing of the chlorophyll, and a failure to form starch over this area in the light.

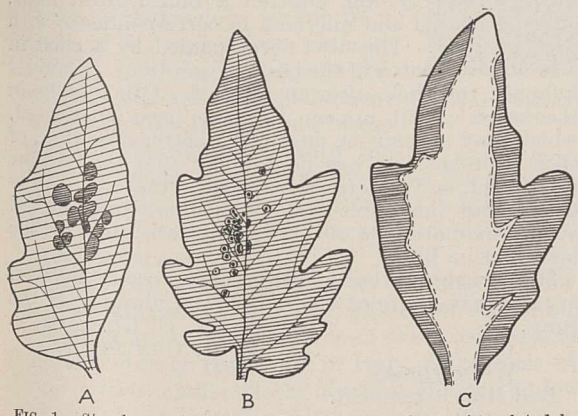


FIG. 1.—Starch reaction with iodine of tomato leaves inoculated by friction with Aucuba mosaic. *A*. Three days after inoculation, kept in greenhouse, tested 9.30 A.M. *B*. Four days after inoculation, kept in dark fifteen hours before testing. *C*. Fourteen days after inoculation, kept in greenhouse, tested 2 P.M.

2. The acidity of an aqueous extract of infected leaves sampled at dawn, that is immediately after loss of starch, is greater than that from healthy leaves.

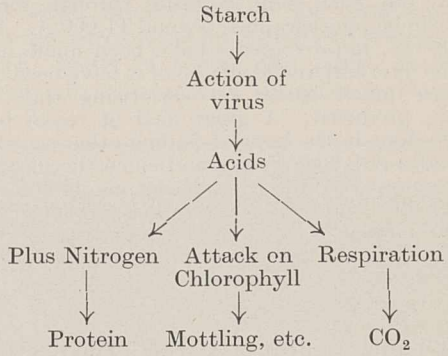
3. Local absence of starch in the leaves, even during the day, appears to precede the appearance of mosaic symptoms.

4. The freshly discoloured chlorophyll appears to react with copper salts, regenerating a green colour.

5. At a later stage of infection, some days or weeks after typical mottling has appeared, a marked accumulation of starch is found in parts of the infected leaves and complete absence in other parts.

6. No definite evidence has yet been obtained as to the relative respiration rates of infected and healthy leaves.

While not desiring to attach undue importance to these results, we venture to suggest the following sequence of metabolism :



This view agrees with all the observed facts as we know them, such, for example, as the different type of winter and summer symptoms, the effect of nitrogen, darkness, and other factors on infected plants.

While much of the work must be repeated under more critical conditions, the above results appear of sufficient interest to be recorded at this stage.

BERNARD D. BOLAS.
W. F. BEWLEY.
Experimental and Research Station,
Cheshunt, Herts,
Aug. 27.

Photographic Sensitisers for the Infra-Red.

A STATEMENT which has been circulated recently (compare NATURE, Aug. 9, p. 218) that the late developments in the technique of infra-red photography have come largely from the needs of the motion picture industry is not accurate, and I think it is worth while to have the record correct.

The making of sensitising dyes for the extreme red seemed to have reached a limit about 1907 with the discovery of dicyanine, and no great progress was made until Adams and Haller at the Bureau of Chemistry in Washington discovered kryptocyanine in 1919. The Bureau of Chemistry was at that time working on sensitising dyes with the general view of making improvements in the preparation of dyes for photographic purposes. Kryptocyanine was utilised by W. H. Wright for his photographs of the Yosemite Valley from Mount Hamilton and later for his photographs of Mars. Its first use in the motion picture industry was by J. A. Ball, who used it for sensitising motion picture film for making imitation night scenes.

Kryptocyanine was not of much value in spectroscopy, its sensitising power being limited to the region below 8000 A., in which region dicyanine was already known to be effective.

Improvements in methods of sensitising with kryptocyanine have now made aerial photography possible with it, and the photograph of Mount Ranier at a distance of 227 miles referred to in the note in NATURE was made on kryptocyanine sensitised film.

In a preparation of kryptocyanine, Dr. H. T. Clarke in 1925 found another dye to be present, which was separated and found to have sensitising power for the extreme infra-red. The name of neocyanine was given to this dye, and it is by the use of neocyanine that the advances in spectroscopy have been made. The discovery of neocyanine had thus nothing to do with the demands of the motion picture industry. It was an accidental discovery resulting from the manufacture of kryptocyanine, which was being used chiefly in miscellaneous scientific work. The maximum sensitising power of neocyanine is at 8300 A.; its sensitising power begins to fall off rapidly at 9000 A., but with long exposure through screens, spectra can be photographed beyond 11,000 A. Since its discovery, improvements have been made in the use of the dye, and modifications of it have been made which are much better for sensitising than that originally produced. A great deal of research has also been done in the hope of finding other sensitisers for the infra-red, both before and since the discovery of neocyanine, but up to the present, no dye has been found which is more effective for the infra-red region than neocyanine.

C. E. KENNETH MEES.

Kodak Research Laboratories,
Rochester, N.Y., Aug. 25.

Vitamin Content of Marine Plankton.

THE appearance of the letter in NATURE of Sept. 13, by J. C. Drummond and E. R. Gunther, on the vitamin content of marine plankton, simultaneously with the résumé on p. 423 of the same issue, of the paper by G. Belloc, R. Fabre, and H. Simonnet on the study of plankton sterols, stresses the importance of a knowledge of the vertical distribution of plankton animals in the sea. It is a general rule that most of the plankton animals in Plymouth waters in sunny weather during April, May, and June live at depths below 10 to 15 metres, thus presumably avoiding the layers in which irradiation is likely to take place. In July, however, a definite change comes over the plankton, certain species previously only to be found in the deeper layers becoming abundant right up to the surface itself; this condition persists throughout July, August, and perhaps September. This seems significant in view of Belloc, Fabre, and Simonnet's findings that the sterols collected in July were found to be biologically active, whereas those collected in April only acquired biological activity after irradiation.

F. S. RUSSELL.

Marine Biological Association,
Plymouth.

Mortality amongst Plants.

ON the Cretaceous plateau that occupies so much of East Devon (800 ft.-900 ft.) beech trees flourish in considerable numbers. The roads crossing the upland are separated from the adjoining enclosures by massive earth banks that are quite remarkable for their breadth and solidity, some being upwards of twelve feet in breadth and six to eight feet in height. On these banks beech trees usually grow, and in some instances form a continuous avenue. Between the roads and the banks are shallow ditches, and in the late spring the bottoms of these ditches are completely green with the first true leaves of seedling beech. None of these come to maturity, as they are browsed off by rabbits. Even in the enclosed 'rough lands' beech seedlings exist in abundance, but only where some protective environment occurs does the seedling achieve maturity. The mortality must be enormous.

The seedlings of *Pinus sylvestris* offer a complete contrast. Extensive plantations of this tree exist all over the upland plateau, the woods frequently surrounding waste common land. The seeds find their way to the open commons and the seedling plants practically all reach maturity, so that in a very short space of time a piece of open common land becomes a Scots pine wood. It is obvious that in this case the resinous excretion of the plant preserves it from the attacks of the hordes of rabbits inhabiting the district.

Seedling oaks are rarely seen in any quantity, however prolific the autumn crop of acorns may have been. The oak in this district is principally a tree of the lowland, and in the autumn the droves of pigs from the numerous farmsteads effectually clean up the supply of dropped acorns around the enclosures, and very often in the country lanes also.

G. T. HARRIS.

Buckerell, E. Devon.

Noise Associated with Lightning.

THE thunderstorm which burst upon Petersfield on the night of Aug. 29–30 was accompanied by an unusual effect on the electric lighting system in a house on Bell Hill, distant 1¼ miles from Stoner Hill, where the same storm was observed by Capt. C. J. P. Cave (NATURE, Sept. 13).

The lightning was first noticed shortly after 9 P.M., and flashed incessantly every ten to thirty seconds, but was not at its nearest to Bell Hill until 1 A.M. to 2 A.M., when, to judge from the interval of ½–½ second between the flash and the thunder, a storm centre was within 500 feet.

At the time of observation there were no lights burning in the house. Simultaneously with the nearest lightning flashes, an electric light bulb, hanging from the ceiling, emitted a bluish green light, which flickered and quivered in correspondence with the lightning. This was accompanied by a click in a small pear switch of the lamp in question. Thunder followed the click, after an interval. Other bulbs in the same circuit appear to have been unaffected, which may perhaps be due to the better insulation of their switches. It was next found that the current had failed, and we afterwards learnt that the supply throughout the whole of Petersfield was interrupted at approximately 12.50 A.M. owing to a surge on the high tension line.

It is suggested that a current of electricity, induced in the mains, jumped the switch and illuminated the lamp.

M. H. D. GUNTHER.
E. R. GUNTHER.

White House,
Bell Hill, Petersfield.

A Cypriote Threshing Sledge.

IN your notice of Mr. Hornell's description of the Cypriote 'dukani' or 'tribulum' in the Research Items in NATURE of Aug. 23, it is stated that "In some parts of Spain and the Canary Islands it is in use without the flints as the straw is required whole". A specimen that I saw at work near Burgos was well provided with flints, which like those in Cyprus are of Miocene age. It is known as a 'trillo'.

JOHN W. EVANS.

62 London Wall,
London, E.C.2,
Sept. 15.

Recent Hydro-Electric Developments in Northern Italy.

By Dr. BRYSSON CUNNINGHAM.

IN a preceding article (Sept. 6, p. 371), attention was directed to an essential difference in principle governing systems of hydro-electric development in the Alps and in the Apennines, distinguished in general terms as stations of high and of low altitude. Although my tour in Italy was confined to the northern provinces, and an opportunity was not forthcoming for inspecting developments actually among the Apennines, yet the installations visited within the Alpine region did, as a matter of fact, present certain characteristics of low altitude stations; that is to say, they were in some cases more dependent for supplies of water on rainfall and river flow than on the melting of ice and snow in glaciers.

The first installation inspected was that which constitutes the main source of energy of the Società per l'Utilizzazione delle Forze Idrauliche del Veneto, itself a branch of the great Società Adriatica di Elettricità, which is one of the largest in Italy and among the most important in Europe. It supplies current to a region of considerable extent, covering the whole of north-eastern Italy comprised in the provinces of the three Venetias and Emilia, and stretching from the shores of Lake Garda to the confines of Yugoslavia. The undertaking derives its principal water supplies jointly from the River Piave and Lake Santa Croce, and develops power in a series of five stages from summit level at Lake Santa Croce to the outfalls at Castelletto and Caneva, where the discharge from these stations finally passes into the River Meschio, which conveys it to the sea. The power generated is transmitted at tensions of 70 to 120 kilovolts to the towns and cities of the districts served.

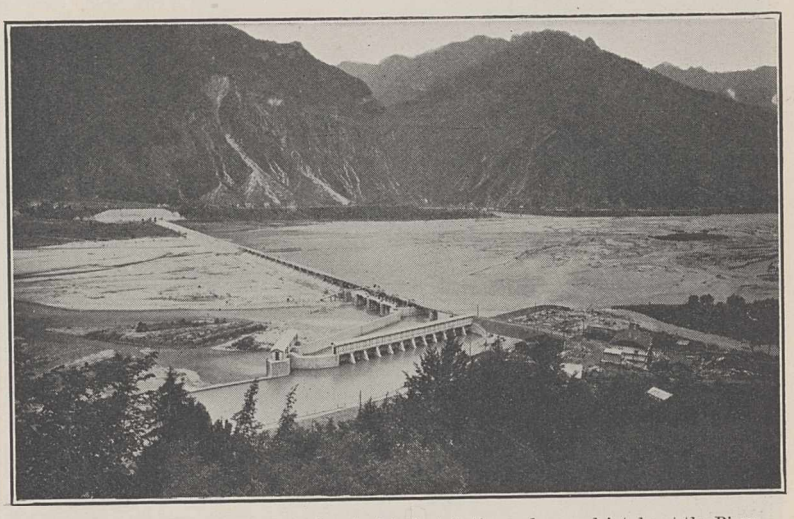


FIG. 1.—Piave and Santa Croce hydro-electric installation; dam and intake at the Piave. By courtesy of the Società per l'Utilizzazione delle Forze Idrauliche del Veneto.

Lake Santa Croce, with its surface area of 8 square kilometres and its content of 120 million cubic metres of water, is one of the most capacious natural storage reservoirs in Italy. Together with one or two smaller sheets of water among the lower slopes of the Venetian Alps some 40 miles or so to the north of Venice, it lies adjacent to the upper basin of the River Piave, and there are indications that at some remote epoch it constituted part of the course of the river in its passage from the Carnic Alps to the Adriatic. The formation of a moraine across the head of the lake has apparently resulted in blocking the passage, and the waters of the Piave are now diverted in a south-westerly direction from a point in the river some five miles above the town of Belluno. Since this diversion took place, instead of feeding the lake as in times past, the Piave has been receiving the overflow from the latter in periods of flood.

Advantage has been taken of these circumstances to effect a joint service. At or about the point of diversion above alluded to, the level of which is some 1280 feet above sea-level, the bed of the Piave has been intersected by an earthwork embankment and masonry dam, to be seen in Fig. 1, with a combined length of rather more than half a mile. The dam provides an overflow crest for a length of about 300 yards, with a set of automatic adjustable weirs for relief in times of heavy flood. The water intercepted by the dam and weir is diverted into a canal on the eastern side of the river, which, partly in tunnel and partly in the open, conveys it a distance of six miles to the northern extremity of Lake Santa Croce, there to augment the natural drainage into the lake and to raise the surface to a level which, when the works in hand are completed, will be 1266 feet above sea-level and will permit, by a lowering of the level to 1180 feet, of the utilisation of a supply of 120 million cubic metres of water for power purposes. To this end, a long earthen embankment with clay hearting is in process of formation at the northern end of the lake.

At the south end of the lake, the water passes into a tunnel which has a connexion with the lake at the level of 1059 feet above sea-level. The tunnel is nearly $1\frac{3}{4}$ miles in length and it transmits the supply to the five pressure tubes, 8 ft. 6 in. in diameter, which enter the power house at Fadalto, where five groups of turbo-alternators, each with a capacity of 24,500 horse power, are installed. There are also two other pressure tubes belonging to an earlier installation, serving two groups of generators of 4000 horse power each. A view of

the power houses and pressure tubes is given in Fig. 2. In its complete development the new power station at Fadalto will possess a sixth unit of 24,500 horse power, making a total of 155,000 horse power generation under a maximum head of 348 feet.

The water discharged from the tail race at Fadalto passes into another natural lake of much smaller size—Lago Morto, or Dead Lake—which is utilised as a storage reservoir for the next stage of descent. The Dead Lake can provide 3 million cubic metres of water in the course of lowering its surface by 13 feet from 905 feet to 892 feet above sea-level. Leaving Lago Morto by a tunnel which is 2 miles in length, the water passes onwards to the power station at Nove, where there are four pressure tubes, 8 ft. 6 in. in diameter, connected up with three groups of generators of 22,000 horse power each and two groups of 8000 horse power each, making a total capacity of 82,000 horse power for the station under a working head of 321 feet.

FIG. 2.—Hydro-electric station at Fadalto.
By courtesy of the Società per l'Utilizzazione delle Forze Idrauliche del Veneto.

From Nove the water is directed into an artificial basin, designated Lake Restello, which has been formed out of a natural depression by means of a masonry dam. At its lower end, the supply under a head of 46 ft. reaches the station of San Floriano, where there is a small installation generating some 5000 horse power.

Leaving San Floriano, the water, after passing through the little lake of Negrisiola, enters a long canal which, partly in the open and partly in tunnel, conveys it a distance of 5 miles to Castelletto and 9 miles to Caneva, the two terminal stations of the development, from each of which the discharge passes into the River Meschio, where, as a final duty, it serves to irrigate a district containing 36 million hectares. The stations at Castelletto and Caneva develop 5000 and 60,000 horse power respectively. Thus it will be seen that the series of stations from Fadalto to Caneva serve at the present time to produce no less than 280,000 horse power, and with the extensions in view the total will shortly exceed 300,000 horse power.

The whole undertaking, comprising some 25 miles of waterway in canal, tunnel, river, and lake, with dams, shafts, buildings, and machinery, is a remarkable example of resourcefulness and technical skill in overcoming natural obstacles and constructional difficulties, such as beset in a rugged country the realisation of schemes for turning the forces of Nature to useful ends. The benefit to Italy of such undertakings is of the highest importance: every water horse power realised is the equivalent of about 6 tons of coal per annum, and the Piave-Santa Croce installation alone is capable of rendering unnecessary the annual importation of more than a million and a half tons of coal.

The supply of water being to a certain extent seasonal, there is inevitably a falling-off in production during certain winter months, and, accordingly, the Società Adriatica di Elettricità has to fall back on a thermic generating station as an auxiliary for such periods as the hydraulic supply is insufficient. This station is installed at the new industrial port of Marghera, Venice, and in its present form is capable of producing 86,000 horse power, with provision for future expansion as the need for additional current production manifests itself.

The second station visited was even more northerly than Santa Croce; it is right in the heart of the Dolomites, but here again the local conditions have conduced to the utilisation of a water supply derived from reasonably continuous river flow. The station belongs to the Società Idroelettrica dell' Isarco, which is linked up with the Società Idroelettrica Piemonte, one of the leading Italian concerns. The River Isarco, a tributary of the Adige, has a catchment basin above the town of Bolzano of some 3350 square kilometres. Hydrographic data collected over a period of about twenty years show that the mean winter flow (Nov. 1 to Mar. 31) ranges from 30 to 60 cubic metres per second; that the mean summer flow (April to November) ranges from 72 to 90 cubic metres per second, and that the average for the year lies between 56·8 cubic metres and 72·6 cubic metres. As the mean annual flow only occasionally (3 years in 19) falls below 60 cubic metres, it has been considered permissible to estimate that in conjunction with a working head of 163·50 metres at Cardano, where the generating station is located, a volume of electric energy amounting to 586 million kwh. is capable of realisation, and this over a period of 7400 hours per annum reduces in round figures to 500 million kwh., of which 210 million kwh. are continuous.

