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CONTENTS

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Science in the Schools

THE recent report on the School Certificate examinations conducted in England and Wales* is an illuminating and an alarming document. It reveals the grave fact that an examination originally "designed to test the results of the course of general education before the pupil begins such a degree of specialisation as is suitable for Secondary Schools" has petrified the curricula of the schools in a mould that eliminates almost completely any individual efforts at originality or initiative. The danger was foreseen, for when the scheme was begun, some fourteen years ago, it was laid down as a cardinal principle that "the examination should follow the curriculum and not determine it". What apparently was not foreseen was the impossibility of establishing a general examination with a limited syllabus, yet preventing schools from working almost wholly to that syllabus. It is true that there are eight distinct bodies conducting School Certificate examinations, but the greatest pains have been taken to make all eight examinations as like as so many peas, until now no one could distinguish between them by a mere inspection of the questions.

In the summer of 1931, 66,909 candidates sat for the School Certificate examination. Assuming four years as the average time of preparation, it follows that the educational course of a quarter of a million boys and girls in England and Wales is being directly moulded by the requirements of eight slight variants of the same syllabus. The candidates are by no means drawn from the State-aided schools alone; on the contrary, the public schools present a contingent that forms perhaps 25 per cent of the total entry. The question whether this application of mass-production to education is not likely to have extremely pernicious results is consequently a very pertinent one, demanding the immediate and careful attention of everyone who has the interests of the children of the country—and therefore the future of the country itself—at heart.

Examinations are not necessarily an evil. They serve purposes that could not be adequately fulfilled by any other means, and a body of competent examiners can form a very accurate, and thus very useful, estimate of a candidate's attainments and ability. It is, however, clearly

* The School Certificate Examination: being the Report of the Panel of Investigators appointed by the Secondary School Examinations Council to inquire into the Eight Approved School Certificate Examinations held in the Summer of 1931. (London: H.M. Stationery Office, 1932.) 2*s*. 6*d*. net.

undesirable that the educational system of the country should be so ridden by a stereotyped examination that, to all intents and purposes, every boy and girl at sixteen has learned exactly the same things, taught in exactly the same way. It is particularly deplorable that the public schools, where experiments in education are most easily possible, and where, in the past, great educational reforms have in fact been initiated, should have fallen so completely under the spell of the School Certificate.

Admittedly their position is difficult. The possession of a School Certificate is of great value to many boys (especially since it may be, what it certainly ought not to be, a matriculation qualification), and of vital importance to some; so that if parents require public schools to prepare their sons for this examination, the schools must either acquiesce or lose the fees. The latter, under present conditions, they can ill afford to do, and so the fetters become more and more firmly riveted. It is a depressing thought that the great schools of England should be judged, in any degree, upon the lengths of their respective lists of successful candidates at the School Certificate; but there is growing evidence that judgment is frequently passed upon these very grounds. Freedom to follow new ideas is essential to the health of education, and if the public schools are to remain hampered by the rigid demands of the School Certificate syllabus, our best educational laboratories will become stultified and unfruitful.

For the moment, however, we must face the unhappy fact that the School Certificate is the predominating influence in secondary education. Until that influence can be reduced to the useful minimum originally anticipated, it behoves the country to ensure that the examination is brought to the highest degree of efficiency, the broadest degree of sanity, and the lowest degree of pedantry in syllabus, that can be achieved; though there are many who doubt whether an external examination of any kind, however excellent, is desirable at the early age of sixteen. The present report, drawn up by a panel of investigators composed of several of H.M. inspectors of schools and representative head-masters, head-mistresses and other teachers, while disturbingly complacent over the problem as a whole, offers many suggestions for improvement in detail and is reassuring upon the efficiency of the examining bodies. Upon the last point, indeed, no one has any serious doubt. The machinery is well designed and runs smoothly; examiners are chosen with care and are properly coached in their duties; cases of injustice to candidates are so rare as to be practically non-existent; and the schools are taken into free and constant consultation. There are, inevitably, technical details that require adjustment, and the panel has many observations to make on such matters, but the general impression left by the report is that the administrative and examining sides of the system—one had almost written the industry—leave little to be desired.

The real difficulties become apparent only when we pass from the machinery to the syllabuses. Though there is a good deal that might be said upon the other subjects of the examination, in these columns we shall deal solely with the problem of science—partly because it is our proper sphere, but chiefly because the place of science in education is still so largely a matter of controversy that School Certificate science needs very close consideration. The cardinal fact, always to be borne in mind, is that the School Certificate syllabus represents the whole of the training in science that the vast majority of middle and upper class citizens are likely to receive. We must inquire whether the work is oriented towards satisfactory objectives and whether it is pursued by adequate methods. The country is fortunate in possessing two such enthusiastic and able bodies of teachers as the Science Masters' Association and the Association of Women Science Teachers, but the grip of the School Certificate is so firmly set upon the schools that every public and secondary school master or mistress must work within narrow and well-defined limits. Consequently, though the methods of science teaching may be sound, the position cannot be regarded as satisfactory unless the examination limits are wide enough to admit the full objectives, and unless the objectives themselves are adequately conceived.

We confess that, in our opinion, the proper aims of school science do not appear to have been fully realised either by the panel of investigators or by the examining bodies. The importance of science to a good citizen, *qua* citizen, is duly emphasised, as in a modern system of State education it could scarcely fail to be. The value of scientific knowledge to a man or woman, as an aid to health and as a factor in earning a livelihood, is also not forgotten. But of the joy of science for its own sake, the intellectual joy that gives pleasure of a permanent and unequalled quality, the School Certificate (O shade of Aristotle!) has apparently never conceived. Also, except in so far as it is one

among many essential social activities, the future of science is completely ignored. It has not yet occurred to our educational arbiters that, if the world is to continue to exist, the well-being and progress of science must be assured. We should like to have seen a bold gesture on the part of the investigators, either completely remoulding the present syllabuses in science, or insisting upon a radically different method of examining upon them. Intrinsically, perhaps, the syllabuses are moderately satisfactory, and in some branches even good; but the questions set—which determine the teaching—are far too academic. History shows us unmistakably that scientific philosophy is late in flowering; and if we may take the maxim as roughly true that the intellectual development of the child recapitulates that of the race, we shall see the folly of asking a normal boy or girl of sixteen to deduce Gay-Lussac's law from Avogadro's hypothesis, or to answer similar questions on recondite theory. If an external, uniform examination is to be inflicted upon young children, then, so far as science is concerned, the work should be much more largely observational and descriptive, a wider choice of subjects should be allowed, and the questions should be far less technical.

The panel takes a step in this direction—a step that we welcome—by recommending the establishment of an obligatory paper on elementary science, covering an extensive field, followed by additional papers on physics, chemistry and biology which would be optional. The basic idea of this scheme is admirable, and, with reservations, we hope that it may be adopted. It would result in a broader appreciation of science, and would attract many children who are frankly bored or dazed by the more purely academic courses at present offered them. But it is easy to foresee certain difficulties that will have to be overcome if the step in advance is not to metamorphose into a retrograde movement. The most serious of them is to prevent the danger that a course in elementary science may develop into a shallow smattering of more or less disconnected topics, in which all the peculiar value and character of science is lost. A second difficulty lies in finding teachers properly equipped for a scheme of this kind, for it seems clear that the course could not fully attain its purpose if different parts of it were taught by different men; while unfortunately many science teachers are not well informed in branches of science other than their own. A third difficulty, which is, however, a matter for the administration, will arise from the fact that Higher Certificate science will need to be reorganised if a School Certificate candidate can obtain a pass in science on the proposed elementary paper.

A final point of importance in the recommendations in the report is the suggestion that practical examinations be dropped at the School Certificate stage. Some of the examining bodies have already taken this course, and the panel of investigators thinks that the others might well follow their example. If the authorities are satisfied that the practical work in schools will not suffer by the absence of a practical examination, we have no adverse comment to make; but we may perhaps remind them of the long and strenuous fight that had to be made to put school practical science on a sound footing, and we trust that they are not proposing to throw away a valuable asset.

Evolution of the Microscope

The History of the Microscope: Compiled from Original Instruments and Documents, up to the Introduction of the Achromatic Microscope. By Dr. Reginald S. Clay and Thomas H. Court. Pp. xiv+266. (London: Charles Griffin and Co., Ltd., 1932.) 30*s.* net.

THE story of the development of any scientific instrument is an interesting one, but this is especially so when the result of the development is so universally known and used as the microscope.

It is impossible to imagine the modern scientific laboratory without this invaluable tool. The pathologist, to whom the clinician refers for help in a diagnosis, the bacteriologist, studying the purity of our foods, and the physicist, making measurements of fundamental importance, all depend on the efficiency of a system of lenses grouped together to magnify the object which is being observed. The microscope has become such a commonplace that we are apt to forget its importance, and its origin.

The book under review has been prepared by two men particularly well equipped to write an authoritative treatise on the history of the microscope. Both of them are known as collectors of old optical instruments. Mr. T. H. Court, the generous donor of a unique collection of scientific instruments to the Science Museum, South Kensington, has for many years collected not only instruments but also books, catalogues, and trade-cards which have thrown great light on

many obscure points in connexion with the manufacture and sale of the microscope. Dr. R. S. Clay, possessing not only a valuable collection of microscopes but also of optical literature, has brought to his task a knowledge of optics which is authoritative.

The microscope is not old as compared with the astrolabe or some of the instruments devised for determining the position of the heavenly bodies. The single lens, however, is undoubtedly the oldest optical instrument, and from combinations of such lenses the telescope and the microscope were evolved.

The authors have examined many early references, and show that the credit for the invention both of the telescope and microscope must be given to the Dutch spectacle-makers, Hans Jansen and his son Zacharias. The first instruments were made about 1590, or at the beginning of the seventeenth century, the period which saw the birth of physical science as we understand it. The knowledge of the possibilities of the microscope soon spread, and we learn that Cornelius Drebbel (the mathematical tutor to James I) was making microscopes from 1619 to 1623, although they were probably single-lens instruments. The Drebbel instruments became well known, and the value of the instrument for scientific research may be said to date from this time.

In 1665 Robert Hooke published the "Micrographia"—a book which fills one with wonder at the originality and variety of the ideas contained in it. It includes many copper-plate illustrations of objects which Hooke had drawn in great detail with the aid of the microscope, such as the edge of a razor, the point of a needle, sections of plants, moulds and insects. Hooke described in some detail the construction of his microscope. The objective consisted of a double-convex lens of short focal length, mounted in a cell with a pin-hole diaphragm close to the lens; the eye-piece consisted of a large field-glass and an eye lens. For some time it was thought that Hooke had suggested the use of the field lens, but there is little doubt that this was due to Monconys, who in his "Voyages", published in 1665, gave a specification of a microscope he had had constructed by Campani in 1660, which included a field lens. There is no doubt that microscopes fitted with field lenses were being sold in London in 1662. Helvelius, who had a great admiration for the English microscope, added in 1673 to an English-made instrument, the focusing screw, and a fine adjustment for focusing the object—a great advance on the cumbersome method of sliding the vellum tubes one inside the other.