The river is bridled by means of a massive dam or embankment, ten miles north-east of Cardano and a little more from Bolzano, containing a set of three large sluices and a smaller sluice. The main sluices have openings 15 metres wide, the small sluice an opening 4 metres wide. Through the intake at the embankment, the water of the Isarco enters an accumulation and sedimentation basin with a serviceable capacity of 290,000 cubic metres, excavated in fairly level ground on the right bank of the river and provided with discharge outlets into the river capable of emptying it completely.

In the station itself are installed five generating groups of 45,000 horse power each and three groups of 14,700 horse power each, making an aggregate of about 270,000 horse power. The maximum demand, or peak load, will absorb the full capacity of four principal groups, leaving the fifth in reserve for the present. The whole of the energy, except the 25 million kwh. generated by the smaller units, which will be supplied to the State railway for the electrified line from Bolzano to Brennero, will be transmitted at a tension of 240,000 volts to the transformer station of Cislago, near Milan, and thence distributed throughout the provinces of Lombardy and Piedmont.

The exceptionally great power of the installation and the unusually high tension of the transmission lines make the Cardano station of the Società Idroelettrica dell' Isarco one of the most notable stations in Europe. It is also remarkable as being the first plant in Europe working at so high a tension. This outstanding enterprise was brought into commission during 1929, but at the time of my visit to the station, at the end of May last, there was still enough finishing work to be done to occupy several months.

The last station in my itinerary in Italy was the new Ponale installation in connexion with the utilisation of the waters of Lake Ledro, which lies rather less than 4 miles north-west of the head of Lake Garda, near Riva. The Ponale is the natural discharge of the overflow from the first lake into the second and there is a fall of 1800 feet between the two. Advantage had been taken of this fact by the municipality of Riva to construct a plant adjacent to the outfall at Ponale so early as 1894. The plant was of small calibre and with gradual accretions only reached 2000 horse power in 1915. The capabilities of the location were obviously very much greater and after the War considerable attention was given to the matter, the problem being whether to enlarge the existing station or to design an entirely new installation on lines of greater convenience and service.

Lake Ledro has an area of 2·1 square kilometres, with a catchment basin of 105 square kilometres. Its surface level is 654 metres above sea level, and it is fed by two subaqueous influents and two torrential streams. Its greatest depth is 48 metres and it has a content of 75 millions of cubic metres of water. It is obviously of glacial origin, and is blocked at the eastern end by a frontal moraine. It acts, therefore, as a suitable seasonal reservoir.

The matter was settled by the action of the combined municipality of Rovereto and Riva, which with expert advice decided upon an installation with a power station at Riva, and the works were commenced in November 1924. Discarding the old power station, a new conduit for the water has been formed by means of a tunnel 6 kilometres in length and 2·9 metres in diameter, running from a point near Mezzolago to an outlet near Riva, where the water enters two pressure tubes of 1·15 metres diameter for transmission to the power house at the edge of Lake Garda below. A view of the power house and pressure tubes is given in Fig. 3.

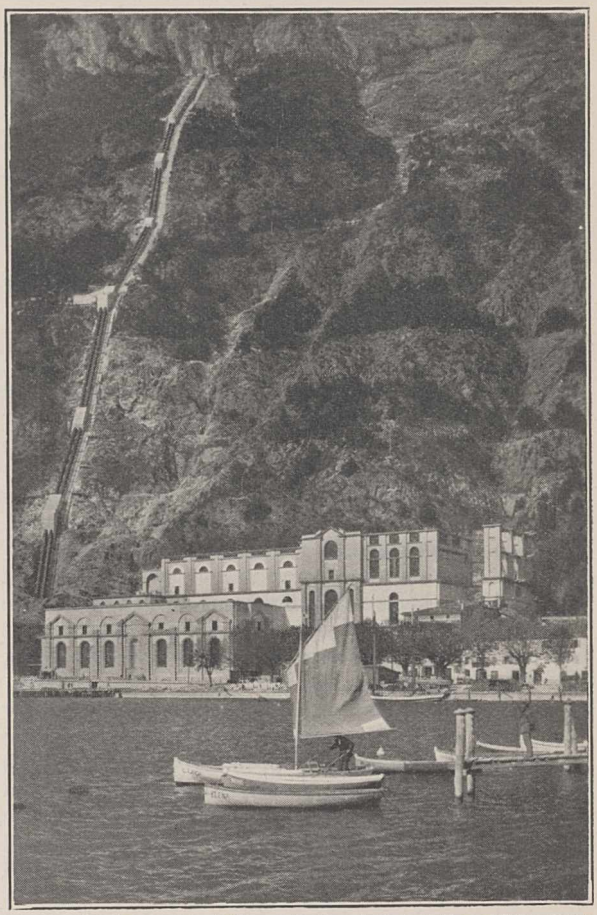


FIG. 3.—Hydro-electric station of the Ponale Installation at Riva, Lake Garda. By courtesy of the Consorzio Industriale delle Città di Rovereto e Riva.

The power generating plant consists at present of two sets of Pelton water wheels, each with an output of 30,000 horse power, coupled to alternators of 21,000 kva. capacity. A third wheel of 45,000 horse power coupled with an alternator of 35,700 kva. is in course of installation and nearing completion. There is provision for a fourth unit.

The foregoing descriptions of plant and installations, which, despite their individual importance, form but a small portion of the activities of the Italian nation in regard to hydro-electric generation, will enable some idea to be formed of the projects which are now in hand and are playing so important a part in the industrial and commercial development of the country.

Present-Day Problems in Taxonomic and Economic Botany.*

By Dr. A. W. HILL, C.M.G., F.R.S.

TAXONOMIC workers have tended to fall into one of two categories, for to some a 'species' has covered a wide range of forms grouped around a mean type, while others have taken a more restricted view and their species have represented far smaller and more sharply defined classificatory units. Both methods have been of value; the broader view has had its advantage very often in relation to questions of geographical distribution, while the narrower one has caused us to inquire into questions relating to the origin of species themselves and the significance of so-called 'varieties'. They have also had their drawbacks, since in one case many matters relating to the influence of habitat, general conditions, etc., have not been fully appreciated, while in the other the possibilities of hybridisation, segregation, and adaptation have usually received little or no recognition.

The intensive study of the flora of a region, or of particular genera, such, for example, as *Rubus*, *Taraxacum*, or *Hieracium*, has led in some cases, I feel, to the adoption of a very narrow outlook, which has tended to detract from the importance of taxonomic work in the eyes of the younger botanists. In the past, no attempt was made to study effects of light and shade or other environmental conditions, or to make cultural experiments to test the validity or otherwise of the find. Such experiments may involve controlled cultivation, genetical research, and very careful tabulation of statistics before full light can be shed on the true nature of what may have been regarded as a large 'compound-species' or a host of small, closely allied 'micro-species'.

Until I had the opportunity of visiting New Zealand I was not very greatly exercised about the problems underlying the species question, and was content, like others, to describe a new species from a single specimen. The extraordinary prevalence of hybridisation, however, in the New Zealand flora, seen under the able guidance of Dr. Leonard Cockayne, quickly made me realise how rash it would be to think of describing any New Zealand plant as belonging to a new species with only a single specimen before one. Here, then, is a large and vital problem which, to my mind, very greatly widens the interest and importance of our herbarium studies, since problems relating to the possible hybrid origin of the plants we are dealing with demand careful study in the field, with visits to the countries where the plants are native.

A somewhat parallel case, though of a different order, is afforded by the common mistletoe, *Viscum album*. Tubeuf gives an account of the races of *Viscum album* which are definitely associated with particular host plants. Three definite physiological races, however, are clearly marked: (1) the form which is found on deciduous trees, (2) that associated with the silver fir, *Abies pectinata* and other species of *Abies*, and (3) the form parasitic on *Pinus sylvestris*, *P. Laricio*, and *P. montana*. The races are so far distinct that seeds of the 'pine form', for example, will not grow on the apple or fir, and vice versa. Physiologically, therefore, they are distinct, though morphologically they cannot be separated. A case like this suggests that we may be witnessing the advent of three species from one, and that eventually morphological differences may also become evident.

The vegetation of South Africa supplies some taxonomic physiological problems of a like nature, which up to the present have not been satisfactorily solved. These relate to the difficulty of differentiating between two or more forms of the same species which, though distinct physiologically, cannot be separated on any structural characters. Several such physiological strains are now known in South African species of *Pentzia* and *Salsola*. There are two strains of *Salsola glabrescens*, which grow side by side. One of these plants, with purplish-red young twigs, is closely grazed, while the other, in which the young twigs always appear to be pale-coloured, remains untouched by cattle or sheep until there is nothing else to eat. It would be of great interest, therefore, could we discover how the animals are able to distinguish the palatable from the unpalatable form, since we might then become as acute as they appear to be in appreciating the significance of fine distinctions.

Then again, there are puzzling problems connected with the character of certain species on different types of soil in South Africa: for a species may be a useful pasture plant on, say, a red loamy soil, yet when the same species, growing on tufaceous limestone, is eaten by stock, a heavy mortality may result.

It is also very remarkable that the Indian lac insect (*Coccus lacca*) has directed our attention to the existence of two physiological forms of *Schleichera trijuga* (Sapindaceæ), and to two forms of *Butea frondosa* (Leguminosæ), upon one of which it feeds while the other it does not touch; yet the botanist is unable to separate them in either case!

As it is so desirable that the importance and value of taxonomic work in its widest sense should be better appreciated in our schools and universities, I think it is worth while to say something as to what is now implied by taxonomy in the light of modern developments, in the hope that taxonomy, combined with ecology, may again occupy a prominent place in the studies of our developing botanists.

It is true, of course, that the taxonomist must know his plants and must be able, with careful training, to use to the full his powers of observation and deduction, so that he can appreciate small differences, weigh evidence, and draw up descriptions in comparison with allied species, etc.; but he will not go very far if he stops there.

* From the presidential address to Section K (Botany) of the British Association, delivered at Bristol on Sept. 4.

That we are appreciating now the problems surrounding every species which we are able to examine critically, through studying it in the field, and if need be under cultivation, is a healthy sign; for it is, I think, clear that the taxonomist, in undertaking experimental and field studies, will be able to throw much light on the 'origin of species', and on the meaning and importance of the so-called 'variations' which such experimental study reveals.

This seeking after truth by means of experiment is not exactly a new development, though it may be claimed that the conception and planning, during the past few years, of new lines of inquiry has raised the status of these experiments to the definite plane of research. Isolated experiments to test the persistence of individual forms, varieties, or species have been made since Linnæus's day, but it is only in recent years that they have been carried out under careful control.

The classical experiments of Gaston Bonnier are well known. Daniel and F. Krasan have also published papers recording the direct influence of the environment on plant characters, but it is when we come to the work of Turesson in Sweden and Clements and Hall in America that the importance of transplant work to taxonomists, geneticists, and ecologists can be fully understood. The value of Turesson's work may be said to be that he has been able to come to conclusions as to the different types of variation shown by the plant he has observed, both growing wild and under cultivation, and has been able to demonstrate that in some cases they are of a heritable nature, while in others they are merely fluctuations.

These new lines of research, which bring together ecology, genetics, and taxonomy, are now being actively pursued at Potterne. Thanks to the kindness and keen interest of Mr. E. M. Marsden-Jones, the experiments are being made by him in his garden at Potterne, near Devizes, in co-operation with Dr. W. B. Turrill. Four large raised beds have been made side by side, and each has been filled with a distinct type of soil—clay, chalky clay, calcareous sand, and non-calcareous sand. On each type of soil twenty-five individuals of each of six species are now being grown, all being of known genetic origin. Climatic conditions are being recorded, and full records of all features connected with the growth and behaviour of all the plants on the different soils are being kept. The species transplanted are *Centaurea nemoralis* Jord., *Silene vulgaris* Garcke, *S. maritima* L., *Anthyllis vulneraria* L., and *Plantago major* L., while during this year *Fragaria vesca* L. has been added. It is interesting to find that the most obvious changes are taking place in *Silene vulgaris*, *S. maritima*, and *Plantago major*.

Centaurea nemoralis does not at present appear to be plastic; *Silene vulgaris* is slowly plastic under certain edaphic conditions; *S. maritima* is decidedly more plastic than its congener; *Anthyllis vulneraria* is not plastic, and is not capable of survival under a wide range of edaphic conditions, and *Plantago major* is exceedingly plastic.

In addition to what the taxonomist is seeking to discover from this intensive study of plants by means of 'transplant experiments', he is also anxious to elucidate the problems associated with certain 'critical' British and European genera, such as *Silene*, *Centaurea*, *Rubus*, *Taraxacum*, and *Hieracium*, in which botanists have described a multiplicity of species.

In the case of *Rubus* also it seems likely that carefully controlled experiments would possibly reveal the fact that habitat or hybridisation, rather than a 'fixed' type, was the *raison d'être* of several 'species'. Whatever research may reveal in these genera, it has been shown in *Centaurea* that at least three described 'species' are of hybrid nature, for exact counterparts of *Centaurea jungens* Gugl., *C. pratensis* Thuill., and *C. Drucei* C. E. Britt. have been artificially produced at Potterne.

An important development, arising out of the more intensive study of wild species and possible hybrids and the associated genetical work and controlled cultivation which is so pregnant of far-reaching results, is the need of greatly extended herbarium records and field notes. For genetical work to be of permanent value it is essential that ample material of the parent plants and their offspring should be preserved for reference; and in the case of assumed wild hybrids, representative specimens of the parents and of all the linking forms are required. I am glad to say that at Kew we have now established special 'herbaria' for genetical specimens and for hybrids, where specimens forming as complete a set as possible are kept together, apart from the general herbarium collection. We have also formed a collection of fruits and seeds, which it is hoped in course of time will be as comprehensive and complete as is the collection of the vegetative and floral specimens in the general herbarium.

Now let me turn to some problems on the economic side. In the first place, I would direct attention to the interesting observations made by Dr. A. B. Stout and others on the flower behaviour of Avocados, *Persea gratissima* Gaert. (Lauraceæ). These afford an excellent example of the assistance that the botanist can render to the grower and of the practical application of a remarkable botanical phenomenon of great scientific interest.

The Avocado pear bears hermaphrodite flowers, but they exhibit a daily rhythmic alternation of sexes reaching maturity for the entire plant. This synchronous dichogamy apparently reaches a perfection of phsyiological regulation to ensure cross-pollination unknown in any other group of plants. All the flowers that may be open at any one time, on trees of the same clonal variety, are in either the female or the male condition. If the trees belong to one of the varieties placed in 'Class A' by Stout, of which the Taylor variety is taken as an example, the flowers when they first open in the morning are found to be functioning as females with a receptive stigma, but the anthers are not yet mature. About midday these female flowers close, for none but flowers in the female state are open on the trees, and another set of flowers then opens in the early afternoon, normally

without any overlapping, so that there are never on any tree of 'Class A' flowers in the male and flowers in the female condition open at one and the same time. These afternoon flowers are found to be in the male condition with the stigma withered; the anthers are in an upright position, with their valves open and shedding their pollen.

Careful investigation of trees of 'Class A' has shown that the flowers, when they first open, function as females for some four hours in the forenoon; they then close about midday, remain closed all night and all the following morning, and reopen on the afternoon of the second day in the male condition. Self-pollination of individual flowers is thus rendered impossible by this sex-alternation, and since there is normally a definite time interval, about midday, when no flowers on trees of the same 'Class' are open, cross-pollination on the same tree or between different trees of the same clonal variety can rarely occur.

This rhythmic phenomenon is all the more remarkable because there is an entire reversal of the process just described in other clonal varieties and individual seedlings, which Stout places in his 'Class B'. In trees belonging to 'Class B' the flowers are in the *male* condition when those of 'Class A' have their stigmas receptive, and are *female* when the pollen of 'Class A' trees is being shed. These reciprocating changes in sex thus provide the opportunity for mutual cross-pollination between the trees of 'Class A' and those of 'Class B'. The practical application of this discovery scarcely needs pointing out, but it is clear that an orchard planted with trees of only one variety is not likely to yield a rich harvest of fruit!

With regard to pistachio nuts, which are grown as a crop in California, the problem facing the plant breeder, if he is to satisfy the grower, is to produce varieties bearing nuts which crack naturally. If varieties are produced the nuts of which have to be cracked by hand, they are of no value commercially, since the labour cost involved in cracking by hand in the United States is prohibitive if the nuts are to be sold at a profit! Fortunately, scientific research has now produced the desired article, and those who delight in pistachio ices, etc., can rest assured that they are coloured and flavoured by the genuine article and not by some synthetic product.

Limes, again, the staple industry of Dominica, present a curious and difficult problem. The wither-tip disease has made it imperative to carry out experiments with the object of producing races or varieties immune to the disease.

There seems good prospect of success attending these efforts. Dominica, however, is very hilly, and the lime bushes are grown on such steep hillsides that hand-picking of the fruit would be well-nigh impossible. The lime of commerce has the useful habit of shedding its fruit when ripe, so that the Dominican peasant merely has to go and collect the fruit under the trees or bushes. The problem before the plant breeder, therefore, is to produce a lime which not only is immune to disease but will also shed its fruit when ripe. Unless this second essential can be attained, the new variety is of little or no commercial value.

Dr. Walter T. Swingle's researches on the pollination of the date palm (*Phœnix dactylifera* L.) are of great interest: "Each species of *Phœnix* seems to have determined its peculiar action in ripening the fruit of the date palm. The amazing thing is that the pollen of the huge Canary Island palm used on the date palm produces a small seed, quite different from the ordinary date seed, and small or medium-sized fruit that ripens late, whereas the tiny palm *P. Roebelinii*, which has the smallest seeds of any *Phœnix*, when used to pollinate the date palm, causes the formation of large seeds, and makes large dates which ripen extremely late." The economic importance and scientific interest of these discoveries need no comment.

Systematic botanists in the past have, I think, been rather too apt to regard the 'species' they have described as fairly definite units, recognising and recording from time to time 'varieties', but, as I have said earlier, frequently without sufficient material to enable them to say what such varieties really represent, or how constant and definite they may be. In some cases they may be the so-called 'Jordanons', while in others, no doubt, as we are beginning more fully to realise, they are the resultants of hybridisation. For the majority of plants the occurrence of such 'varietal' forms appears to be of little more than purely scientific interest, and they may be passed by with only a casual comment.