Marshall may be regarded as the first great English optician. His microscopes were well constructed and in great demand. He revived, if he did not re-invent, the slow-motion focusing adjustment of Helvelius, and fitted a ball and socket joint at the bottom of the pillar so that this instrument could be inclined at a convenient angle for observation. He was the first to fit a condensing lens under the stage of the microscope for the better illumination of transparent objects. A set of six objectives of varying magnifying powers were generally supplied in a drawer fitted in the base of the instrument.

The circulation of the blood had been discovered by Harvey in 1628, and thus its demonstration in the tail of a fish or in the web of a frog's foot was of great interest to users of microscopes. Marshall actually advertised his instrument as the "New Invented Double Microscope for Viewing the Circulation of the Blood". The possibility of being able to demonstrate the circulation of the blood with a microscope remained for more than a century one of the greatest selling points of the instrument. Accessories for holding the frog or fish were included in the majority of microscope outfits.

The next great step in the development of the microscope was due to Hertel. In a book published in 1716, he described in detail an instrument which contained some important features, the chief of which was a plane mirror for illuminating transparent objects; he also invented a screw, and a ruled micrometer—three inventions of such importance that his name should be remembered with gratitude. About fourteen years later, Culpeper introduced the concave mirror mounted on gimbals and placed in the optic axis of the instrument. This, as the authors point out, was one of the greatest inventions made in connexion with the microscope, combining as it does the functions of the reflector and condenser. The placing of the mirror permanently in the optic axis had a great influence in perpetuating the rigid upright axis. In 1744, Cuff made the vertical type of microscope completely in brass, and reverted to the Helvelius method of focusing which had been so strangely neglected for seventy years.

Benjamin Martin, 1704–82, had a great influence on the development and use of the microscope.

He published a large series of popular handbooks on physics, and particularly on optical instruments. Judging by the number of these books that are to be found in the catalogues of second-hand booksellers, they must have had a large circulation. He was responsible for the design of the 'drum' microscope which became so popular, being made in large numbers on the Continent. The two George Adams, father and son, made microscopes of outstanding quality, and they vied with Martin in making advances in the design and construction of their instruments. In addition to their mechanical abilities, they both had marked literary gifts which were shown in a series of textbooks. The father published the first edition of his "Micrographia Illustrata" in 1746, and the son entirely re-wrote the work in his "Essays on the Microscope" published in 1787. In his 'Prince of Wales' microscope, Adams, Sr., mounted the instrument on trunnions, and fitted a rack and pinion coarse-adjustment, and a screw fine-adjustment. For convenience in working, and for rigidity, this instrument was far ahead of its competitors. It is not easy to understand why the trunnion form of mounting was not adopted. It had to wait for nearly fifty years before it was re-introduced; it is now used universally in all first-class instruments.

Space has not allowed of any discussion on the simple microscope. This is not for want of material in the book, because the authors have given us in Chap. iii (45 pages) an interesting story of Leeuwenhoek's instruments, and the development of the simple instrument. Chap. x, dealing with solar and scroll instruments, brings home vividly to the reader the disadvantages of sunlight as a source of illumination as compared with the modern electric lamp.

A list of instrument makers, with brief biographical notes, contains information which must have taken a great deal of patient research to obtain. This research is an outstanding feature of the book.

A few errors and omissions have been noted, and should be corrected in a second edition. Page 118—the name Baker is incorrect, it should be Barker (see p. 229): Page 156—the date of the invention of the micrometer by Gascoigne was 1638 not 1743: Page 183—for Milsdoerffer, Mitsdorffer should be read: Page 199—the title of the book by Adams, Jr., was "Essays on the Microscope" and not "Micrographical Essays": the name of John Cuff should be inserted in the list of instrument makers.

It is not easy to clothe the dead bones of the history of an instrument and to make them tell a living story. This the authors have succeeded in doing in a way which evokes admiration. Unfortunately they finish the story of the microscope before the introduction of the achromatic lens. It is to be hoped that some day, in a succeeding volume, they will be able to bring the narrative up to modern times.

ROBERT S. WHIPPLE.

A Concise Theoretical Physics

Lehrbuch der theoretischen Physik. Von Prof. Dr. Georg Joos. Pp. xvi+644. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1932.) 26 gold marks.

THE author has set himself the considerable task of covering in six hundred pages the whole of theoretical physics, including modern developments, and it may be said at once that he has been extraordinarily successful in conveying, in the brief space at his disposal, the essence of the theories which he exposes. While the book is necessarily mathematical, no calculation of any importance is ever carried out without introductory discussion in which the assumptions and their meaning are carefully set forth. It is, in fact, just such a treatment as the practical physicist requires, and the exemplary self-control, such as is not always exercised by his countrymen, with which the author has confined himself to essentials, has not only enabled him to pack his matter into one volume but has also given that volume a very attractive unity.

The first third of the book is taken up by a mathematical introduction, quite simply written, in which the author expounds the vector calculus and certain matters not usually dealt with in ordinary courses of elementary mathematics, and by a section on mechanics, covering elementary elasticity and hydrodynamics and leading up to relativity. The next section, which can be roughly described as dealing with classical electricity, includes, as a development of electromagnetic waves, all that the book has to say of light. It is followed by a treatment of the atomic aspect of electricity, in which the author starts with the conduction through liquids, and then proceeds to gases and finally metals. He takes dielectrics and magnetism together, a good example of the method in which he has frequently abandoned traditional arrangement

in favour of, from the mathematical point of view, a more logical grouping. The theory of heat he treats first from the thermodynamic, then from the statistical point of view, the latter leading up to radiation and the new statistics of Fermi and Bose. His last section, on the structure of the atom, closes with a brief treatment of wave mechanics.

The author very justly says in his preface that the book is not a mountain railway, to bring the reader without effort to the peaks, but rather a mountain guide, which leads the reader to places from which he can get a good view of the peaks. It will not make easy reading for a student approaching the subject for the first time, but it is a most excellent book for him to study with a teacher, or for him to use in order to complete and consolidate preliminary knowledge. For the more experienced student and for the teacher of physics rather than of applied mathematics, it is in every way to be commended. E. N. da C. A.

Descriptive Zoology

Handbuch der Zoologie: eine Naturgeschichte der Stämme des Tierreiches. Gegründet von Prof. Dr. Willy Kükenthal. Herausgegeben von Dr. Thilo Krumbach.

(1) Bd. 2: Vermes Amera, Vermes Polymera, Echiurida, Sipunculida, Priapulida. Lief. 11. Pp. 257–416. 18 gold marks.

(2) Bd. 2, Lief. 12. Pp. 32 + 64. 12 gold marks; Lief. 13. Pp. 65–212. 18 gold marks.

(3) Bd. 2, Lief. 14. Pp. 160. 20 gold marks.

(4) Bd. 3, Hälfte 2: Chelicerata, Pantopoda, Onychophora, Vermes Oligomera. Lief. 1, Teil 3. Pp. 160. 20 gold marks; Lief. 2. Pp. 32 + 48. 10 gold marks; Lief. 3. Pp. 32 + 64. 12 gold marks.

(5) Bd. 6: Acrania (Cephalopoda), Cyclostoma, Ichthya, Amphibia. Hälfte 2, Lief. 1. Pp. 112. 15 gold marks; Lief. 2. Pp. 113–208. 12 gold marks.

(6) Bd. 7: Sauropsida, Allgemeines; Reptilia; Aves. Hälfte 1, Lief. 1. Pp. 128. 16 gold marks.

(7) Bd. 7: Sauropsida, Allgemeines; Reptilia; Aves. Hälfte 2, Lief. 6. Pp. 545–656. 14 gold marks.

(Berlin und Leipzig: Walter de Gruyter und Co., 1930–1932.)

VOL. 1 of this work, which is to consist of seven volumes, was completed nearly seven years ago and the first half of Vol. 3 in 1927 and of Vol. 4 in 1930. Most of the other volumes are making good progress except the fifth volume (Mollusca, Echinoderma and Tunicata) three parts of which, completing the account of the Mollusca, appeared during 1925 and 1926. About 6,500 pages of the work have now been issued. The editor and publishers are to be congratulated on the output of more than 1,100 pages during 1931, and on maintaining the high standard of authorship and production referred to in our previous notices.

(1) In this part Prof. Fuhrmann completes his account of the Cestoda, characterised by concise and skilful treatment and by its excellent illustrations, seventy of which in the present part are original. The author does not favour the view that the pseudophyllid Cestoda, for example, *Caryophyllæus*, are nearly related to the Trematoda; he regards as much more probable that the Trematoda and Cestoda are quite separate and have been derived from nearly related Turbellaria, for example, the Rhabdocœla, and that resemblances between the Pseudophyllidea and the Trematoda are due to convergence.

(2) A short general introduction to the Annelida by Dr. Riesiger leads to Prof. Hempelmann's account of the structure, reproduction and biology of the Archiannelida and the Polychæta. While this is for the most part altogether adequate, a fuller account of the histology of the nervous system would have been welcome and would have afforded the opportunity for a useful summary of the extensive work on the neurones and their fundamental inter-relationships in Polychæta and other Annelida.

(3) In Prof. Baltzer's hands the Priapulida (14 pp.), Sipunculida (47 pp.) and Echiurida (100 pp., unfinished) receive thorough treatment. The author inclines to the relationship of the Priapulida to the Kinorhyncha, and holds that the Sipunculida and Echiurida are separate and that the old group of Gephyrea must be definitely abandoned. New details are given on the structure of the uterus of *Bonellia*. This uterus is divided into two parts—one for the eggs and the other harbouring the dwarf males—separated by a narrow canal closed by a plug of mucus which is dissolved at the time of egg-laying when the eggs pass into the second chamber and are there fertilised on their way to the exterior. Dr. Baltzer provides a useful summary of the observations and experiments on the determination of sex in the post-larval development of *Bonellia* and on the production of various grades of intersexes. He directs attention, in his

account of the trochosphere of *Echiurus*, to the mesoderm which, as he showed in 1917, does not develop from teloblasts and does not become segmented ; in both these points he corrects the well-known account by Hatschek which is repeated in most textbooks. From the list of parasites of the Echiurida is omitted *Oligognathus bonelliæ*, parasitic in the cœlomic cavity of *Bonellia*.