When, however, almost any plant comes into the limelight of applied botany and is found to be of some economic value, then the importance and significance of varietal differences at once become apparent. A few cases may be cited in illustration:

Para rubber (*Hevea brasiliensis*) is considered to be a good botanical species, but a careful examination of the trees now being grown in plantations in the East reveals a number of forms, very similar as regards their morphological characters, but showing marked physiological differences, especially with regard to the yield of latex.

A similar problem, where the systematic botanist requires the assistance of his economic colleague, has recently been investigated in Australia by Messrs. Penfold and Morrison. This concerns the oil yielded by *Eucalyptus dives* Schæur. *E. dives* is a species easy of botanical determination, and is of economic value for its oil, which has a piperitone content of about 45–50 per cent, which is used for the manufacture of thymol and menthol. Oil has been obtained yielding only 5–15 per cent of piperitone—morphologically, however, the trees were true *E. dives*—while others contain oil with less than 5 per cent piperitone and 45–75 per cent cineol. It might be thought that ecological conditions are concerned in these striking differences—for a typical form and three distinct physiological varieties have been recognised by their oil characters—but the type form with 40–50 per cent piperitone has been found growing alongside the variety B, containing only 10–20 per cent piperitone with 25–50 per cent cineol. Here, then, is an

interesting piece of investigation which brings the botanist into alliance with the chemist. A similar problem exists with regard to camphor, where, as is well known, two, and perhaps more, physiological varieties exist in the species *Cinnamonium Camphora*, which botanists are unable to separate.

Then again, the tung oil trees, *Aleurites Fordii* and *A. montana*, the seed of which yields a very valuable drying oil, are now being introduced through Kew and the Imperial Institute to all suitable Dominions and Colonies. In these trees the flowers are borne in clusters, and each flower-cluster usually consists of a large number of male flowers surrounding a single female flower. It was noticed that certain trees bore two or three female flowers in each inflorescence. Selected seed from this 'multiple-cluster' type appears to transmit this characteristic, and trees showing this favourable variation may thus be expected to crop more heavily and yield more oil than trees with only one female flower in the cluster.

The problem, therefore, which may arise is analogous to that which confronts us with Para rubber in the matter of latex-yield or with cacao as regards permanent poor-yielders and permanent heavy-yielders. Cases such as these, and there are many others of a like nature, afford an apt illustration that economic and systematic botany can provide romances, possibly of more scientific interest to the botanist than to the commercial planter, but of so great material importance to the latter that the botanist looks to the man of affairs for the financial assistance to help him to discover their solution.

This brief summary will suffice to show that we are living in an era of progress and development, and that we are alive to the opportunities offered of widening our outlook and our interests in the domains of taxonomic and economic botany. As I have hinted earlier, our studies in taxonomic botany, to be living and of practical value, need to be transported from time to time from the herbarium to the field. In this way only can we realise fully the extent and character of variations, the effects of soils and climates, and the prevalence and significance of physiological races.

By the widening of our horizon through travel and by means of vegetational studies in the field, I feel myself on sure ground in maintaining that we are thereby more efficient, more enlightened, and more useful taxonomists, both in the pure and applied directions, than if our studies were strictly confined to the examination of the dried and mounted specimens in a herbarium.

Vast and enthralling as is the prospect, we seem somewhat to have failed to attract a sufficiency of able recruits. If this is so, then we must needs look for the reason. We may and, in fact, I think we are apt to say, like the 'children sitting in the market-place', 'We have piped unto you and ye have not danced'; but with whom does the fault lie? May it not be, as regards taxonomic botany, that we have piped on a wrong note, that 'we have' in fact 'mourned' in a minor key, and have failed to pitch our tune on the high note of enterprise and endeavour?

Need I say I refer to the millstone of nomenclature, which encumbers and weighs down the neck of the systematic botanist. The theme itself, 'taxonomic botany' in its widest sense, is full of charm and interest, but it has been so obscured that many have failed to be attracted by the grandeur and harmonies of its melody. Much of our failure to attract disciples is due, I fear, to the misplaced activities of those whom I might call our taxonomic 'Scribes and Pharisees', who have tended to substitute the shadow for the substance. It remains for us to point the way and bring the labourers into the vineyard.

We are hampered to-day in our pursuit of scientific research by the all-important and interdependent problems of recruitment and remuneration. With regard to recruitment—and naturally I am speaking only with regard to botanical science—are we fully satisfied with the efforts, laudable as they are, that are being made in our schools and universities, for training the rising generation in biological science? A good deal has been said recently about the advantages and disadvantages of early specialisation in science in the schools, at the expense of a more 'liberal' education. We realise that the last years at school are the time for laying the foundations of a sound education, and it is certainly a debatable matter whether the now prevalent severe competition (I might almost say scramble) for scholarships at the universities is not, after all, detrimental to the recruitment of those who should develop into the scientific naturalists for home and overseas appointments.

There is no question that the scientific training now given in many of the schools of Great Britain is of a very high order, and that it is given with the most splendid enthusiasm. But nevertheless may we not, owing to competition between school and school, be unduly forcing the pace and producing a superficial scientific precocity in our youth which will not stand the strain?

Science should not be looked upon as a task, but as a guiding tendency, for it is only by regarding it in this way that we can expect to produce the men with a true interest in and enthusiasm for scientific research. The flowering stage, so to speak, has been achieved before the roots and leaves have developed sufficiently to bear the fruit, and our young plants, raised from seed which may have fallen on stony places, will be found prematurely to wither away.

Then again there is a danger of the groundings of science being neglected at the universities, since there is a tendency to assume that the standard of school science teaching is that of the scholarship holder. There are, however, many who turn to science after they have had the good fortune of receiving a classical education, and I could mention botanists who only discovered their natural inclination and aptitude was towards science after they had entered the university.

There is still need to point out that the services which science can render, and for which there is so great a demand, cannot be obtained without making due provision for the cost.

News and Views.

HEARTY congratulations are extended to Prof. W. Mitchinson Hicks, who celebrated his eightieth birthday on Tuesday last, Sept. 23. Born at Launceston, he was educated at a private school in Devonport, proceeding thence to St. John's College, Cambridge, being placed seventh wrangler in 1873. Prof. Hicks was principal of and professor of physics in the University of Sheffield from 1883 until 1905. At the Ipswich meeting of the British Association in 1895 he was president of Section A (Mathematics and Physics). The Royal Society awarded him a Royal medal in 1912, during the presidency of Sir Archibald Geikie, for his researches in mathematical physics, and especially for his investigations on the theory of spectroscopy. Among researches specially associated with his name may be mentioned those on hydrodynamics, and particularly on vortex motion, published in the *Philosophical Transactions*. Prof. Hicks was elected a fellow of the Royal Society in 1885, and has served on the council on several occasions.

FRIDAY next, Oct. 3, will be the hundredth anniversary of the birth of Albert Günther, one of the most distinguished naturalists in England in the second half of last century and for twenty years keeper of the Department of Zoology in the British Museum. To mark the centenary, his son, Dr. R. T. Gunther, of Oxford, has prepared a bibliography of his father's writings, which has been published as a supplementary number of the *Annals and Magazine of Natural History* (August). A brief biographical sketch is prefixed, followed by a tabular analysis showing the wide zoological and geographical range of the subjects dealt with. Apart from the personal interest, the list of books and papers will be of great use to zoological bibliographers, since it catalogues not only the works well known to all students of the groups dealt with, but also numerous short notes in such periodicals as the *Field* which are sometimes difficult to trace. The first paper on the list is an article on animal poisons, published in 1853. The last item is the "Appendix to the History of the Collections in the Natural History Departments of the British Museum", issued in 1912, giving the general history of the Department of Zoology from 1856, the year before Günther entered the Museum, to 1895, when he retired on reaching the age limit. His death on Feb. 1, 1914, spared him the sorrow of witnessing the conflict between his native land and that of his adoption. It is to be hoped that Dr. R. T. Gunther may find occasion to expand his sketch of the life of one to whom more than to any other single individual is due the present position of the zoological departments of the British Museum.

A JOINT discussion on the relation between past pluvial and glacial periods was held between the Sections of Geology, Geography, and Anthropology at the recent Bristol meeting of the British Association, with Prof. H. J. Fleure in the chair. Prof. J. W. Gregory, who was probably the first observer to correlate equatorial pluvial with European glacial periods, devoted his remarks in the discussion to the emphasising of difficulties in taking correlations beyond the broadest outlines. Misses Gardner and Caton Thompson from work in the Fayum, Mr. Leakey from work in Kenya, and Mr. Armstrong from work in Rhodesia, all stated that they had been led to the conclusion that there were in the Pleistocene two pluvial maxima separated by a period of relative aridity. Dr. Sandford (from Egypt) had not been able to find evidence of a mid-Pleistocene arid period. European workers indicated that there was a tendency to look upon the Mindel ice age as a major phenomenon and upon the Riss and Würm phases as episodes of a second major glaciation. Prof. Sölch (Heidelberg) said that he thought Central European opinion was trending towards the idea of the subdivision of the Pleistocene ice age mentioned above, and urged British workers to bear in mind that orographical changes (an uplift of perhaps 500 metres) were among the phenomena of the later Pleistocene ice age. He gave as the general opinion of Central European glaciologists the view that the Hötting breccia belonged to the Mindel-Riss interglacial period. Dr. C. E. P. Brooks gave Dr. G. C. Simpson's view of the succession of conditions in the ice age, and then stated some of his reasons for not accepting the idea of a long arctic interglacial in the middle of the ice age. He showed that a weakening of the monsoon, and consequent aridity, would be the inevitable result of heavy glaciation on the Central Asiatic Highlands. Prof. Barbour showed that in China in the Pleistocene a pluvial period separated two more or less arid periods characterised by loess. Mr. L. A. Cammiade's observations in South India agreed with those of Prof. Barbour in China.

THE National Radio Exhibition which was held at Olympia on Sept. 19–27 was nearly twice as large as that held last year. The radio industry is apparently one of the few industries which are practically unaffected by the world trade depression. There are no unemployed on the register of skilled workmen in the radio trades and they are steadily absorbing unskilled labour. Since Madame Melba broadcast from Chelmsford about ten years ago, the progress made in perfecting the transmitting and receiving sets has been extraordinarily rapid. This is due to the fact that from the start it was recognised that progress could only be made when based on scientific principles deduced from careful physical researches. The tendency towards a standardisation of types was very apparent in this exhibition. The prices varied from about £30 for a good 'all-electric' set down to about 30*s*. for a serviceable radio set. In the making of 'all-electric' sets the manufacturers have proceeded on very similar lines of development. Good Continental reception necessitates a four-valve set, arranged preferably with a small outdoor aerial. Ability to receive at least twenty stations can be guaranteed. The lowering of the royalty charged for valves has led to the use of a greater number of them. The European stations have wave frequencies varying between 155 and 1400 kilocycles per second, and the

'all-electric' sets as a rule can be adjusted so as to receive any within this range. But few of them can be adjusted for the short-wave emissions, varying from 3748 (Rome, Prato Smeraldo) to 18,821 (Java, Bandoeng). This is no real drawback to dwellers in Europe. The British Broadcasting Corporation has put forward a scheme for an Empire broadcasting service. This will be discussed at the forthcoming Imperial Conference. It will be of interest to learn whether any of the Dominions wishes to join in this scheme.

THE summer meeting of the Newcomen Society took place at Liverpool on Sept. 15–17, thus enabling members to visit the exhibition in St. George's Hall, and the exhibition and pageant in Wavertree Playground in connexion with the centenary celebrations of the Liverpool and Manchester Railway. One day, however, was devoted to visits to certain small factories at Prescot where tools are still made by hand, and to Rainhill, the site of the famous locomotive trials of 1829. Though marine chronometers are made by various London firms, much of the mechanism is made in a small workshop in Prescot by two workmen who have inherited a business a hundred years old and possess the requisite skill and experience. In other shops were seen hand file cutting, hand broach making, and the manufacture by hand of high-class pliers and wirecutters. In file making, the steel blank in the soft state is held down on a lead block by two straps pulled down tight by the foot of the file cutter. The tools necessary are the chisel and hammer, both of special shape so as to render the action of the cutter natural. Skill is easily and quickly acquired and the teeth on a file seven or eight inches long can be cut in less than ten minutes. It is the burr raised by one cut which forms the guide to the tool for the next cut and enables the work to be done so quickly and accurately. In broach making similar dexterity was shown. The broaches being made varied in size from fine needles to lead pencils, but all were tapered and five-sided. The broach was held in a pair of pliers and laid in a groove in a bone block while being filed, and the accuracy with which the pliers were turned a fifth of a circle at each stroke of the file was not the least surprising part of the work. In the making of pliers and cutters, there were operations of an equally interesting character, and it was not a little remarkable to find these hand industries still able to hold their own in the days of mass production.

ON Sunday, Sept. 21, M. Laurent-Eynac, the French Minister for Air, unveiled a statue to Clement Ader, one of the pioneers of flight, at Muret in the Haute Garonne. Ader's experiments were carried out in the nineties of last century. Through the writings of Mouillard he studied the flight of birds in Algeria, and in 1890 built an aeroplane of bat-like form and fitted with a steam engine, which on Oct. 9, 1890, is said to have flown a distance of 150 feet. He then built a larger machine on the same lines, to which he gave the name the 'Avion', which was tried in the presence of the French military authorities, but without success, in October 1897. Ader's experiments in France, it will be seen, were contemporary with those of Lilienthal in Germany, of Pilcher and Maxim in England, and of Chanute and Langley in the United States.

THE relics of Andrée's expedition of 1897 which were found last August on White Island (or Giles Land) by a Norwegian expedition have arrived in Norway on their way to Sweden. The *Times* has published a preliminary report of the Swedish experts who have examined the remains and diaries. There were three men in the balloon when it left Danes Island, Spitsbergen : S. A. Andrée, N. Strindberg, and K. Frankel. The bodies and diaries of all have been found. The balloon came down on the ice on July 14, 1897, three days after leaving and the day after the last message was sent by carrier pigeon. This was in about lat. 83° N., long. 30° E. Instead of striking south for Spitsbergen, the men appear to have sledged eastward. They got into eddies in the drifting pack-ice and had great difficulty in making progress. By Aug. 10 they were in lat. 81° 55′ N., long. 29° E. At times the drift was even north-west. Eventually they were carried on the only part of White Island where a landing is possible, the greater part being ice-covered. There they landed on the south-west early in October 1897. Andrée's notes continue until the end of September, and Strindberg's until Oct. 17. A number of instruments, photographs, and scientific observations have also been found.

IN the twenty-fifth report of the Committee on Photographs of Geological Interest, presented at Bristol to Section C of the British Association, 141 new photographs are recorded, bringing the total of the collection to 8287. From the well-known Reader series of negatives 39 are contributed to the present additions. The Isle of Wight landslip of 1928 is illustrated by photographs by Mr. J. F. Jackson. Prof. S. H. Reynolds contributes sets from Torquay, Snowdon, South London, and Portraine. The submerged forest of Swansea Bay and the raised beach of Hope's Nose, Torquay, are illustrated by Dr. A. E. Trueman and Mr. L. N. Wheaton. River action in South Wales is portrayed by a set from Dr. T. F. Sibly, and Mr. W. F. Chubb has presented a fine view of the Severn Bore. Lundy Island is the subject of a series by Mr. A. O. Rowden. Copies of individual photographs can generally be obtained directly from the photographer concerned, to whom application should be made for further particulars. Addresses are given in the report. The Committee has already published three sets of geological photographs, and these have been widely used in teaching throughout the world. It will therefore be of very special interest to geologists to know that two new sets of 25 photographs each are expected to be available by the end of the present year. For information concerning these new issues application should be made to the honorary secretary of the Committee, Prof. S. H. Reynolds, The University, Bristol.

PROGRESS in the application of scientific methods in the production of raw cotton is well exemplified in the recent issue of the *Empire Cotton Growing Review*

(vol. 8, No. 3), in which questions of breeding, ginning technique and cotton quality, and blackarm disease come under discussion. The chief interest, however, is focused in a résumé of the progress of the cotton industry under successive German and British rule in Tanganyika Territory. Under German administration, experience proved the vital importance of planting on suitable soil and of growing the right kind of cotton, owing to the ravages of diseases and pests on such types as Egyptian and Ceravonica. Lighter soils give better results than the heavier ones, and production is greatly assisted by proper rotation of crops. Under British rule the output has increased rapidly. Production by plantation labour is uneconomic under ordinary conditions, and the policy now is that of definitely encouraging the native smallholder. Under this régime, native production has risen from forty-three per cent in 1922 to from sixty-three to seventy-four per cent of the whole in the succeeding years. It is estimated that during the last nine years more than one million sterling has passed into the hands of the cotton-growing native of the country. Cotton production is much influenced adversely by various factors, of which several may operate at once. Local demand for food crops or other agricultural products, inadequate transport, and unfavourable climatic conditions are but a few of the problems which demand attention, and the solution of which means so much to the economic well-being of the mandated territory.

As a converter of electric energy into heat the electric fire has an efficiency of one hundred per cent. It is desirable to know how much of the energy is converted into radiant heat and how this heat is distributed. In the *Journal of the Institution of Electrical Engineers* for September, Prof. Parker Smith gives the results of experiments on ordinary electric fires which were made to determine their radiant efficiency. This nearly always lies between 55 and 70 per cent, the rest of the heat being carried away by convection. He made tests on five modern types of gas fire and found that the radiant efficiency was from 40 to 50 per cent, the bulk of the remaining heat escaping as flue heat and the rest being carried away by convection air currents. In a room heated by an electric fire, the temperature for comfort of the air should not be less than about 55° F., hence the fire itself needs to produce air convection currents in addition to those produced by objects in the room receiving direct radiant heat. The principal difficulty in connexion with electric heating is the question of ventilation. Means must be provided for admitting fresh air, while the warmed air should escape near the ceiling. Ceiling-panel heating is sometimes employed, but in this case the convection heating is less than with floor and wall panels. If the temperature of the heating elements is raised by over-running, the heat carried away by the convection currents increases more rapidly than the radiation heating. It would seem that ordinary electric fires run at approximately the right temperature, but more attention should be paid to designing proper ventilation for the rooms in which they are placed.