(4) Lief. 1 contains Dr. Herman Graf Vitzthum's account of the Acari, in which a fair share of attention is devoted to the internal anatomy and to the section on ecology. While the Acari are probably monophyletic, the author points out that the common stem must have divided, possibly in early Devonian times, for the mite *Protacarus crani* from the Old Red Sandstone, Aberdeenshire, described by Hirst, already shows some differentiation towards the recent Eupodidæ. At present there are six main branches forming the recognised sub-orders. The number of genera of Acari approaches 1,000 and of the species about 6,000.

Lief. 2 consists of accounts of Rhabdopleura by Drs. B. Bergersen and Hj. Broch and of *Balanoglossus* by Prof. van der Horst, both well done and fully illustrated. In the first part the authors examine the view put forward by Schepotieff that the Graptolites were Pterobranchia, which they conclude is untenable.

The account of the Merostomata (32 pp. unfinished) by Prof. U. Gerhardt and of the Pycnogonida (64 pp.) by Dr. H. Helfer constitute the third section. In the latter, the development, larval stages, ecology and phylogeny are the most interesting sections.

(5) These two parts form the first portion of the account of the Amphibia by Dr. Franz Werner. A brief survey of the main facts of structure, development, distribution and biology of the class precedes the detailed consideration of the osteological features and the classification of the Stegocephali and the excellent account, with many good figures, of the Apoda (Gymnophiona).

(6) This contains the first instalment of Dr. O. V. Wettstein's description of Sphenodon—the skeleton and teeth (42 pp.), musculature (53 pp.), and nervous system (unfinished 23 pp.), all of which are described in considerable detail and are well illustrated. The labelled drawings of the posterior, ventral, dorsal and lateral aspects of the skull will be helpful to advanced students for such drawings are not readily accessible elsewhere, and a word of commendation is due also for the account of the epiphysis and the pineal eye.

(7) Dr. Stresemann continues his admirable account of the birds and discusses in particular the various movements of the wings and the different types of flight in relation to the anatomy of the bones and muscles and to the feather-planes. Due attention is given to the swimming and diving of birds and the movements in relation thereto of wings, feet and tail. An interesting description follows of the structures concerned in the production of voice and song, in the alteration of tone and in resonance. In the section on geographical distribution are found data on the rate of spread of species and on discontinuous distribution as a result of the past history of the earth.

Short Reviews

Grundzüge der regionalen Limnologie. Von Prof. Dr. Einar Naumann. (Die Binnengewässer : Einzeldarstellungen aus der Limnologie und ihren Nachbargebieten, herausgegeben von Prof. Dr. August Thienemann, Band 11.) Pp. xiv+176+8 Tafeln. (Stuttgart : E. Schweizerbart'sche Verlagsbuchhandlung (Erwin Nägele) G.m.b.H., 1932.) 20.50 gold marks.

Dr. Einar Naumann, professor of limnology at the University of Lund and director of the Limnological Laboratory at Aneboda, Sweden, gives us an instructive discussion on modern principles of research relating to the study of fresh-water lakes. Among his many works on limnology he has already contributed two volumes to "Die Binnengewässer" on the foundations of experimental plankton investigation and an introduction to the study of lake bottoms. Closely related to these is the present work on regional limnology, which embraces a large number of side issues concerned with the detailed investigation of fresh water lakes, their origin, form and contents, both organic and inorganic, involving the co-operation of geologist, physicist, chemist and biologist. This is a very new branch of biological science although a large amount of preliminary work has already been accomplished, especially at Prof. Naumann's own laboratory, which is the headquarters of all such research.

First and foremost in the work are concerned the life in the lakes with the available food and the mapping of the regions and classification with regard to all factors involved—the nature of the bottom, chemical contents, physical features and the plant and animal life present. By such maps one can tell at a glance the kind of lake and its

probable inhabitants. The lakes are classified according to the amount and quality of food they can produce and these again are sub-divided. A regular order of these waters is now established so that one can foretell to a large extent what kind of plants and animals inhabit any lake. An enormous amount of work still remains to be done and this is an important addition to the literature of the subject.

Partridge Disease and its Causes, including the Report and Suggestions of the Country Life *Committee of Enquiry into the Diseases of Partridges during the Season 1931–1932.* Edited by Major M. Portal and Dr. Walter E. Collinge. Pp. ix+96+7 plates. (London: *Country Life*, Ltd., 1932.) 12*s*. 6*d*. net.

THE prevalence of a new or hitherto unrecognised disease amongst partridges, which caused heavy mortality during the earlier winter months of 1931, brought about the formation of a *Country Life* committee of inquiry, under the chairmanship of Major M. Portal and with the assistance of Dr. W. E. Collinge as pathologist. While partridges are subject to several fatal diseases, the special features of this epidemic were loss of weight, reluctance of the bird to feed, congestion of the cæca, stomach invariably empty; and the cause was found to be a nematode parasite, *Trichostrongylus tenuis*, harbouring in thousands in the cæca. The life-history of the strongyle has been worked out: it has been found to be spread with the fæces, from which the larvæ swarm up blades of vegetation, with which they are engulfed by other partridges. Although no wild bird seems to be concerned in the distribution of the parasite, earthworms are very frequent carriers of both eggs and larvæ. Any factor which weakens the resistance of partridges predisposes to fatal attack, and amongst such factors the Committee suspects interbreeding, overcrowding in winter, insufficient food, and unfavourable weather conditions. Some of these may be associated, as several replies to a questionnaire issued by the Committee suggest, with modern conditions of farming and roads. Special chapters have been written by experts upon methods of feeding and breeding, so that there has been gathered together in this volume a body of observations and information which no owner of partridge land can afford to ignore.