For some years the advisability of having an extended high tension system of electric supply has been considered in Northern Ireland and Mr. J. M. Kennedy has been asked to report on the scheme. In the *Electrician* for Sept. 5 a résumé is given of his report and of a supplementary one issued on Aug. 29. The scheme links up the principal centres of population in Londonderry, Tyrone, and Fermanagh with the generating station of the Londonderry corporation. It would also link up with networks projected at Dungannon and in Antrim. The western area has been divided into eight districts and it is proposed to connect them by 33,000-volt lines. The report shows that considerable economies can be effected in this way. The capital cost would be about a million pounds, which is about one-fifth that of the Shannon scheme. Several Irish engineers are agitating that before the final decision of the Northern Government be taken, the possibility of effecting still greater economies by having an all-Ireland electricity programme be considered. We think that it would be for the mutual benefit of the north and the south to have an all-Irish grid. As the power available at the Shannon power station is limited and nothing has yet been done in constructing the northern grid, the time seems opportune for discussing the larger scheme. In a few years' time the water power of the Liffey will probably be harnessed and the falls on the Erne in the north-west of Ireland could be utilised. The water power from the Erne would be particularly helpful to both governments. Mr. Kennedy mentions in his report that it would be a comparatively simple matter to connect the northern system with the Free State grid at Newry. The *Irish Electrician* points out that it would be to the mutual advantage of Dublin and Belfast. An agreement between the two governments would be necessary.

So far back as 1880 Sir William Siemens made experiments on the effect of illuminating plants by electric light. He found that with a few hours' illumination he could make tulip buds blossom, and he suggested that in the future gardeners might become independent of sunlight and regulate the growth of the plants entirely as they wished. In 1920 Jacobsen, a Norwegian engineer, observed that the position of the electric power cables underground could be told at once by the strips of green grass above them. These two fundamental observations form the basis of the procedure in electro-horticulture, which is being carried out in the Experimentalfaltet—a little 'science town' near Stockholm. In the *Electrical Times* for Sept. 4, Charlotte Gast gives an account of the satisfactory results already obtained by Sven Oden and Gustaf Lind. The work is mainly to expose different kinds of plants to light coming from incandescent lamps. As in November 1929 Stockholm had only 23 hours of sunshine, the results were sharply defined. The plants subjected to the electric light were much the more flourishing. Conclusions have not yet been obtained as to the best length of time for the exposure. Cucumbers, which ordinarily require five weeks to produce marketable fruit, can be ripened in three weeks with the use for a few hours

daily of artificial light. The experiments made on the heating of the soil by electric cables have given promising results. It has been proved definitely that it does pay to heat the soil in greenhouses for the cultivation of melons and cucumbers. Nine hundred Swedish gardeners and florists are using soil-heating equipment. A usual price in Sweden for a night electric load for gardening is a farthing a unit. If this could be supplied at a cheaper rate, as in Norway, where there is a special commercial night-rate of a tenth of a penny per unit, Swedish growers could force early spring vegetables and compete successfully with market gardeners situated much farther south.

THE partial absorption of X-ray quanta observed photographically by Dr. B. B. Ray, which was the subject of two letters in NATURE of Sept. 13, p. 398, is one of the large group of atomic phenomena which involve quantised transfers of energy. All have three partially distinct aspects—the magnitude of the energy interchange, the probability that it shall occur, and the relation between the initial and final directions of motion of the reacting particles. There is good evidence from Dr. Ray's measurements, as well as from others made with an ionisation chamber by Prof. Bergen Davis and his collaborators, that the energy change in this case is a decrease, or, more rarely, an increase, in the energy of the X-ray quantum, by an amount determined by the X-ray spectra of the atom traversed. In a further letter which we have received from Dr. Ray, which we are unable to find space to print in full, he has pointed out that certain experiments which might be held to disprove the existence of this effect have been performed under conditions which he would expect to yield only a feeble modified radiation. The chief ground for this statement is the important one that the modified quantum is believed by him to proceed almost, if not exactly, in the original direction of the unmodified quantum, a hypothesis which, he shows, fits in very reasonably with the observations. No estimate appears to have been made as yet of the probability of transfer of energy in this way, but it is evidently not unduly small, and sufficient data probably exist to permit of a rough calculation. Should the reality of this effect continue to be admitted, as seems likely, it will undoubtedly open up a convenient method for investigating certain types of soft X-rays indirectly, much as the Raman effect is now applied to the study of the infra-red spectrum.

ALTHOUGH it has been said that there are already too many scientific periodicals in existence, we have no hesitation in offering a cordial welcome to *Oceania*, a new publication which is devoted to the study of the native peoples of Australia, New Guinea, and the islands of the Pacific. It is issued on behalf of the Australian National Research Council under the editorship of Prof. A. Radcliffe-Brown as the organ of the Anthropological Research Fund, which was established three years ago by a grant from the Rockefeller Foundation and an amount equal to the grant contributed by Australia. It is not intended that *Oceania* should be a mere record of observation. Its policy will be based on the view that the study of the culture of a people can be carried out only by specially trained scientific workers in the field, whose object is not only to record facts, but also to discover their interpretation, that is, their meaning and function. Thus, in the first issue, Miss Camilla H. Wedgwood on war in Melanesia, Prof. A. Radcliffe-Brown on social organisation in Australian tribes, Dr. Raymond Firth on a dart contest in Tikopia, and Miss Ursula McConnel on the Wik-Munkan tribe of Cape York Peninsula, each dwells on the functional aspect, in the respective societies, of the facts which they record and analyse. Beside the four papers mentioned, *Oceania* includes in its contents reports of the proceedings of societies, notes and news, and reviews of books dealing with the area covered by the Anthropological Research Fund. As a record of the researches now being undertaken by Australia, largely owing to the initiative and organising ability of Prof. Radcliffe-Brown, *Oceania* will be of enduring value to students of social anthropology.

IN the recently issued year-book for 1929 of the Carnegie Institution of Washington, Dr. Sylvanus G. Morley publishes his usual annual review of the activities of the Institution in excavation among the Maya ruins of Central America. The excavations at Chichen Itzá and Uaxactun continue to constitute the major operations, but this year a medical survey of the modern Maya living in the neighbourhood of these ancient cities was instituted. This survey already shows promise of producing much information of value to the anthropologist. The chief interest of Dr. Morley's report this year, however, does not lie in the account of the excavations and their result. At the close of the report he makes the pregnant suggestion that the time has now come for excavation in Central America to be more highly organised. He points out that there are now four major expeditions regularly in the field: those of the Carnegie Institution, the British Museum, the Field Museum, and that of the Government of Mexico, which is carrying out investigations in the northern Maya area and the southern part of the republic. In addition, universities, museums, and individuals are engaged on the work of excavation and exploration from time to time. He therefore suggests that a committee should be formed composed of representatives of the bodies interested and engaging in this work. The duties of the committee would be to survey the present state of knowledge, to formulate the problems suggested as the result of this survey, and then, in order to avoid overlapping and waste of effort, to allocate the investigation of these problems to the institutions willing and best fitted to take up the work.

A RÉSUMÉ is given in the *Bell Laboratories Record* for August of the scientific experiments which were carried out by that corporation's acoustical research department for the Noise Abatement Commission of New York City. Complaints had been made that the average city-dweller is continually submerged in an ocean of sound made up by the horns of motor cars, squeaking brakes, rumbling trucks, roaring subway

trains, the rapid fire of riveting machines, and the noise of radio loud-speakers. To find out which were the worst offenders, about ten thousand outdoor observations were made from a truck of the Health Department by the Bell engineers. It was found that trucks, motor cars, elevated trains, tramways, and other agencies of transportation were the principal offenders. Next came the noises made during building operations, often of greater intensity but much less widespread in their effects. It is hoped that the measurements made will enable the special committees which have been appointed to reduce the noise evil. It is stated that this appreciably decreases the vitality and efficiency of the citizens of New York. The figures obtained during the survey are of interest. The most intense noises were furnished by building operations. In one case a riveter produced a noise level of 99 above audibility, the arbitrary unit chosen being in decibels. The use of explosives in the subway excavations of the Bronx produced a noise of 98 decibels. The ever-present roar of street traffic, however, was found to vary between 50 and 80 decibels. A subway express passing a local station produces a level of 96 decibels, a steamship whistle slightly less, and elevated trains a level of 90 decibels.

THE Annual Report for 1929–30 of the executive committee of the Central Library for Students marks the close of the Library under the management which has controlled it since its foundation fourteen years ago. A new constitution has been adopted, the Library has become the National Central Library, and future reports will be issued by the new committee. The purpose of the Library is generally to supply, to serious readers, books which they are unable to obtain for themselves or at their local libraries, and that means as a rule the more expensive books, or books dealing with highly specialised subjects, for which there could be no local demand. Unfortunately, the committee points out, lack of funds prevents the purchase of those very books, and borrowing libraries have been protesting that they cannot obtain the books specially wanted. Unfortunately also the unrestricted grant of £5000 a year recommended by the Public Libraries Committee has been reduced by His Majesty's Treasury to a grant of £3000 allocated for three specific purposes, which do not include the purchase of books. During the year the volumes in the Library have increased from 45,177 to 59,606, of which 3506 have been purchased and 10,923 have been presented. Of the utility of the Library there can be no doubt, but the committee is far from satisfied with the service it has been able to give to meet the most pressing needs of readers.

WE have received vol. 2 of the Collected Papers of the Rowett Research Institute, edited by the director, Dr. J. B. Orr. The first volume was published in 1925; the present covers the ensuing five years and includes the majority of the papers published during this period by the workers at the Institute, but excluding those published by members of the staff working in other parts of the Empire. The volume contains seventy-one papers and runs to 588 pages. Broadly speaking, all deal with the subject of animal nutrition, including the food supply and also certain diseases; a few are concerned with the subject of human nutrition. In a prefatory note Dr. Orr mentions that the Duthie Experimental Stock Farm should be completely established during the present year; that the Imperial Bureau of Animal Nutrition has been established in connexion with the Reid Library to serve as a clearing-house for information on nutrition; and that a residence for temporary workers and visitors is to be built in the vicinity of the Institute. The co-operation of the Institute in work in different parts of the Empire is in increasing demand, and is an indication of the growing value of the research work carried out by the members of the staff and their collaborators.

UNDER arrangements made at the beginning of this year, the Sociological Society was united with the newer organisation of Le Play House, to form an Institute of Sociology, pure and applied. The Institute will continue and extend the work for which both the Society and the House have become well known, namely, study and research in sociology and the development of civic and regional surveys. During the present year a number of preliminary and experimental surveys have been conducted at home (for example, Chichester) and abroad, and detailed civic surveys at Chester and Brynmawr have been directed or assisted. Le Play House was founded by Mr. and Mrs. Victor Branford. Both the founders have since died, and their property has been left in trust to further the objects of the Institute and forms the nucleus of an endowment which, it is hoped, will be added to from other sources. The annual conference will be held in the Duveen Gallery at the Imperial Institute on Saturday and Sunday, Nov. 1 and 2. The sessions will take the form of lectures and discussions on sociological and survey topics. The annual exhibition will be open, in the same gallery, on Oct. 20–Nov. 3 inclusive, and will include representative examples of survey materials from various parts of Great Britain.

WE much regret to announce the death, which occurred on Sept. 18, at the age of seventy-eight years, of Prof. H. B. Dixon, C.B.E., F.R.S., honorary professor of chemistry in the University of Manchester.

THE inaugural sessional address of the School of Pharmacy of the Pharmaceutical Society of Great Britain will be delivered this year on Oct. 1, by Dr. Arthur W. Hill, Director of the Royal Botanic Gardens, Kew. The Pereira Medal of the Society will be presented also on this occasion.

A SMALL brochure has been issued by The British Drug Houses, Ltd., London, N.1, describing in handy form the medical products issued by this firm. A brief description of each substance is followed by notes of the indications for its use, of its methods of administration and modes of issue. Among the newer products mentioned, we noted carotene, which has been shown to act as a potent source of vitamin-A in animal experiments; digitalis leaf tablets, physiologically standardised to contain a definite fraction of an inter-

national unit; and sodium morrhuate, which is now being used for the injection treatment of varicose veins. A therapeutic index of diseases is also included. We have also received from the same firm a leaflet describing the applications and uses of the acriflavine group of antiseptics; illustrative cases are quoted and a selected bibliography is appended. These antiseptics have a wide use in the treatment of wounds and a great variety of septic conditions.

"METHODS and Problems of Medical Education", 17th Series, has been issued by the Rockefeller Foundation, N.Y. This volume deals with departments and institutes of anatomy, histology, and embryology in all parts of the world, including Lima, Batavia, and Manila. It is profusely illustrated with plans and views, and gives details of the accommodation, staffing, courses of instruction and research work, and budgets of a number of the leading schools of the world.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—An organising secretary of the Land Utilisation Survey of Britain—Dr. L. Dudley Stamp, c/o The London School of Economics, Houghton Street, W.C.2 (Sept. 29). An engineer in the Offices of the Divisional Road Engineers—Establishment Officer, Ministry of Transport, Whitehall Gardens, S.W.1 (Oct. 1). A graduate assistant in electrical engineering at the Wolverhampton and Staffordshire Technical College — Clerk to the Governors, Education Office, North St., Wolverhampton (Oct. 4). A lecturer in experimental psychology at the Otago University, Dunedin—High Commissioner for New Zealand, 415 Strand, W.C.2 (Oct. 10). Assistant executive engineers for the Indian Service of Engineers, and assistant executive engineers for the Indian Railway Service of Engineers—The Secretary, Services and General Department, India Office, Whitehall, S.W.1 (Oct. 31). A teacher in mechanical power plants equipment for evening classes at the Central Polytechnic, Croydon—Education Officer, Education Office, Katharine St., Croydon. A temporary full-time lecturer in mechanical engineering at the Municipal Technical School (The Gamble Institute), St. Helens — Secretary for Education, Education Office, St. Helens. An evening lecturer in geography at the West Ham Municipal College—The Principal, West Ham Municipal College, Romford Road, Stratford, E.15. Assistant engineers for the Public Works Department of the Federated Malay States—The Crown Agents for the Colonies (quoting M/1990), 4 Millbank, S.W.1.

Our Astronomical Column.

Pluto.—The first observation of Pluto after its conjunction with the sun was obtained by Prof. M. Wolf at Königstuhl on Aug. 29 (on two plates taken with the reflector); the approximate position is R.A. $7^h\ 27{\cdot}9^m$, N. Decl. 21° 54′, which is in accord with the ephemeris in *Lick Bulletin*, No. 427. The period adopted in that *Bulletin* is 249·1661 years. Many other computers have found similar periods, so that the orbit is now known within narrow limits. The *Bulletin* gives approximate ephemerides for every year back to 1890, in the hope that further images may be found. Prof. Wolf has found an image that may be Pluto on a plate exposed on 1914 Jan. $23^d\ 7^h\ 33{\cdot}0^m$ Königstuhl M.T.; R.A. (1914·0) $5^h\ 57^m\ 54{\cdot}93^s$, N. Decl. (1914·0) 17° 37′ 23·0″; the Lick ephemeris, reduced to the same equinox, gives $5^h\ 58^m\ 1^s$, 17° 38′. As some approximations were used in preparing the ephemeris for past years, the discordance is not excessive.

Prof. T. Banachiewicz gives a full description in *Cracow Circ.* No. 26 (see also *U.A.I. Circ.* No. 296) of the work carried out at Cracow on the orbit of Pluto. It will be remembered that the ephemerides calculated there led to the detection of an image of Pluto on an Uccle plate of Jan. 27, 1927; that in turn led to the detection of the images of 1919 (Mt. Wilson) and 1921 and 1927 (Yerkes). Individual observations of Pluto in 1930 give residuals that occasionally attain 3″. These residuals explain the very erroneous orbits that were first published. Prof. Banachiewicz shows that by using a large number of observations made in 1930 an orbit can be deduced that is similar to those that were obtained with the aid of the observations made in 1919, etc.

The following additional observations have been received from Prof. Wolf: they are for 1930·0.

1930 Aug. $30^d\ 2^h\ 36{\cdot}5^m$ U.T.	R.A. $7^h\ 27^m\ 57{\cdot}97^s$	N.Decl. 21° 53′ 55·9″
Sept. 5 2 35·0	7 28 26·38	21 53 16·7

The star places are from the Abbadia Catalogue.

Orbits of Binary Stars.—*Bull.* No. 195 of the Astronomical Institute of the Netherlands contains several determinations of orbits by G. P. Kuiper. The orbit of the close pair β232 is now determined for the first time. Since its discovery in 1876, 240° of the orbit has been described. The period found is 91·2 years, periastron 1914·9, *a* 0·368″, *e* 0·326. Using Eddington's mass-luminosity curve, the masses are 0·95 and 0·91 of the sun, the absolute magnitudes 4·5 and 4·7, parallax 0·0148″.

0Σ77 is a pair with equal magnitudes in which there is liability of confusing the two components when they emerge from periastron; Jackson and van den Bos adopted different identifications and found periods of 95·2 and 51·6 years respectively. The ten years that have since elapsed decide against the short period. Mr. Kuiper finds the period 122·6 years, periastron 1883·4, *a* 0·472″, *e* 0·170; the hypothetical mass of each star is 1·13 sun, absolute magnitude of each 3·97, parallax 0·0146″.

0Σ82 is in the Hyades, and the brighter star is a spectroscopic binary; Prof. Hussey gave the period of the visual pair as ninety-eight years, using observations up to 1900; subsequent observations show that this is too short, and the new period is 487 years. The parallax appears to be close to 0·02″, and the sum of the three masses is between two and three times that of the sun.

The fourth system studied is a fivefold one. It is shown that the double star Σ1999 is probably in physical connexion with the triple system ξ Scorpii, from which it is distant 281″; the common parallax is estimated as 0·04″; the masses of the components of the triple system are given as 1·50, 1·39, and 0·95 of the sun; those of the binary are stated to be equal to each other, but their values are not given; the two systems are about 7000 astronomical units apart in the direction normal to the line of sight. The shift of the second system relatively to the first is only 0·25″ in sixty-four years, whereas the proper motion of ξ Scorpii in that period is 4·7″.

Research Items.

Growth - Changes in Physical Correlation. — Dr. Joseph Bergson, in *Human Biology*, vol. 1, No. 4, publishes the result of a study of the relation of height, weight, and chest measurement in the human male from birth to maturity in accordance with Pearsonian biometric methods. His object is to show that, as conjectured, the alternate stimulus and retardation known to be exhibited during growth are incidental to an all-pervading interdependence of one structure and another. He finds that intercorrelations between height and weight, weight and chest circumference, and height and chest circumference all show significant variation with age. The correlations between height and weight show in their trend on age alternate maximum and minimum points in the neighbourhood of ages 1·5 years, 3 years, 6 years, 11 years, 14 years, and 21 years. The correlations between weight and chest measurement and height and chest measurement, as well as between height and weight, show a maximum point in the neighbourhood of 14 years. Each of the other statistical functions, means, standard deviations, and coefficients of variation, also shows in its trend with age a maximum point in the neighbourhood of 14 years. This is taken to be associated with adolescence and a subsequent decline is regarded as a "post-pubescent decline". The relative size of the correlation coefficient after about 10 years is highest for weight-chest circumference and smallest for height-chest circumference. Between the ages of about 6 years and 10 years the height-weight correlation coefficient is higher than the weight-chest circumference coefficient, while the latter and height-chest circumference retain the relative position they occupy after 10 years.

Archæology of the Mediterranean Lands.—Excavations continue to furnish further links in the history of the Mediterranean region. A distinguished visitor to Section H (Anthropology) of the British Association at Bristol was Dr. Miloje M. Vassitz, of Belgrade. His excavations on the now famous site at Vinča yielded in 1930 important evidence of commercial relations between Vinča and the south-east, the Ægean, Asia Minor, and Cyprus. Remains of wattle and daub buildings with a floor consisting of horizontal beams overlaid with mud plaster, the surface of which had been fired, were reminiscent of floors discovered at Tcherna-Voda on the Danube in Bulgaria, and also in south-west Russia. Obsidian implements suggest a link between Vinča and the Bükk district, as does one type of decoration on the pottery. The most important find of the year, however, was a type of pottery related to Minyan ware. This would confirm Dr. Vassitz's dating of the beginning of Vinča culture as early Troy II., since Minyan ware belongs to the Middle Minoan and Middle Helladic periods. Details of the work are being published in *Man*. Prof. J. L. Myres read a report from Mr. W. A. Heurtley on a Neolithic and Early Bronze Age site on the south side of the Haliakmon in western Macedonia. Mr. Heurtley's excavations have added an important piece of evidence as to the earliest incursion of northerners into Greece, largely based on pottery finds. A complete skeleton, buried in a crouched position, was found and awaits examination by an anthropologist. Since this skeleton is probably that of one of the invaders, great interest will attach to its characters. Miss M. A. Murray, working in Minorca on the clearance of the temenos round megalithic structures, which consist of an upright stone slab with a horizontal slab placed table-wise on the top, discovered painted Iberian ware of a type associated with eastern Spain and southern France.

A Dart Match in Tikopia.—Dr. Raymond Firth describes in *Oceania*, vol. 1, No. 1, the game of dart throwing as played in Tikopia, an island lying between Banks and Vera Cruz islands in the Pacific. This game was a popular sport in old Polynesia, and records of it, varying in details, are preserved among the Maori, in Samoa, Niué, and Fiji, where it drew the interest of the whole community. In Tikopia, matches are watched with most intense interest by crowds which include women and children. Though primarily a public diversion, it is also closely connected with the social organisation and religious belief of the people. The game is played on a *marae*, a long, narrow platform of ground, about 130 yards long by six to seven yards in width, which is cleared of all vegetation. The *tika* or dart has a head of hard wood about five inches long, which curves gently from base to point and is highly polished to make it glide gently over the ground when the dart is thrown. It fits by a tang into the socket of a reed shaft about three feet long. When thrown with a low trajectory, it flies for about fifty yards and then, on striking the ground, glides along for another seventy or eighty yards. Additional impetus is gained by a protective ring of coconut fibre on the forefinger, which fits into a notch in the base of the shaft. The game is played by two sides of twelve to twenty players each—known, figuratively only, as "the Bachelors" and "the Married Men". Actually the sides are drawn, irrespective of their married status, primarily from two clans. The composition of the sides, rules, order and methods of playing are traditional, dating back to the times when men were gods, and thus as the 'sport of the gods' the game is taboo, especially on certain occasions, as for example, when the object is to seek efficacy for the land. In the scoring, only the dart thrown farthest on either side counts; and a complicated system of scoring points and cancellation of points scored makes a complete victory by one side a rare occurrence.

Adaptations of the Kangaroo Mouse.—In 1891 C. Hart Merriam described "one of the most remarkable of the many new and interesting mammals that have been discovered in North America during the past few years"—the kangaroo mouse, *Microdipodops megacephalus*. It is of no economic importance, one way or the other, for it lives largely upon seeds, but its adaptations are well marked, as E. Raymond Hall and Jean M. Linsdale show in the most complete account that has been written of this rare creature (*Jour. of Mammalogy*, vol. 10, p. 298; 1929). The eyes are large and black, and suggest nocturnal habits—the only occasion on which any individual was known to bite was when it was endeavouring to escape from a strong light. Stiff projecting hairs occur on the sides of the hind feet, and the hind feet and lower legs are greatly lengthened—a young mouse repeatedly jumped out of a can without touching its sides, although the sides were seventeen inches high and the can only ten inches in diameter. The auditory bullæ are greatly inflated and reach their maximum relative size in kangaroo mice, yet the ear pinnæ are extremely small, consistent with the burrowing habits of the species. The mice are found only in the Great Basin region at altitudes ranging from 4000 ft. to 6000 ft., but the distribution is far from uniform, because fine sandy soil associated with vegetation appears to offer the only suitable habitat.

Clyde Muds.—An investigation into the Clyde muds with a new sampling apparatus was undertaken by Mr. H. B. Moore ("Muds of the Clyde Sea Area:

I. Phosphate and Nitrogen Contents", *Journal of the Marine Biological Association of the United Kingdom*, vol. 16, No. 2, March 1930). The instrument is described in a separate paper in the same number of the *Journal* by Mr. Moore and Mr. R. G. Neill ("An Instrument for Sampling Marine Muds"). A column of mud from 12 in. to 16 in. can be taken, the depth ranging from 10 fm. to 70 fm. The sampler is worked by hand and consists of a heavy brass body containing a glass tube open at both ends when descending. This falls under its own weight and drives deeply into the mud, which partially fills the tube. A valve at the top closes when the sampler stops, and by this, and by its own friction against the glass, the mud is held in the tube while the sampler is hoisted. This has been in use at the Millport Laboratory for some months and is very satisfactory, serving for collecting the mud fauna and for chemical analysis. The phosphate and nitrogen contents of the mud at thirty-three stations in the Clyde Sea area were determined at 5 cm. stages, down to 20 and sometimes 30 cm. below the surface. The phosphomolybdic method was used in estimating the phosphates and the Kjeldahl method for the total nitrogen. Whilst no general relation was found between phosphate or nitrogen values and the depth of water, the phosphate values in depths of less than 40 metres all lie close together and fall off with increasing depth in the mud, usually showing a rise at the 10 to 15 centimetre level, and the nitrogen values usually fall with increasing depth in the mud. Stations with strong tides usually show low phosphate and nitrogen values.

Japanese Sipunculids.—Dr. Hayao Satô in his "Report of the Biological Survey of Mutsu Bay, 15. Sipunculoidea" (*Science Reports of the Tôhoku Imperial University*, Fourth Series (Biology), Sendai, Japan, Vol. 5, No. 1, April 1930) records nine species, four of which are new to science. Critical notes, keys, and good figures are given and there is an extensive bibliography. The new species *Phascolion ikedai* lives in a state of commensalism with the madreporarian coral *Stephanoceris carthausi*. This had already been discovered by Ikeda, who observed them in the Sagami Sea, but although noting that the *Phascolion* was new he did not name it. This is the only species of *Phascolion* hitherto known to live as a commensal with a coral, although several cases are recorded for *Aspidophora*. A polychæte belonging to the genus *Syllis*, more than 40 mm. long and 1 mm. broad, usually lives with the *Phascolion* in the coral.

Fish Breeding in Aquaria.—Goldfish breeding is always popular. In the *Aquarian Review* for July (vol. i. No. 12), the president of the British Aquarists' Association, Dr. H. B. Jones, gives useful instructions and hints to would-be breeders. The eggs should be hatched out quickly with a slightly raised temperature and much attention must be given to the food—infusoria at first, later sifted daphniæ. In the same number Mr. L. B. Katterns begins a series of articles dealing with the breeding of tropical fish, the first giving instructions for equipment and general requirements. Here again temperature is necessarily of great importance, and the author states that it is easier to keep the aquarium heated to an even temperature than to keep a cold-water aquarium cool during hot weather.

Eruption of Komagatake (Japan) in 1929.—Near the south end of Hokkaido, the northern island of Japan, is an inlet, Volcano Bay, opening to the east. The volcano, Usu-san, of which there was a great eruption in 1910, lies near the northern shore. On the opposite side is the volcano Komagatake, 3740 feet in height, of which the most violent eruption known occurred in 1640 and the latest on June 17, 1929. This has been closely studied by Mr. H. Tsuya and seven colleagues, and the results are described in a valuable series of papers published in a recent *Bulletin* of the Earthquake Research Institute (vol. 8, pp. 237-319; 1930). The eruption began at 0·30 A.M. with an earthquake and rumbling noises. The activity gradually increased until about 10 A.M., when there was a great explosion, after which it subsided. On June 22–23, a microseismometer, a pair of tiltmeters, and a pair of gravity-variometers were erected in a hut about five miles north of the crater. From June 23 to July 10, 377 earthquakes were recorded, the amplitude being usually less than 1 mm., so that few were sensible to human beings. The foci seem to have been close to the surface. The tilt-curves show several abnormal tilts which were clearly connected with changes in the pressure-gradient and also with pulsations of the ground preceding small outbursts. After the eruption, the levelling was repeated along two lines on the north and west bases of the mountain. This showed that the ground had sunk, the curves of equal depression being parts of ellipses with their centres at the crater. The greatest subsidence measured 2 ft. 9 in. There was no trace of change in the gravitational field large enough to be recorded by the instruments employed.

Nuclear Disintegration of Boron.—In two papers in the *Zeitschrift für Physik* for July 21, W. Bothe and H. Fränz have given an account of a fairly complete investigation of the ejection of protons from boron nuclei, under the influence of α-particles from polonium and radium-C′. The protons were registered by one of the new forms of electrical counters which is sensitive to single α-particles and H-particles, but is practically unaffected by β-rays and γ-rays. At least three groups of protons are produced, the fastest two being fairly homogeneous, with maximum ranges of 33 cm. and 74 cm. in air when set free by the polonium α-particles. The energy of the protons decreases as the angle between their direction of motion and that of the incident α-particle increases, although their number does not vary much with direction, whilst a decrease in the energy of the individual α-particles has a greater effect on the number of protons than on their range. A very recent investigation, to which reference is made by Dr. Bothe in a footnote, has also established that a hard γ-radiation is emitted when certain light elements are bombarded with α-particles.

Analysis of Groups of Alpha-Rays.—Sir Ernest Rutherford, Mr. F. A. B. Ward, and Dr. Wynn-Williams have contributed a paper to the September number of the *Proceedings of the Royal Society* on a method for analysing groups of α-rays, in which the ionisation produced by each particle is amplified linearly by valves until it can be measured by a relatively insensitive galvanometer. This form of counter can be used either with a single ionising chamber or with a double differential chamber, the latter type in particular being most useful for the study of complex beams, revealing immediately, for example, the previously unknown short range α-particles emitted in the dual disintegration of radium-C. These new rays are not homogeneous, and consist of two groups, a main one of range 4·1 cm., and a subsidiary one of range 3·9 cm., a result which is in accord with the complexity of the 4·8 cm. particles from thorium-C, which had already been established by magnetic analysis and again verified in the present investigation, and with the complexity of the 5·5 cm. particles from actinium-C. The 8·6 cm. particles from thorium-C′, the 7·0 cm. particles from radium-C′, and the 3·9 cm. particles from

polonium are, however, homogeneous within the limits of the resolving power of the counter, and it thus seems possible that the complex α-ray spectra are associated with radioactive elements of odd atomic number, a prediction which is being tested by an analysis of the rays from protoactinium. Fuller details of the apparatus are to be published subsequently.

Mobility of Ions in Pure Gases.—An investigation of the motion of ions in gas at high pressure, in which the modern technique for the purification of materials for electrical measurements at low pressures has been used, is described by A. M. Tyndall and C. F. Powell in the September number of the *Proceedings of the Royal Society*. The results are very surprising in the remarkable dependence found in the properties of the positive ions on the presence of minute traces of impurities. It has been known for a long time that the mobility of the negative carriers is largely affected by impurity, but it has now been shown that when the amount of the latter has been reduced to the stage when the negative carriers are almost unaffected, the positive ions still do not attain their maximum possible speeds in the field. To ensure that the measured mobility of an ion is the true mobility of a positive ion in its own gas, it is necessary that the residual impurity should be reduced to the order of a few parts in a million, the total pressure being 100 mm. or more, and the opinion is expressed that no significance can be attached to the values of the mobility of the positive ion previously obtained in any gas. These experiments are being elaborated with a system of alternating fields of square wave-form, in place of the sinusoidal wave-form, which is less suited for accurate determination of the mobility, but it has already been established definitely that the true value of the mobility of the positive helium ion in helium is considerably greater than had been supposed, and of the same order as the value deduced from classical kinetic theory.

Impact Resistance of Steel Castings.—The May number of the *Canadian Journal of Research* contains a paper by R. W. Moffat, of the University of Manitoba, on the effect of low temperatures on the resistance of steel castings to impact. This subject is of importance from the known increased frequency of failures of machine parts in severe winters. Many studies of this effect have been carried out by previous workers, but we miss from the references given in the paper any mention of the interesting work of Robin, published as a Carnegie Memoir of the Iron and Steel Institute in 1911, which clearly showed the greater resistance to impact at low temperatures due to the use of nickel as an alloying element. The present series of experiments is concerned with castings, and shows that plain carbon steels may have a resistance to impact at $-31°$ C. of only from one-quarter to one-half of that at ordinary temperatures. By heat treatment this resistance is increased very considerably. The impact value falls off with increasing carbon. Vanadium or nickel or a combination of the two metals increases the resistance to impact. Castings with 2-3 per cent of nickel have about the same resistance at low temperatures as those with 0·18-0·22 per cent of vanadium. Normalising at 870°-900° C., followed by reheating to 620°-700° C. and cooling in still air is recommended.

The Melting Point of Iron.—Amongst the black-body radiators used by Dr. C. H. M. Jenkins and Dr. M. L. V. Gayler in an investigation of the applicability of optical methods of pyrometry to the measurement of metallurgical temperatures (*Proceedings of the Royal Society*, vol. 129, p. 91) was a very simple and ingenious one consisting of a bubble blown in the molten metal. The bubble was formed on the end of a narrow tube of refractory material, which served in addition as a viewing tube, and was found to behave quite satisfactorily in iron, but not in gold or palladium. The final result given for the melting point of iron of very high purity is $1527° \pm 3°$ C., the local standard of reference being the melting point of palladium, $1555° \pm 2°$ C. The optical pyrometer used was of the disappearing-filament type.

Tri-organo Thallium Compounds.—The only organo-thallium compounds previously known were of the type R_2TlOH, but in the July number of the *Journal of the American Chemical Society*, H. P. A. Groll describes the preparation of thallium triethyl, $Tl(C_2H_5)_3$, from thallium diethyl chloride and lithium ethyl, in absence of oxygen and moisture.

Explosion Rates.—Although several attempts have been made to account for the high speed of propagation of gaseous explosions, the detailed microscopic molecular mechanism of propagation from one layer of gas to the next has not received much attention. In the August number of the *Journal of the American Chemical Society*, B. Lewis has attempted to calculate the velocity of propagation of gaseous explosions on the basis of the theory of reaction chains. A single interaction between two molecules may generate a product which reacts with the next suitable molecule it encounters, the process continuing in like manner from layer to layer by reason of regenerated active products through a large number of steps or a chain of reaction. By means of a special hypothesis as to the division of the energy of reaction among the rather arbitrarily selected numbers of degrees of freedom of the molecules, Lewis finds that the energy on the carrier finally reaches a maximum limit which remains constant, and by equating this to $\frac{1}{2} Mv^2$, where M is the mass of the carrier, the value of v, the velocity, is found. The agreement in several typical cases is good.

High Frequency Steel Furnaces.—The paper on high frequency steel furnaces by D. F. Campbell, which was read on Sept. 16 at the autumn meeting in Czechoslovakia of the Iron and Steel Institute, contains much valuable information. The melting of steel in an ironless induction furnace has long been known as an efficient and economical method of making tool steel. But this is only a very limited application of its uses. At present the largest furnaces in use have a capacity of 20–25 cwt. and have an output of 20 tons per day. For making tool steel, 5-cwt. furnaces melting one charge per hour are commonly used. They are very appreciably cheaper to operate than gas or coal fired crucible furnaces and the necessary labour is less costly and easier to obtain. The quality of the steels produced in this way, especially those containing complex alloys, is much better and more homogeneous. The remelting of low carbon stainless alloys of the chromium series without any 'pick up' of carbon is of value. In small furnaces of extra high frequency (about 20,000) the melting of hard materials of the tungsten-chromium-cobalt-carbide group, which are being cast in form moulds, at a temperature of between 2000° to 2300° C., can be carried out. A comparison is made between a steelworks equipped with six 75-ton open-hearth furnaces, producing 6000 tons a week, and ten 6-ton high frequency units giving the same output and casting direct into ingot moulds. It is shown that the capital cost of the latter equipment is considerably less and that it has many advantages. Improvements in the design of motor-generator sets for producing the high frequency currents have led to an overall efficiency of between 85 and 90 per cent being obtained.

Eleventh International Zoological Congress.