Rhenium (*Opyt monografii elementa No. 75*). By E. S. Kronman. Pp. 85. (Moscow and Leningrad: N. K. T. P. The Gold and Platinum Institute, 1932.) 1r. 25k.

MENDELEEFF'S dwi-manganese was discovered in 1925 and the name rhenium assigned to it by W. and I. Noddack has become accepted. Since its discovery, rhenium has been the subject of more than a hundred scientific communications and Dr. Kronman's Russian monograph follows closely upon Mr. P. M. Tyler's "Rhenium (and Masurium)" issued as an information circular by the U.S. Bureau of Mines and Dr. W. Schröter's "Das Rhenium", both of which appeared about two years ago.

This latest work is the most comprehensive, including as it does as complete an account of the geochemistry, isolation, chemistry and physics of the new element as the author has been able to ascertain from the publications accessible to him. He has been somewhat dependent upon abstracts in the *Chemisches Zentrallblatt* for the non-German contributions to the subject (including the letters in NATURE during 1925 *et seq.*). He has, nevertheless, omitted very little of importance and it is therefore regrettable that this monograph, being in Russian, is inaccessible to all but a few chemists and others who are interested in the new element.

J. G. F. DRUCE.

Architectural Graphic Standards: for Architects, Engineers, Decorators, Builders and Draftsmen. By Charles George Ramsey and Harold Reeve Sleeper. Pp. ix+233. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1932.) 37*s*. 6*d*. net.

IN recalling the important buildings upon which architects and their assistants worked in bygone years, it does not seem as if the elaborate 'simplicity', claimed for this book, is required. Specifications and details were prepared in those days with an assurance and success, which no mere "graphic and diagrammatic assembly of data, standards and information" would have produced. If this book may be regarded as supplying between two covers a large amount of valuable information for students, it is well, though greater simplicity might be desired. It may be seriously doubted whether any practising architect in Great Britain would be troubled with this, or any similar, work. It would not be proper to criticise American building methods unfavourably because they differ from English methods; suffice it to note, that the authors have shown their knowledge and have exercised their skill and ungrudging labour in the preparation of the book.

P. L. M.

Kamet Conquered. By F. S. Smythe. Pp. xvi+420+48 plates. (London: Victor Gollancz, Ltd., 1932.) 16*s*. net.

SEVERAL attempts had been made on Kamet before Mr. Smythe's successful expedition of 1931; so long ago as 1912 Mr. C. F. Meade discovered the best line of approach from the east by which he reached the mountain in the following year and gained an altitude of 23,500 ft., or less than two thousand feet short of the summit. Mr. Smythe's party used the same route by the East Kamet Glacier and Meade's col, reaching the top, 25,447 ft., with some difficulty but without accident. This volume, however, is more than a mere record of this and other climbs in the Himalayas. It contains a discussion of many of the problems of mountaineering, material, physiological and psychological. These reflections from an experienced climber are of great value and make the book of real use to future expeditions.

Identification of Vitamin C*

By PROF. A. SZENT-GYÖRGYI, Director of the Institute of Medical Chemistry, University Szeged

ABOUT a year ago vitamin C seemed to be the most elusive of vitamins, apparently defying all attempts at isolation and identification. To-day this substance can be bought at a relatively low price, neatly sealed in tubes, in the form of beautiful white crystals. It is even used as a reagent for reducing gold and silver in microscopical technique. Also its chemical constitution is cleared up to a great extent.

In spite of this, however, the development of our knowledge has not been so dramatic, and these results have been the outcome of laborious work extending over more than ten years. This vitamin was crystallised more than five years ago and was, so far as we know now, the first vitamin ever isolated in the crystalline form.

The development in our knowledge of vitamin C has taken place in four distinct steps. The first step was the observation of 'hexuronic acid' in 1927 and its subsequent isolation and partial identification at Cambridge in 1928. This observation and isolation in itself was the result of many years extensive studies on oxidation systems of plants and animals. I was led to these studies by the belief that the adrenal gland was in some way involved in oxidation processes. Before this function of the gland could be understood, more had to be known about oxidation itself. Thus oxidation systems were examined one by one, until a new oxidation system was brought to light in which the central rôle seemed to be played by an interesting substance with very striking chemical properties. This substance has been isolated and found to be a monocarboxy acid corresponding to the formula $C_6H_8O_6$. This formula, together with some qualitative reactions, suggested a relation with the hexuronic acid series. The substance was thus called 'hexuronic acid' and the oxidation system the 'hexoxidase system'. More recent results, however, obtained in Prof. Karrer's and Prof. Haworth's laboratories, do not bear out this relation to uronic acids and, I have proposed, in association with Prof. Haworth, to call it henceforth 'ascorbic acid'.

The most remarkable chemical property of this acid is its very high reducing power, unique among purely carbon compounds. This reducing power is the more remarkable, since the oxidation of the acid itself is reversible. It is in fact this reversible oxidisability by which the substance exerts its biological activity. It is oxidised and reduced alternately, giving off and taking up two atoms of hydrogen, thus acting as a hydrogen carrier between different parts of its oxidation system.

This same substance has been found in relatively large quantities in the adrenal cortex, of which it forms definitely a specific constituent.

*Substance of a lecture given at the University Club, Szeged, on December 15.