THE Eleventh International Congress of Zoologists, which met in Padua on Sept. 3–11, under the presidency of Prof. Paolo Enriques, attracted more than six hundred members, representing thirty countries. The British delegates were Dr. F. A. Bather and Dr. G. C. Robson (representing H.M. Government), Dr. K. Jordan, Dr. H. W. Parker, Lieut.-Col. J. Stephenson (Indian Government), and Prof. A. Willey. In the Aula Magna of the University, surrounded by memorials of Galileo, Morgagni, Vesalius, Falloppio, Casseri, and Vallisnieri (nor should we here forget Linacre and Harvey), the Congress was formally opened by H. E. Alfredo Rocco, Minister of Grace, Justice, and Culture, as representative of the Government and as president of the Italian Committee for International Intellectual Co-operation. He expressed the deep practical interest felt by the Italian Government in zoological studies, alluded to the contributions of Italians from Leonardo da Vinci to the present day, and mentioned the Zoological Station of Naples and the Biological Institute of Messina as schools open to the students of the whole world.

Prof. Enriques, in an eloquent address, laid particular stress on the Fascist organisation of the Congress: the vast concepts and ideals of zoology, he said, led the mind up to that rarefied atmosphere in which the spirit of Giotto hovered when, under the eyes of Dante, he traced the poem of the Gospel on the walls of the neighbouring chapel; inspired by like ideals, every Italian sought to be worthy of his country's past and to base new works on the ancient traditions; but such a national ideal could not develop without the friendly co-operation of all civilised countries, and in that belief he tendered an affectionate welcome to the zoologists of every tongue. Among those who replied was the veteran Richard Hertwig, who alluded to the story of St. Antony of Padua preaching to the fishes, and to the Paduan studies of Paracelsus and Goethe. "There is much talk", he said, "of a United States of Europe: that does not satisfy zoologists; we wish to see all the States of the world united in the interests of civilisation and of science."

The scientific communications were presented to fifteen sections and to general meetings. Since they numbered more than two hundred and fifty, it is scarcely possible to mention more than a few of those dealing with wider questions. In an opening discourse on "Genetics and Evolution", Prof. Caullery maintained that the mutants made known by geneticists are not really new formations but combinations of pre-existing genotypes; that, though they may exist where they first appear, they would be eliminated by natural selection and would not give rise to new species distinguished by the criterion of interspecific sterility. It is difficult, he said, to regard evolution as due to successive mutations.

"Biogeography and Evolution" was the theme of Prof. G. Colosi, who, in most explanations of the known facts, finds difficulties (as of contradictory physiographic changes) that are obviated by Rosa's theory of hologenesis. This assumes a world-wide extension of the original life-forms, with parallel orthogenesis, so that the same or similar species arose in widely-separate regions; thus land-bridges or sea-connexions are unnecessary. Dealing with the distribution of populations, from insect epidemics to the races of man, Prof. F. Bodenheimer attributed the chief influence to climatic conditions. On the other hand, Dr. Boettger's account of "Artbildung unter dem Einfluss des Menschen", exemplified by the snails *Agriolimax lævis* and *Potamopyrgus crystallinus*, seems to prove nothing more than the distribution of mutants by human agency. His title would have been more applicable to Prof. Ghigi's account of crossings in pheasants and guinea-fowls with the formation of alleged new species, themselves fertile but sterile when crossed; Ghigi finds that sterility and fertility are sex-linked characters, and regards hybridisation as an important factor in evolution.

Birds also were the subject of Prof. O. Riddle's experiments on the relation of metabolism to sex; metabolism is influenced by temperature more in males than in females, and the amount of hæmoglobin is also affected; the sexes and their corresponding metabolic types are both reversible. Other papers on sexual characters were contributed by A. Arcangeli, A. Banta, E. Caroli, J. de Mallasz, and E. Padoa, and on hybrids by F. Cavazza and G. Montalenti, while F. Poche discussed the possibility of a third sex.

Returning to problems of evolution, one notes Prof. Enriques' studies in Radiolaria because they show similar minute characters repeated through generically differing forms, much as the varieties of wheat are paralleled in rye. Dr. Robson's researches on the origin and descent of Octopoda lead him to attribute much to orthogenesis. In connexion with Cephalopods, the important paper on their nervous system by E. Sereni should be mentioned. Prof. A. Sewertzoff announced an evolutionary principle as "the substitution of functions", which means the replacement of an organ by a totally different organ that performs a function which is analogous or biologically equivalent to that of the suppressed organ. In the reduction of organs, Sewertzoff claims that those parts disappear first which are the last to be formed embryologically.

Other papers with a general bearing might be cited did space permit, but the practical side of zoology demands mention, since a whole section was devoted to silkworm culture. The address by Prof. Pigorini, director of the Bacological Station at Padua, did indeed deal with important embryological questions. Among the papers here were two by Prof. Matsumura on the silkworms of Japan. A visit to the Station proved of exceptional interest, and the preparations of larvæ by Dr. Amelia Tonon were much admired. Here also may be recalled the R. Stazione di Poltiçultura near Rovigo, where experiments are conducted on numerous breeds of gallinaceous and other birds.

This last was visited during an excursion which included an inspection of Count Arrigoni's ornithological collection with welcome refreshment at his villa, Cà Oddo, and a banquet at Rovigo, where the Minister of Agriculture spoke. Another excursion was to the Royal Villa at Strà, where the company of four hundred was entertained by Count Giusti, Mayor of Padua, to such effect that "grave and reverend signiors" were seen to join in the subsequent fox-trots. On Sunday there was a delightful trip to Venice and the islands of its lagoon. A ball in the fine rooms of the Casino Pedrocchi and a final dinner offered by the local committee in the great and ancient Sala della Ragione were among other general entertainments. Special invitations were extended by certain ladies of Padua to all ladies attending the Congress.

Some of the general meetings were held in a new Aula of Pathological Anatomy, formally opened by Prof. Cagnetti, while sections met in the various aulæ of the new university buildings. In the Zoological Institute a room was provided for exhibits by members, and hard by was an exhibition of books and apparatus. Here Koristka of Milan showed a new

"Stand A" for monocular microscopes and "Stand U" capable of taking various forms of binocular with either single or double objectives; Reichert of Vienna exhibited microscopes, microtomes, projection and photographic apparatus; Zeiss of Jena had a particularly interesting show of projection apparatus; A. C. Zambelli of Turin showed thermostats for embryological research and microscope observation *in vivo*. Allusion may here be made to the cinema film of young orang-utans shown by Prof. G. Brandes of Dresden, and the remarkable results displayed by Prof. Storch of Graz in his cinema studies of small crustacea under the microscope. In the Library of the University, Profs. Ageno and Ducceschi had arranged an exhibit of old books relating to biological science; an excellent illustrated catalogue was provided.

At the concluding session of the Congress reports were presented from the Commissions on Parasitology and on Nomenclature. It was decided that in future the Congress should be held at intervals of five years. In view of the large number of such meetings, the decision is probably wise, but it is to be hoped that care will be taken not to clash with other congresses in allied sciences. The International Institute of Intellectual Co-operation might be asked to act as a co-ordinating body. These congresses would be more useful if papers dealing with relatively special and trivial points were eliminated, especially when the results have already been published. Attention should be concentrated on general problems, towards the discussion of which authorities in various branches might contribute; and on such forms of co-operation as biological surveys, studies of migration, and especially action requiring government assistance. At present the Commission on Nomenclature seems to be the body that continually does really practical international work, however restricted its field may be. What the Permanent Committee of the Congress does between whiles, not even its members seem to know.

The preceding remarks are not intended to reflect in any way on the organisation of the Padua Congress, for which high praise is due to the energy of Prof. Enriques and the labours of the general secretary, Dr. Fausta Bertolini, with her lively and courteous staff of students of both sexes. Padua preserves the intimate and homely character of an ancient university city, and all its inhabitants united in so warm a welcome that the chief characteristic of the Congress now past was its friendly and homely character; and that, after all, is the chief value of these international gatherings.

The Liverpool and Manchester Railway Centenary Celebrations.

THE Centenary Celebrations of the opening of the Liverpool and Manchester Railway were opened on Sept. 13 in St. George's Hall, Liverpool, by the American Ambassador, General Dawes, and were brought to a conclusion on Sept. 20 by a final performance of the great Pageant of Transport which had been shown night by night in Wavertree Playground.

Enacted on a stage 300 feet long and by some 3500 performers, the Pageant of Transport was designed to show the various methods of transport by animals, sledges, carts, wagons and coaches, and by the early railways. The final scene recalled the events of Sept. 15, 1830, when the Duke of Wellington, Sir Robert Peel, Mr. Huskisson, and other notable persons set out in the first of a procession of eight trains from Liverpool to Manchester. A replica of the original train had been constructed, and it was drawn by a replica of the engine *Northumbrian* which in 1830 was driven by George Stephenson himself. In the Wavertree Playground—a large open space kept solely for games—was also an exhibition of old and modern locomotives, together with examples of up-to-date carriages and wagons. It need scarcely be said that a copy of the *Rocket* was to be seen, while the *Lion*, an engine built for the Liverpool and Manchester Railway in 1838, but now the property of the Liverpool Engineering Society, was under steam and worked "a train of 1830" carrying passengers around a circular track.

While the pageant and exhibition and the shows at Wavertree provided for the popular taste, an exhibition of historic material, models, etc., in St. George's Hall provided food for the student and specialist and fascination for boys and girls. The celebrations have been held under the auspices of the corporations of Liverpool and Manchester and with the support of the London, Midland and Scottish Railway. The responsibility for the exhibition in St. George's Hall lay with a committee of which Mr. Robert Gladstone was chairman, and its success was largely due to his energy and foresight. While there were scores of model locomotives and a splendid model railway to be seen, the chief features of interest consisted of a series of exhibits illustrating the work of the pioneers, Cugnot, Trevithick, Murray, Blenkinsop, Hedley, Hackworth, Stephenson, and others, and another series relating particularly to the history of the Liverpool and Manchester Railway, much of the material for which came from the Liverpool Public Library.

There was much to recall the famous locomotive trials at Rainhill in 1829, between the *Rocket*, *Sans Pareil*, *Novelty*, and *Perseverance*, and one of the original cylinders of the *Novelty*, recently procured from an old works near Rainhill Station, was on view. The fellow cylinder for many years has been in the Science Museum. Of especial interest to serious students of railway history was the exhibition of a recently discovered letter from Robert Daglish referring to locomotive engines he made in 1812 and 1816. Hitherto nothing has been known of these Lancashire engines, and inquiries at the colliery at which they worked have already brought some interesting facts to light.

A Handbook and Programme of the Centenary Celebrations was available, as were also a catalogue of the exhibition and a bibliography of the printed and illustrated material on the Liverpool and Manchester Railway in the Liverpool Reference Library. The London, Midland and Scottish Railway issued "One Hundred Years of Railways", written by Mr. Dendy Marshall; while Prof. G. S. Veitch's book, "The Struggle for the Liverpool and Manchester Railway", was published just before the celebrations.

Of other events connected with the celebrations mention may be made of the commemoration service in the Cathedral, the unveiling of a memorial tablet on the first railway station in Manchester, the performance of a pageant of the industries of Liverpool by the workers of the railway, and the public lectures in Picton Hall arranged by the Liverpool Corporation. At least two additions will be made to the nation's historic machines as a result of the celebration, as the cylinder of the *Novelty* is to be placed on permanent exhibition in Rainhill Station, and the locomotive *Lion* is to be placed on a pedestal in Lime Street Station, Liverpool.

Sinanthropus.

AT a joint meeting of the Sections of Geology and Anthropology of the British Association at Bristol, Prof. G. B. Barbour, of the Department of Geology, Yenching University, gave a very interesting lecture on "The Geological Background of Peking Man (*Sinanthropus*)." Chou-kou-tien, where *Sinanthropus* was discovered in an abandoned limestone quarry, overlooking the re-entrant margin of the Yellow River delta plain, lies 37 miles south-west of Peiping (Peking), on a branch of the Peking-Hankow railway. The fossiliferous deposit was first reported by J. Gunnar Andersson in 1921, and in the following year Otto Zdansky discovered mammalian material, reporting in 1926 that it contained hominid teeth. In 1928 B. Bohlin, C. C. Young, and W. C. Pei found an adult right ramus, with three molars *in situ*, together with part of another jaw and many skull fragments. In 1929 W. C. Pei, a young geologist on the staff of Yenching University, discovered first fragments of a skull, since reconstructed, and later an uncrushed adult skull. This latter discovery occurred at 4 P.M. on Dec. 2, the last day on which it was possible to work because of the increasingly wintry weather. The skull was embedded in a travertine matrix, and Prof. Barbour described the infinite care and skill with which Dr. Davidson Black removed the matrix, taking repeated casts and photographs, in an effort to ensure that the fullest records should be available for future workers.

The skull is that of a young adult, for the sutures are deep and unfused. The lower face is apparently missing, but the ear-hole and the back of the skull are present; the jaw sockets are massive, suggesting marked biting capacity. Dr. Davidson Black considers that the length of the skull approximates to that of *Pithecanthropus*, which it also resembles in its massive brow-ridges, but the distinct frontal swelling and the development of slight parietal bosses mark it off from the Java skull. A feature of importance in the site is that remains of at least ten individuals have been found, and, curiously enough, all skeletal parts so far recognised belong to the head.

In addition to the richness of the *Sinanthropus* finds, the quantity and variety of the vertebrate remains form a striking feature at Chou-kou-tien.

More than fifty types of mammals, besides frogs, snakes, turtles, and birds, have been recorded. In the three seasons, 1927 to 1929, about 8800 cubic metres have been excavated, and 1475 boxes of fossil material have been removed. The most characteristic types are *Sinanthropus*, *Euryceros* (flat-antlered deer), *Rhinoceros*, cf. *sinensis*, and *Hyæna sinensis*. *Trogontherium* (big beaver) and *Bubalus* (primitive buffalo) also occur. The fauna has suggestions of a southern affinity and is distinctly older than the Loess fauna of Middle Pleistocene date, which includes *Rhinoceros tichorinus*, *Hyæna crocuta*, and *Cervus elephas* in place of those mentioned above. It can be closely dated as very early Pleistocene in view of the absence of truly archaic types and the presence of modern types, including *Equus*, but it is definitely older than the Middle Pleistocene. The fossil material is found *in situ* at various level deposits, and is of essentially the same age from top to bottom.

The finds were made in deposits of breccia, gravel, sand, and clay filling fissures and caves in Ordovician limestone. With the aid of a series of remarkably clear photographs, sections, and block diagrams, Prof. Barbour demonstrated the origin, by dissection, of the various clefts or caves, which at one time must have formed shelters for animals and are now filled with the brecciated clayish or sandy fossiliferous formations, comprising the typical Chou-kou-tien deposits. The interest of the lecture was greatly enhanced by the exhibition of casts of *Sinanthropus* and of a tooth. Prof. Barbour concluded by pointing out that all new data are issued from the laboratory of Cenozoic Research, under the combined control of the Geological Survey of China and the Peking Union Medical College. He paid a tribute to the way in which work has been continuously carried on in spite of the grave difficulties due to the prolonged political crisis in China. Reference was made to the important paper by P. Teilhard de Chardin and C. C. Young in *Bull. Geol. Soc. China* (vol. 8, No. 3, 1929), which not only gives a clear and detailed account of the geological history of the Chou-kou-tien formations, but also has a bibliography of all publications on the subject up to December 1929. Vol. 9, No. 1, 1930, gives further data.

It had originally been planned that Prof. Elliot Smith should open a discussion on the characters and affinities of Peking man, but he decided in early August to go to China to study *Sinanthropus* on the spot. His report, and a further one from Dr. Davidson Black, will be awaited with keen interest.

Staining Yeasts with Methylene Blue.

WORKERS who use the time-honoured method of staining yeasts with methylene blue are familiar with the untrustworthy results often obtained when an attempt is made to distinguish living from dead yeasts. It is now realised that apparently contradictory results may be due to differences in working conditions employed by various workers, and in this connexion a recent letter in NATURE (Brooks, **125**, p. 599; April 19, 1930) may be cited, in which the importance of *p*H value, concentration and purity of the stain, and of the effects of light are indicated.

Fuchs also (*Woch. Brau.*, **46**, p. 437; 1929: **47**, pp. 171, 183; 1930) has pointed out that the concentration of methylene blue, which is usually 0·0001 per cent, may be increased to 0·001 per cent without any immediate marked change in the proportion of stained to unstained cells. After 15 minutes, however, this proportion may increase very rapidly. If this result is correlated with the fact that granulated cells, which are usually considered dead, stain well, we have a certain amount of evidence that methylene blue is toxic to yeasts after a short period of contact.

Haehn and Glaubitz (*ibid.*, 315) actually showed, however, that preparations from which unstained yeasts were entirely absent grew in wort, and they therefore concluded that cells which take a weak stain are living, though impaired in vitality. The weak staining in the first instance may probably be attributed to adsorption by mucilage on the cell-walls. In both cases a 0·0001 per cent solution is favoured, and Fuchs adds this until the colour is blue-green and immediately counts the deeply stained dead cells. In the case of suspensions in wort the proportion of stain must be increased, as some is adsorbed by the wort-colloids.

Against this increase in stained cells on prolonged

contact must be set the decolorising effect of reductase, which persists when the cell is dead and is greatly increased at low *p*H values (for example, in wort). The influence of *p*H values has been accounted for by Fink and Weinfurtner (*ibid.*, **47**, pp. 89, 110, 124; 1930) by the fact that methylene blue is a base, the hydrochloride of which is soluble in neutral or in acid solutions. In alkaline solutions, however, the less soluble base is liberated and is available for adsorption. Thus, at *p*H 2·2 less than 1 per cent of the cells examined were properly stained, the remainder being pale-blue in colour, whilst at *p*H 4 a deeper shade of blue was obtained, increasing progressively in depth of colour until, at *p*H 8, all the cells were deep blue. The marked time-effect is illustrated by the increase in one case of from 5 per cent to 20 per cent of stained cells in 3 minutes (*p*H 2·6 to 6·8).

Yet another source of anomalous results was traced to the electrolyte-content of the medium in which the yeast is suspended. Thus, staining occurs more rapidly in distilled water than in tap-water, but a trace of electrolyte (for example, salt) added to the former before the addition of the stain inhibits its action. It is not clear to what extent this is due to a corresponding change in *p*H value, since some substances, for example, dextrose and lævulose, have the effect of predisposing the yeast to staining. Maltose and glycerol are less effective in this respect, while mannitol is inactive. Electrolytes containing chlorides, iodides, thiocyanates, bromides, sulphates, nitrates, tartrates, citrates, and acetates act as inhibitors in decreasing order of efficiency, and it is suggested that their absence renders the yeast-walls more permeable to the stain.

Another important fact which emerges from these investigations is that one set of conditions cannot be formulated for all strains of yeast, so that there appears to be every reason why a study should be made of possible substitutes for methylene blue. In this connexion attention may be directed to the proposal of a 0·25 per cent solution of erythrosin by Devereux and Tanner (*Jour. Bact.*, **14**, p. 217; 1927), and to the use by Tolstouhov of eosin-yellow for *p*H values above 3, and acid fuschin for *p*H 0·8-3·0.

International Eugenics Conference.

THE International Federation of Eugenic Organisations held a conference at the Larmer Tree Grounds, Tollard-Royal, Wiltshire, on Sept. 10–15. Eighteen countries maintain membership in the Federation, and many of them sent representatives. Among those present were Sir Bernard Mallet, of Great Britain; Dr. A. Ploetz and Prof. Rüdin, of Germany; Prof. Reichel, of Vienna; Dr. Heuyer, of Paris; Dr. Van Herverden, of Utrecht; Dr. J. A. Mjøen, of Oslo, and Dr. H. H. Laughlin, from the Eugenics Record Office, U.S.A. Mrs. C. B. S. Hodson acted as organiser and interpreter of the conference. One object of the conference was to co-ordinate research in different countries. Reports were received on eugenics and war, and on recent eugenic developments in various countries. Committees were formed or continued for the study of human heredity, race crossing, racial psychiatry, and the standardisation of anthropometrical measurements, physical and mental. Different conferences were held on the standardisation of human measurements, on race crossing, on racial psychiatry, and on human heredity. Miss Tildesley outlined proposals on behalf of English anthropologists for standardising measurements, and Miss B. Schieffelin discussed methods of measuring psychic differences.

In her report on the work of the American Eugenic Research Association on Mental Measurement, Miss Schieffelin pointed out that the search for any such thing as a measurement of hereditary mental endowment has proved a failure. A central clearing-house should be established so that all mental tests could be thoroughly classified and their value gauged. This clearing-house, which would of necessity be an expensive business, would be able to review the situation and plan future research. Workers would be able to apply to it for advice and should be able to obtain the existing position in relation to mental testing and its application to hereditary factors.

Prof. Rüdin outlined a scheme of research on racial psychiatry, and Prof. C. G. Seligman contributed some observations on Chinese and Japanese psychiatry. An afternoon was devoted to papers on human heredity.

A public meeting held in the Tythe Barn, Hinton St. Mary, at the invitation of Capt. Pitt-Rivers, on "The Urgency of Eugenic Reform", was attended by many local people. Sir Arthur Keith spoke on eugenics from the evolutionary point of view; Prof. Ruggles Gates, on human heredity and segregation in racial crossing; Prof. Rüdin, on heredity of insanity; and Dr. C. J. Bond, on dangers of racial decay and the remedy.

Sir Arthur Keith, in his address, briefly traced the development of modern man from the time of *Pithecanthropus erectus* through the age of agriculture and showed how gradually the production of race was sacrificed for the accumulation of wealth. The new age, the eugenic age, is, it is hoped, to be one of constant race improvement. There are many difficulties in the way of execution of eugenics ideals, chief of which are human prejudice, emotion, and passion. The Church is falling into line, placing its blessing on attempts at racial improvement and paving the way for the more practical side which is the work of the eugenist. The evolution of man is not, as some people imagine, at a standstill, for it is slowly but surely progressing, and must be directed by the knowledge of the eugenist.

Dr. C. J. Bond emphasised the presence of a considerable element of mental and physical degeneracy in the general population. He pointed out that the remedy lay in first of all carrying out an exact ascertainment of the degree of mental and physical deterioration in the various social groups and then applying the principles of sterilisation and segregation. This would in course of time eliminate the defective and unstable members of society.

At another public meeting, cinema films showing various features of cell division and embryonic development were shown by Prof. Ruggles Gates, and Prof. Elton Mayo, of Harvard University, spoke on the physiology of efficiency.

Excursions were made to the surrounding country to view some of the numerous archæological remains in this vicinity. Under the guidance of Mr. O. G. S. Crawford and Mr. St. George Gray, the ancient British village and Roman camp on Hod Hill, Ackling Dyke, Worbarrow, Stonehenge, Woodhenge, and other neolithic and later remains were visited. The numerous archæological relics and models of excavations to be found in the Pitt-Rivers Museum at Farnham, Dorset, were also examined, as a preliminary to visiting some of the places from which they were excavated.

Historic Natural Events.

Sept. 28, 1876. **Tornado at Cowes.**—A rapidly revolving whirlwind, looking like a waterspout or huge funnel, point downwards, approached the south-west shore of the Isle of Wight between Blackgang Chine and the Needles. It passed north-eastwards across the island and reached Cowes between 7 and 8 A.M., doing damage estimated at £10,000 to £12,000. Corn, light articles, and even bricks were dropped on vessels in the Solent, and on the mainland south of Titchfield.

Sept. 29, 1210. **Tay Flood.**—Cant, in his notes to the Muses' Threnodie, says: "So violent was the torrent that the whole town [of Perth] was undermined, the houses levelled, and many persons of both sexes lost their lives. The Royal Palace [of William the Lion] did not escape. The King's youngest son, John, with his nurse, were carried down the river and drowned, with about fourteen of the Kings domesticks."

Sept. 29, 1538. **Formation of a New Volcano.**—Monte Nuovo is a conical hill, 440 feet in height above the sea-level, and lies about 8 miles west of Naples. For two years before the eruption that formed it there had been frequent earthquakes in the district that increased in frequency and reached their maximum on Sept. 27–28, 1538. The next day a fissure opened in the ground, from which scoriæ, lapilli, dust, and mud were ejected and, falling round the fissure, gradually formed a hill similar to many others in the district. The eruption died down in about a week, most of the hill having been formed during the first two days.

Sept. 29, 1915. **Hurricane in the Gulf of Mexico.**—The most intense hurricane in the history of the Gulf of Mexico struck the coast of Louisiana on Sept. 29. At Burrwood, La., the wind reached a velocity of 140 miles per hour in a gust, the highest ever recorded in the Gulf. In New Orleans nearly every building was damaged and several were totally destroyed, and some neighbouring towns and villages were completely wrecked: there were a number of shipwrecks, and the loss of life amounted to 275. This loss would have been far heavier but for the warnings issued by the U.S. Weather Bureau; in fact the greatest individual catastrophe, at Rigolets, resulted from the complete disregard of specific advice.

Sept. 29, 1927. **Rainbow Phenomena.**—About 4 P.M. seven distinct rainbows were seen simultaneously near Campbeltown in Kintyre. The three interior bows were the brightest, especially the third.

Sept. 30, 1513. **Rockfall in Ticino, Switzerland.**—A fall of rock from the Pizzo Magno dammed the lower part of the Val Blenio in Ticino. The waters of the river Brenno accumulated behind this dam and drowned the village of Malvaghe, including its campanile 130 feet high. The dam broke on May 20, 1515, and the valley was entirely devastated, 400 houses destroyed, and 600 persons killed. When the flood reached Lake Langensee immense waves were formed and several shipwrecks occurred.

Sept. 30, 1555. **Flood in London.**—Holinshed records that "on the last of September by occasion of great wind and rain that had fallen was such great floods that the Kings palace at Westminster and Westminster Hall was overflown with water".

Oct. 1, 1250. **Storm in North Sea.**—This gale was very violent in the southern North Sea. It is said that the sea flowed twice without ebbing and the noise of the waves was heard a great distance from the shore; at night it appeared to burn as if on fire. Many ships were wrecked, and at Winchelsea, besides the damage to bridges, mills, and dykes, three hundred houses and some churches were drowned owing to the height to which the waters rose. Enormous damage was done in Holland and the marshes of Flanders, where the rivers, choked back by the rise of the sea, overflowed their channels.

Oct. 1, 1899. **Whirlwind over Wiltshire.**—During the passage of a barometric depression from south-west to north-east across England, a whirlwind or tornado about 2.15 P.M. travelled from south-south-west to north-north-east through Wiltshire, the track having a length of nearly 20 miles but a breadth of only about 100 yards. Many trees were uprooted and a great deal of damage done to buildings.

Oct. 3, 1780. **West Indian Hurricane.**—A violent hurricane developed to the south of Jamaica on Oct. 2 and travelled northwards across Jamaica, Cuba, and the Bahamas. On Oct. 6 and 7, in about 28° N., 74° W., it wrecked Admiral Rowley's squadron of eight or nine vessels and so moved away to the north-west, doing further damage to a squadron off Cape Henry. The wind and the inrush of the sea entirely destroyed the town of Savanna-la-Mar in Jamaica and several ships were left stranded on dry land; the *Princess Royal*, in fact, was afterwards used as a house. The ground half a mile inland was submerged to a depth of ten feet. The dead lay unburied for weeks, and a pestilence carried off many of the survivors. In the town of Lucea only two houses remained standing, and near Montego Bay four men-of-war were lost.

Oct. 4, 1526. **Hurricane at Porto Rico.**—According to Dr. Juan de Vadillo, "on the night of Oct. 4 there began on the island of Porto Rico such a storm of wind and rain, here called a hurricane, as to destroy the greater portion of the city of San Juan and to do great damage to the estates in the country by overflowing the rivers".

Oct. 4, 1869. **"Saxby's Gale."**—In 1868 Lieut. Saxby, a British naval officer, basing his prediction on the supposed influence of the moon, foretold a great storm on Oct. 5, 1869, but without specifying the locality. The storm, accompanied by a very high tide, which crossed New Brunswick, Maine, and Nova Scotia on Oct. 4, was popularly hailed as a verification of this forecast and remembered as "Saxby's Gale".

Societies and Academies.

LONDON.

Institute of Metals (Annual Autumn Meeting at Southampton), Sept. 9.—**D. Hanson**: The use of non-ferrous metals in the aeronautical industry (Autumn Lecture). The present state of aerial transport is in large measure due to the development of suitable alloys and their use in aircraft construction in large quantities. The non-ferrous alloys are strong for their weight, and also possess the advantages that they can readily be used as die-castings, forgings, stampings, and so on, and lend themselves readily to methods of standardised production. Perhaps the most notable feature in regard to aluminium alloys is the extent to which heat-treatment is employed in developing their useful properties. The use of magnesium alloys is of more recent origin, but is rapidly extending. Improvements in melting and casting methods, as well as the discovery of new alloys, have contributed to this extension, and the application of the processes of heat-treatment in suitable instances will probably lead to further improvements.

Sept. 10.—**Ernest A. Smith**: Rolled gold; its origin and development. The paper deals briefly with the history of the rolled-gold industry from its begin-

ning in Birmingham, in 1817, until the present time.—**W. Rosenhain, J. D. Grogan, and T. H. Schofield**: Gas removal and grain refinement of aluminium alloys. A number of selected volatile chlorides have been passed into molten aluminium and certain alloys. All were found to be efficacious in removing dissolved gas from the metal. Some, particularly titanium tetrachloride, also produce a marked reduction in grain-size. The reduction of grain-size occurs also when titanium is added to aluminium in the form of titanium-aluminium alloy produced by the 'Thermit' process.—**J. D. Grogan**: Pressure die-cast aluminium alloy test-pieces. The behaviour of selected alloys when subjected to the attack of molten aluminium alloy and the method of entry of metal under pressure into a simple cylindrical mould are described. If certain serious technical difficulties can be overcome, the pressure casting process will yield products of excellent mechanical properties.—**N. W. Ageew and Olga I. Vher**: The diffusion of aluminium into iron. The process takes place in two stages: (1) Solution of iron in liquid aluminium; (2) diffusion of the alloy formed into solid iron. Weiss's law of diffusion has been verified for the binary system iron-aluminium.—**K. L. Meissner**: The artificial ageing of duralumin and super-duralumin. The effect of artificial ageing upon duralumin consists, after an initial softening at lower temperatures, mainly in raising the yield-point, whilst the tensile strength is influenced only slightly. At the same time, the elongation, flexibility, and other cold-working properties are decreased very markedly, and, as shown in previous work, the resistance against corrosion is also decreased. In contrast to duralumin, the tensile strength of super-duralumin (duralumin with addition of silicon) is markedly raised by artificial ageing, but the rise keeps behind that of the yield-point, relatively.—**Wm. L. Fink and Kent R. Van Horn**: Lattice distortion as a factor in the hardening of metals. Rockwell hardness measurements and diffraction patterns showed that lattice distortion can be accompanied by appreciable softening in an externally stressed aluminium alloy ('17 S') or α-brass. Maximum lattice distortion and maximum hardness are not necessarily coincident in age-hardened alloys.—**Marie L. V. Gayler**: A study of the relation between macro- and microstructure in some non-ferrous alloys. The results of a previous investigation are confirmed, namely, the higher the temperature from which an alloy is cast the coarser becomes the macrostructure, and at the same time the microstructure becomes finer, but in a less marked degree. The macro- and microstructure of an alloy do not seem to be affected by various gases, provided the casting temperature is kept low. If, however, the casting temperature is raised, the atmosphere to which the molten metal is exposed has a very marked effect on the macrostructure, together with a small effect on the microstructure; thus hydrogen causes the formation of a fine macrostructure in contrast to that obtained on casting under normal conditions. A copper-aluminium alloy which has been previously freed from gas by the nitrogen process and then melted *in vacuo* still shows inverse segregation. Furnace gases have little effect on the 'modification' of aluminium-silicon alloys. 'Modification' of a silicon-aluminium alloy cannot be obtained by casting into a heavy, water-cooled copper mould.

PARIS.

Academy of Sciences, Aug. 4.—**Bigourdan**: The astronomical instruments and observations of Bochart de Saron.—**André Roussel**: The general expression of the infinitesimal increase of a function.—**Georges Giraud**: The principal Cauchy integrals and their application to certain problems relating to equations of the elliptic type.—**Thadée Banachiewicz**: The determination of the orbit of Pluto.—**Benjamin Jekhowsky**: The trans-Neptunian planet Pluto.—**Maurice Robert**: Starting low tension dynamos.—**Pierre Chevenard and Albert Portevin**: The influence of reheating on the expansion and hardness of tempered aluminium-silicon alloys.—**J. Perreu**: The measurement of the vapour pressures of aqueous solutions of some hydrated salts. Measurements made by a differential method against water are given for solutions of sodium hyposulphite, sodium sulphate, and manganous chloride.—**Chapas**: The solubilities of some substituted benzoic acids in some chloro-aromatic hydrocarbons.—**Maurice Nicloux**: The determination of oxygen in sea water. A modification of Winkler's method requiring only 5 c.c. of sea water.—**Mlle. Jeanne Lévy and J. Sfiras**: The action of ammonia and of dimethylamine on the ethylene oxides of allylbenzene, phenylcyclohexene and their homologues.—**E. Urion**: The catalytic decomposition of divinylglycol by reduced copper.—**A. Mailhe and Renaudie**: The transformation of ethylene into liquid and solid hydrocarbons. The ethylene was passed over silica gel heated to 700° C.; a complex mixture of hydrocarbons was obtained with boiling points ranging from 75° C. to 330° C.—**Georges Brus and J. Vébra**: The transformation of camphene into isobornyl esters and the decomposition of bornyl and isobornyl esters into camphene. It is shown that the transformation of camphene into isobornyl esters is a reversible reaction, and consequently cannot be quantitative.—**R. Weil**: Observations on quartz.—**H. Derville**: Napoleon marble and its varieties.—**M. Tenani**: The tides of the eastern Mediterranean.—**G. Guittonneau and J. Keilling**: The separation of two soluble sulphur compounds in a soil rich in organic matter. The presence of hyposulphite and pentathionate has been proved.—**J. Risbec**: The duration of evolution in *Ælolidia amœna*.—**A. Sartory, G. Hufschmitt, and J. Meyer**: A new mycosis caused by a yeast of the genus *Debaryomyces*: *Debaryomyces mucosus*.—**G. Cuvier and J. A. Carrère**: The action on cancerous subjects of extracts of tumours, administered by the mouth in small doses.

Aug. 11.—The president announced the death of A. J. Le Bel.—**Bigourdan**: Observations and co-ordinates of the Châtillon tower.—**Alayrac**: Extension of the method of conformal representation to movements in three dimensions.—**L. Brillouin**: Electrons in metals and the classification of the corresponding de Broglie waves.—**Louis Natanson**: The variations of relative intensity in the resonance spectrum of selenium.—**René Truchet**: The reaction of organo-magnesium compounds on the aryl sulphonchlorides. The principal reaction is $ArSO_2Cl + RMgX = Ar.SO_2.MgX + RCl$, the author confirming the work of Gilmann and Fothergill.—**P. Mondain-Monval and B. Quanquin**: The formation of peroxides in the direct oxidation of hydrocarbons by air. Hydrocarbons (pentane, hexane, octane) mixed with air and passed through a tube kept at 300° C. give, besides aldehydes and carbon dioxide, a yellow oily substance. This oil gives the reactions of a peroxide of the type of the methyl hydroperoxide of Rieche and Hitz, $CH_3.O.O.H$.—**G. Chalaud**: The first phases of the development of the gametophyte in *Lophocolea cuspidata* and in *Chiloscyphus polyanthus*.