The second step to the establishment of the chemical nature of vitamin C was the discovery of the antiscorbutic properties of ascorbic acid. The striking similarity in chemical properties and distribution of the acid and the vitamin has been evident since the discovery of the former. It was not, however, until the autumn of 1931 that, in collaboration with J. L. Svirbely at the Institute of Medical Chemistry at the University Szeged, I was able to find the necessary external condition for the test of the antiscorbutic activity.

Meanwhile evidence was accumulating that one of the reducing substances of plant juice and the vitamin were identical. Tillmans in Germany pointed out in his extensive studies the very close parallelism of both, not only in distribution, but also under different experimental conditions. In the end he arrived at the conclusion that the main reducing factor and the vitamin were identical. In the United States, C. G. King and his collaborators emphasised the reducing power and acidic nature of active fractions, while S. S. Zilva in England has also found many close parallelisms between reduction and antiscorbutic activity. This author, however, also found differences which have led him to believe that these factors are not identical.

Our first test, undertaken by J. L. Svirbely in the autumn of 1931, clearly brought out the antiscorbutic activity of 'ascorbic acid'. We were able to show, that not only had this acid a strong antiscorbutic activity, but also that the antiscorbutic activity of lemon juice corresponded to the activity of the quantity of ascorbic acid which it contained. Our results were not announced until March 1932, by which time the experiments were repeated three times with identical results.

At this time, March 1932, W. A. Waugh and C. G. King obtained crystals from lemon juice, which they thought to be identical with hexuronic acid and which seemed to have some action on the vitality of animals. Two months later the same authors were also able to present evidence for this identity and the antiscorbutic activity.

Our own experiments were checked at our request by S. S. Zilva and L. J. Harris and were confirmed. This evidence may be summarised by saying that all the preparations of ascorbic acid tested had strong antiscorbutic activity. The investigation had now arrived at a most difficult point. The question arose, whether the activity of the preparations was due to the ascorbic acid itself or to a contamination of the preparations with some more potent substance. The daily protective dose of ascorbic acid is 0·5–1·0 mgm. Should the crystals have contained 0·1 per cent of a substance, acting (as other vitamins) in doses of 1γ, their activity could be explained by this contamination. Our own substance employed in the test as well as the preparations of Waugh

and King had a melting point 10° lower than that of pure ascorbic acid, and thus certainly contained more than 0·1 per cent impurity. This question, whether the activity is due to a definite substance or to contaminations, applies to all research on vitamins and is usually one of the most difficult problems to solve.

There is, however, much circumstantial evidence in favour of the identity of vitamin C and ascorbic acid. The parallelism in distribution and behaviour under experimental conditions, and the quantitative correspondence of the antiscorbutic activity of plant juice and its ascorbic acid content, point in this direction. Harris has shown that this quantitative correspondence holds also for the adrenal cortex with its high ascorbic acid content. Svirbely has shown that the ascorbic acid disappears from the gland very readily on vitamin-free diet, thus demonstrating the inability of the animal to build up this substance. Svirbely has also shown that our ascorbic acid, prepared from the adrenal gland, retained its antiscorbutic activity after five recrystallisations. Work on purely chemical lines alone could give direct and definite evidence of the identity of the vitamin and ascorbic acid. Unfortunately, the great scarcity of the material rendered such work impossible. Fresh adrenal glands, a convenient source for preparations, were not available in the necessary quantity, and all our efforts to prepare ascorbic acid from lemons, oranges, tomatoes, or cabbages on a large scale have failed.

In the third step in our work these difficulties were overcome and the way opened for direct chemical work, providing definite evidence for the identity of vitamin C and ascorbic acid. This progress we owe to the discovery that local varieties of Hungarian red pepper (*Capsicum annuum*) contain the acid not only in relatively large quantities but also under conditions which make its isolation exceedingly simple. It is due to this fact that during the last few months Svirbely and I have been able to prepare a full pound of crystalline ascorbic acid for chemical studies. Unhampered thus by the lack of material, we could set out with L. v. Vargha to study derivatives of ascorbic acid, an investigation which has led to the preparation of a mono-acetone derivative. This substance seemed to be almost ideally suited for our purpose. It forms big, beautiful crystals with great ease and is stable in anhydrous solution, from which it can be recrystallised without difficulty. After due recrystallisation the original acid can be recovered unchanged by simply boiling it in water for a few minutes. Since the acetone derivative does not hydrolyse in cold water immediately, it was found in the antiscorbutic experiment to be but moderately active. The ascorbic acid, recovered from the recrystallised derivative, was fully active, a definite evidence for the identity of ascorbic acid and the vitamin.

The last and perhaps the most difficult step towards the definite chemical identification of the vitamin is the establishment of the chemical constitution of ascorbic acid. The possibility of preparing ascorbic acid in quantity has also opened the way for the chemical analysis. It was a great privilege for my American collaborator Svirbely and myself to be allowed to supply material to Prof. Haworth at Birmingham and Prof. Karrer at Zurich for this analysis.

The work of the laboratories at Zurich and Birmingham has clearly brought out that ascorbic acid is, confirming my original findings, a simple substance, consisting of 6 carbon, 8 hydrogen and 6 oxygen atoms; it contains one carboxy group, but is, however, not a member of the uronic acid series, and thus is not a hexuronic acid. Two of the carbon atoms are present as C = O groups forming a keto or aldehyde group with strong enolisation. One carbon is present as CH_2. The remaining two carbon and oxygen atoms are present as alcoholic groups. In this way the essential features of the molecule are cleared up and there remains only to ascertain the relative position of these groups.