Aug. 18.—**G. Bigourdan**: The observations of Méchain and of Saron. The co-ordinates of the Observatory of Colombes.—**Ch. Achard and M. Hamburger**: The proteins of the blood serum in some

anæmic conditions. Details of ten cases giving the number of red corpuscles, total proteins, serine, globuline, and, in five cases, the myxo-protein. In pernicious anæmia the diminution in the number of red corpuscles is always accompanied by a reduction in the serum proteins, and the latter increase when the number of red corpuscles goes up under treatment.—Ch. Achard and I. Ornstein: Some constituents of blood-serum in myxœdema. Analytical details of twelve cases.—C. Gutton and E. Pierret: Radiotelephonic transmission on waves of 17 cm. length. Details of apparatus giving successful transmission over a distance of 6·8 km.—Edouard Callandreau: Remarks on the elastic line of a bar loaded at one end.—Albert Portevin and Etienne Pretet: The influence of deformation on forging or hot rolling on the mechanical properties of steel.—Thadée Banachiewicz: A new method of determination of the orbit of a trans-Neptunian planet.—A. Bogros: The saturated vapour pressure of lithium. A modification of Knudsen's effusion method was employed; vapour pressures for six temperatures between 510° C. and 572° C. are given.—Ny Tsi Zé: The influence exercised by the X-rays according to F. Allison on the magnetic rotatory polarisation and on the properties of inactive liquids. In a field of 21,000 gauss, no confirmation of Allison's effect could be obtained with water, carbon disulphide, or nitrobenzene.—A. Cotton: Remarks on the preceding communication.—B. Nitikin and L. Komleff: The amount of radium in the petroleum waters of Baku and Daghestan.—Mme. Pierre Curie and Georges Fournier: A relation between the disintegration constant of radioactive elements emitting α-rays and their capacity of filiation.—M. Prettre, P. Dumanois, and P. Laffite: The oxidation and inflammation of mixtures of pentane and air. This hydrocarbon shows two points of inflammation, one between 260° C. and 300° C., the second between 660° C. and 670° C. In the first interval the gas mixture shows a blue flame, which disappears when the temperature is raised above 300° C.—L. Bert and P. Ch. Dorier: A new method of synthesis of cinnamic aldehyde and its homologues.—Pan Tcheng Kao: The micrography of piezoelectric quartz.—E. Rothé, J. Lacoste, and Mlle. J. Roess: Earthquakes in France in 1928 and 1929. Details concerning five earthquakes in 1928 and eight in 1929.—Pierre Dangeard: A labile iodo-complex produced by Laminaria.—Marc de Larambergue: The cytology of the autofertilisation of *Bullinus contortus*.—H. Pénau and D. Santenoise: The isolation and preparation of vagotonine, a new pancreatic hormone.—E. Ducloux and Mlle. G. Cordier: The study of certain humoral modifications arising in the course of experimental bovine marginal anaplasmosis.—C. Labailly, G. Desbouis, and A. Voulland: An efficacious method of treatment of one of the most widespread causes of infantile mortality in crèches: pneumococcic infection.—F. Vlès, A. de Coulon, and J. L. Nicod: New researches on the treatment of tar tumours in mice by certain amino-acids.—Mme. N. Dobrovolskaia-Zavadskaia, and N. Kobozieff: The lethal factor accompanying anuria and brachyuria in mice.

ROME.

Royal National Academy of the Lincei, April 27.—U. Cisotti: Isotropic tensors.—M. La Rosa and L. Sesta: A two-valve circuit emitting trains of discontinuous waves. The mode of action of a two-valve circuit coupled with a resistance amplifier is considered.—G. Barba: The functional equation $f(x).f'(x) = f[f(x)]$ related to a geometrical problem (2). The analytical solution to the problem of determining the form of the intrinsic equation of a curve in order that this may be similar to its own evolute is now considered in relation to the initial geometrical problem.—F. Sbrana: Characteristic properties of the infinitesimal operation in the group of derivations.—G. Krall: A general method for the approximate evaluation of the critical loads for beams of any type whatever.—G. Natta: The crystalline structure of hydrogen sulphide and hydrogen selenide (2). By means of the powder method and with the help of a special spectrograph adapted for low temperatures, it is found that at −170° solid hydrogen selenide possesses a cubic unit cell of side $6·020 \pm 0·005$ A. and volume $218·2 \times 10^{-24}$ c.c., containing four molecules; the calculated density is 2·456. Hydrogen sulphide and hydrogen selenide exhibit analogous lattices of the fluorite type (spacial group, O_h5). Given the analogies in the structure and in the lattice dimensions of these two compounds, their perfect isomorphism may be anticipated. In calculating the intensities of the lines of the photograms of the compounds, better agreement with the experimental intensities are obtained on the assumption of an ionic structure.—A. Ferrari and C. Colla: Chemical and crystalline structures of certain complex nitrites. The triple nitrites of potassium and lead with copper, nickel, and cobalt respectively form monometric crystals, the unit cell containing four molecules. The values of a and of the calculated density are: $K_2PbNi(NO_2)_6$, 10·55 A., 3·50; $K_2PbCo(NO_2)_6$, 10·49 A., 3·66; $K_2PbCu(NO_2)_6$, 10·52 A., 3·56. The lattice of potassium cobaltinitrite is cubic and of the same type as the preceding: $a = 10·32$ A., calculated density 2·73; the water found on analysis is probably water of impregnation of the lattice and not true water of crystallisation.—C. Andreatta: Bianchite, a new mineral. This mineral, which occurs on the goslarite of an artificial grotto of the Raibl mine, represents a new species of natural hydrated sulphate of the composition $FeSO_4$, $2ZnSO_4$, $18H_2O$. No distinct crystals were obtainable, but the compound appears to crystallise in the monoclinic system. The degree of hydration of the mineral under different conditions has been studied.—A. Belluigi: Physical characteristics of the marginal Apennine plain of Modena.

Official Publications Received.

BRITISH.

Proceedings of the Geologists' Association. Edited by A. K. Wells. Vol. 41, Part 2, 30th August. Pp. 117-219. (London: Edward Stanford, Ltd.) 5s.

The Journal of the Institute of Metals. Vol. 43. Edited by G. Shaw Scott. Pp. xii+338+40 plates. (London.) 31s. 6d. net.

Ceylon. Part 4: Education, Science and Art (G). Administration Report of the Marine Biologist for 1929. By Dr. Joseph Pearson. Pp. G18. (Colombo: Government Record Office.) 40 cents.

The Indian Forest Records. Entomology Series, Vol. 14, Parts 9 and 10: On the Genus Xyleborus. Part 9: Neue *Xyleborus*-Arten (Col. *Scolytidae*) aus Indien, von Hans Eggers; Part 10: The Biology of the Genus *Xyleborus*, with more New Species, by C. F. C. Beeson. Pp. 96+2 plates. (Calcutta: Government of India Central Publication Branch.) 1.6 rupees; 2s. 3d.

Proceedings of the South London Entomological and Natural History Society, 1929-30. Pp. xx+82+2 plates. (London.) 8s. 6d.

Air Ministry: Aeronautical Research Committee. Reports and Memoranda. No. 1302 (Ae. 445): The Stresses in a Radially Spoked Wire Wheel under Loads applied to the Rim. By Prof. A. J. Sutton Pippard and W. E. Francis. (T. 2916.) Pp. 43+17 plates. 2s. 3d. net. No. 1308 (Ae. 448): A Micromanometer of High Sensitivity. By E. Ower. (T. 2917.) Pp. 7+3 plates. 9d. net. No. 1312 (Ae. 451): The Stability of a Body towed by a Light Wire. By H. Glauert. (T. 2927.) Pp. 22+2 plates. 1s. 3d. net. (London: H.M. Stationery Office.)

London County Council. Lectures and Classes for Teachers: Handbook for the Session 1930-31. Pp. 72. (London.)

Oceania: a Journal devoted to the Study of the Native Peoples of Australia, New Guinea and the Islands of the Pacific Ocean. Published for the Australian National Research Council. Vol. 1, No. 1, April. Pp. 128. (Melbourne and London: Macmillan and Co., Ltd.) 7s. 6d. net.

Gold Coast Colony. Report on the Survey Department for the Year 1929-1930. Pp. ii+31+5 plates. (Accra: Government Printing Office; London: The Crown Agents for the Colonies.) 2s.

Journal of the Chemical Society. August. Pp. iv+1709-2036+xii. (London.)

FOREIGN.

Publications of the Manila Observatory. Vol. 1, No. 9: Meteorites in the Philippines. By the Rev. Miguel Selga. Pp. 52+2 plates. (Manila: Bureau of Printing.)

Memoirs of the College of Science, Kyoto Imperial University. Series A, Vol. 13, No. 4, July. Pp. 281-322+4 plates. (Tokyo and Sendai: Maruzen Co., Ltd.) 1.00 yen.

Five Years of Research in Industry, 1926–1930: a Reading List of Selected Articles from the Technical Press. Compiled by Clarence J. West. Pp. 91. (New York: National Research Council.) 50 cents.

Ministry of Agriculture, Egypt: Cotton Research Board. Seventh Report, 1928. Pp. v+57+50 plates. (Cairo: Government Press.) 15 P.T.

U.S. Department of Agriculture. Technical Bulletin No. 195: Control of the Mountain Pine Beetle in Lodgepole Pine by the use of Solar Heat. By J. E. Patterson. Pp. 20. (Washington, D.C.: Government Printing Office.) 5 cents.

CATALOGUES.

The "Clarostat" Book. Fifth edition. Pp. 48. (Liverpool and London: Claude Lyons, Ltd.)

A Large Selection of Books on most branches of Literature, including Notable Works from well-known Libraries and other Sources, recently Purchased. (Catalogue No. 529.) Pp. 108. (London: Francis Edwards, Ltd.)

Wild-Barfield High-Temperature Electric Furnaces for the Heat Treatment of High Speed Steel and General Purposes requiring temperatures up to 1400° C. (Section K.) Pp. 12. (London: Wild-Barfield Electric Furnaces, Ltd.)

Pituitary (Posterior Lobe) Extract B.D.H. Pp. 16. (London: The British Drug Houses, Ltd.)

Surveying and Drawing Instruments and Appliances. (Catalogue No. 564.) Pp. 266. (London: Casella and Co., Ltd.)

Diary of Societies.

WEDNESDAY, OCTOBER 1.

SOCIETY OF PUBLIC ANALYSTS (at the Chemical Society), at 8.—G. W. Baker: Scientific Evidence relating to Firearms, with Special Reference to a Recent Murder Trial. (As the author cannot be present, Mr. G. H. Perry has kindly consented to read the paper and to demonstrate the evidence.)—J. W. Croxford: The Composition of Rye Oil.—G. E. Lester Smith: The Determination of Unsaponified Oil in Soap or Fatty Acids.

THURSDAY, OCTOBER 2.

SOCIETY OF CHEMICAL INDUSTRY (Bristol Section) (in the Chemical Department, The University, Bristol), at 7.30.—Prof. J. W. Hinchley: Air and Water.

FRIDAY, OCTOBER 3.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—S. J. Crispin: The Development of the Bridge.

SATURDAY, OCTOBER 4.

ROYAL SANITARY INSTITUTE (in the Assembly Room, Town Hall, Hereford), at 10.—Councillor Mrs. Luard: The Place of Women in Local Government.—G. H. Jack: The Preservation of the Countryside.—Councillor J. R. Barker: The Health Authority and the Milk Supply.

INSTITUTE OF BRITISH FOUNDRYMEN (Lancashire Branch) (at the College of Technology, Manchester), at 4.—R. W. Stubbs: Presidential Address.

MONDAY, OCTOBER 6.

SOCIETY OF ENGINEERS (at Burlington House, Piccadilly), at 6.— Lieut. Col. H. C. Hawkins: Some Impressions of America.

IRON AND STEEL INSTITUTE (Joint Meeting with the Cleveland Institute of Engineers) (at the Cleveland Technical Institution, Middlesbrough), at 7.30.—H. C. Wood: Open-hearth Furnace Steelworks: a Comparison of British and Continental Installations and Practice.—J. Sárek: What Reasons compelled the Prague Ironworks to Introduce Thin-walled Blast-furnaces.—A. Kříž: The Heterogeneity of an Ingot made by the Harmet Process.—L. W. Schuster: The Effect of Contamination by Nitrogen on the Structure of Electric Welds.—O. Quadrat: A Contribution on the Problem of the Analysis of Basic Slags and the Representation of their Composition in a Triangular Diagram.

TUESDAY, OCTOBER 7.

INSTITUTE OF METALS (Birmingham Local Section) (in Chamber of Commerce, Birmingham), at 7.—T. G. Bamford: Chairman's Address.

IRON AND STEEL INSTITUTE (Joint Meeting with the Lincolnshire Iron and Steel Institute) (at the Secondary Schools, Doncaster Road, Scunthorpe), at 7.—F. Bainbridge: Developments in Fuel Economy at Skinningrove.—J. A. Jones: Chromium-Copper Structural Steels.

IRON AND STEEL INSTITUTE (Joint Meeting with the Sheffield Metallurgical Association) (at 198 West Street, Sheffield), at 7.30.—D. F. Campbell: High-Frequency Steel Furnaces.—W. H. Hatfield: Permanence of Dimensions under Stress at Elevated Temperatures.—A. Kříž: The Heterogeneity of an Ingot made by the Harmet Process.—H. C. Wood: Open-hearth Furnace Steelworks: a Comparison of British and Continental Installations and Practice.

WEDNESDAY, OCTOBER 8.

ILLUMINATING ENGINEERING SOCIETY (at 15 Savoy Street, W.C.2), at 6.30.—Report on Progress in Illuminating Engineering, and Display of Exhibits illustrating Recent Developments in Illumination.

INSTITUTION OF CHEMICAL ENGINEERS (in the Chemical Society's Rooms), at 8.—Dr. Saral J. Kohli: The Effect of Surface Conditions on Heat Transmission.

THURSDAY, OCTOBER 9.

ROYAL AERONAUTICAL SOCIETY (in the Lecture Hall of the Royal Society of Arts), at 6.30.—C. R. Fairey: The Growth of Aviation.

INSTITUTE OF METALS (London Local Section) (at Society of Motor Manufacturers and Traders, Ltd., 83 Pall Mall), at 7.30.—W. T. Griffiths: Chairman's Address.

INSTITUTION OF WELDING ENGINEERS (at the Engineers' Club, Albert Square, Manchester), at 7.45.—J. Ryder: The Training of Operators in the Welding and Cutting Industries.

FRIDAY, OCTOBER 10.

ROYAL SANITARY INSTITUTE (in the Guildhall, Nottingham), at 4.30.—Alderman A. R. Atkey: River Pollution.—Dr. L. P. Lockhart: Industrial Medicine in Relation to Public Health.

IRON AND STEEL INSTITUTE (Joint Meeting with the Local Branch of the South Wales Institute of Engineers) (at the Royal Metal Exchange, Swansea), at 7.—A. Kříž: The Heterogeneity of an Ingot made by the Harmet Process.—H. C. Wood: Open-hearth Furnace Steelworks: a Comparison of British and Continental Installations and Practice.—O. Quadrat: A Contribution on the Problem of the Analysis of Basic Slags and the Representation of their Composition in a Triangular Diagram.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—S. Dunlop: The Refining of Cane Sugar.

INSTITUTE OF METALS (Sheffield Local Section) (in Non-Ferrous Section, Applied Science Department, University, Sheffield), at 7.30.—Conjoint Meeting for the Sixth "Sorby" Lecture.

SATURDAY, OCTOBER 11.

INSTITUTE OF BRITISH FOUNDRYMEN (Lancashire Branch, Burnley Section) (at the Technical College, Burnley).—F. Griffiths: Belgian Moulding Sands in the Iron Foundry.

PUBLIC LECTURES.

MONDAY, OCTOBER 6.

ROYAL INSTITUTE OF PUBLIC HEALTH, at 4.—Prof. W. H. Park: Pneumonia: The Types of Pneumococci in Adults and Children and their Significance (Harben Lecture 1).

TUESDAY, OCTOBER 7.

ROYAL INSTITUTE OF PUBLIC HEALTH, at 4.—Prof. W. H. Park: Pneumonia: The Epidemiology; the Refining of Antipneumococcus Serum (Harben Lecture 2).

KING'S COLLEGE, LONDON, at 5.—Dr. J. W. Pickering: Blood Plasma and Platelets. (Succeeding Lectures on Oct. 14, 21, and 28.)

WEDNESDAY, OCTOBER 8.

ROYAL INSTITUTE OF PUBLIC HEALTH, at 4.—Prof. W. H. Park: Pneumonia: The Therapeutic Use of Vaccines and Antibacterial Sera (Harben Lecture 3).

THURSDAY, OCTOBER 9.

KING'S COLLEGE, LONDON, at 5.15.—Rev. Dr. N. Sykes: The Age of Reaction and Reconstruction (1815–65).

UNIVERSITY COLLEGE, LONDON, at 5.30.—Prof. H. Spemann: Introduction to the Theory and Practice of Experimental Embryology (in English). (Succeeding Lecture on Oct. 10.)

CONGRESS.

SEPTEMBER 29 TO OCTOBER 1.

FARADAY SOCIETY (in Laboratory of Physical Chemistry, Cambridge).—Discussion on Colloid Science applied to Biology.

Monday, Sept. 29, 2 to 4 and 4.30 to 7.—Equilibrium in Protein Systems. In Chair—Sir William Hardy, who will introduce the Discussion.

Prof. A. V. Hill: Membrane-Phenomena in Living Matter—Equilibrium or Steady State.

Dr. R. A. Gortner: The State of Water in Colloidal and Living Systems.

Prof. E. J. Bigwood: Distribution of Diffusible Ions in Gels.

Prof. W. Pauli: The Behaviour of Proteins towards other Colloids and towards Electrolytes.

Prof. F. F. Nord: The Biological Significance of the Physical Influence of Gases on Colloids.

Tuesday, Sept. 30, 10 A.M. to 11.15 A.M., 11.30 A.M. to 1 P.M., 2.30 to 4, and 4.30 to 7; and

Wednesday, Oct. 1, 10 A.M. to 1 P.M.—In Chair—Sir F. Gowland Hopkins, who will introduce the Discussion.

Dr. Honor B. Fell and Dr. Wilmer, followed by Kinematograph Studies of Living Cells by Dr. Canti: The Structure, Behaviour and Physiological Characteristics of Vertebrate Cells cultivated *in vitro*.

Prof. E. Faure-Fremiet: The Kinetics of Living Matter.

Prof. R. A. Peters: Surface Structure in the Integration of Cell Activity.

Prof. O. Warburg: Surface Reactions in Living Cells.

Prof. H. Pfeiffer: Isoelectric Point of Cells and Tissues.

Dr. A. von Muralt and Dr. J. Edsall: Double Refraction in Protein Systems.

Dr. J. H. Quastel: The Mechanism of Bacterial Action.

Other speakers will be: Prof. E. F. Burton, Prof. J. Duclaux, Prof. H. Euler, Prof. H. Freundlich, Prof. H. R. Kruyt, Prof. H. Lundegardh, Dr. P. Lecomte du Nouy, Prof. W. J. V. Osterhout, Prof. Wo. Ostwald, Prof. and Mme. Jean Roche, Dr. Straub, and Prof. T. Svedberg.