It is hoped that the fact that the vitamin is a specific constituent of the adrenal cortex, from which it disappears on vitamin-free diet, will open up many fascinating problems to research and may contribute to the deeper understanding of the relation of hormones and vitamins.

There is one aspect of these investigations on which I look with pride and gratitude. This work has been made possible only by the closest international collaboration. It has been helped by Dutch, English and American hospitality and generosity. At present it is aided by the Josiah Macy, Jr. Foundation.

Geology in the Life of a Nation

THE Indian Science Congress held its twentieth annual meeting this year at Patna under the presidency of Dr. L. L. Fermor, Director of the Geological Survey of India. In his presidential address Dr. Fermor refers to some matters of general interest in the history of the Indian Science Congress, which is modelled on the lines of the British Association, and, like that body, meets annually at different towns.

The initial meeting that led to the formation of the Congress was held in 1912 in the rooms of the Asiatic Society of Bengal and that Society has since taken the general responsibility for the organisation of the Congress year after year. Until 1931 the Congress had no permanent organisation, but a constitution was then adopted whereby it did become a continuous organisation under the title of the Indian Science Congress Association with a roll of permanent members—though the close association with the Asiatic Society of Bengal

is to be maintained. Dr. Fermor appeals to generous donors to remember the Indian Science Congress now that it has an independent existence, since it is hoped that in the future it may have funds for financing special items of research.

Special mention is made of the new periodical *Current Science*, the first issue of which as a monthly journal appeared in July 1932. This periodical has been modelled on the lines of NATURE and there has been no lack of material suitable for publication, but the financial position of the new venture at present leaves much to be desired, though this all-India journal of science can be self-supporting with a minimum of five hundred subscribers.

It is certainly very clear that the Indian Science Congress has fulfilled a want. At the first meeting there were 79 members, a presidential address was given, and 35 papers were read, and the published proceedings occupied eight pages of print. At the nineteenth meeting in 1931 the number of full and associate members was 690 and of student members 183. There were ten presidential addresses, general and sectional, and 693 papers were communicated occupying 467 pages of *Proceedings*.

In choosing as the subject for his presidential address, "The Place of Geology in the Life of a Nation", Dr. Fermor has left the sting of his remarks to the tail. All the countries of Europe, excluding Russia, Finland, Scandinavia, Poland, Greece and Turkey can be fitted into the area of India excluding Burma. The Geological Surveys of the various European countries have staffs numbering more than 250, of which 78 are employed in Germany and 52 in Great Britain. Yet for the adequate geological survey of a corresponding area, the staff of the Geological Survey of India has just been cut down in a most drastic way. It now has only 24 officers, 6 of whom are employed in Burma, leaving only 18 for the whole of the vast area of India. It is small wonder, therefore, that the Director of the Geological Survey should seek to analyse the position which geology should occupy in the life of a nation. In so doing he interprets geology as geographical evolution and states that "geography is the branch of geology that describes the particular shape and form of the earth's surface at the present time".

Although there are few geographers who would accept this definition, they would heartily agree with Dr. Fermor upon the necessity for a detailed study of that portion of the human environment which comes within the domain of the geologist. The position of the capital of India has been dictated by the physical structure of the subcontinent, which in turn depends on its geology. Similarly, the position of the commercial capital, Calcutta, dependent as it is on the nature and extent of its hinterland, has been similarly determined. The black earth region that forms the natural hinterland of Bombay and provides the Bombay cotton mills with their huge supplies of raw cotton, depends in turn upon the existence there of the black soil derived in the main from the Deccan lavas. The close correspondence between the political map of Europe and the orographical and geological is emphasised and it is in particular pointed out how the less stable political units of Europe are those which are less clearly natural geographical or geological units. "India is fortunate, however, in that the general geological conditions have caused the inhabitants, in spite of their diversity of race, religion and language, to be welded after struggles through the ages into one political unit. As the national boundaries in central Europe, the boundaries between the provinces in India pay little attention in many cases to geological considerations. The province of Bihar and Orissa, for instance, . . . is an excellent example of the violation of natural principles by provincial boundaries. But as long as the central political control remains, it does not matter seriously that the boundaries of our provinces take such little account of natural factors. Were the central control, however, removed and all political relationship to one general suzerain power severed, then the future history of India would again become as confused as it was in the past and as confused as that of Central Europe has been throughout the ages and promises to become again in the future."

This is truly the geographer's point of view and it is interesting to find it so clearly voiced by a geologist. There is an unhappy note when Dr. Fermor says towards the end of his address that "at present the scope for new employment for geologists in India has fallen almost to zero". He urges, however, the continued need for geological classes in university institutions as a "branch of general culture".

One cannot regret feeling that Dr. Fermor has not been able, because of his official position as director, to add point to his arguments by reciting some, at least, of the great work which has been carried out by the Geological Survey of which he is head. So it is to be feared that the reduction of this essential service in such an amazingly drastic fashion has passed without the notice that it should have attracted from men of science. For the Survey has a great and continuous record of work and it is to be hoped that under Dr. Fermor's guidance it will force an adequate recognition of its services to the country.

This is not the place for reciting what the Survey has done, but perhaps its Director may be able to remove what have in the past been two of the major criticisms: (1) the perhaps rather inadequate means of publication of the detailed mapping carried out by the officers, whose work in this respect remains unknown even to geologists in India itself, while there is apparently nowhere in Britain where the one-inch maps, on the preparation of which a large proportion of the officers' time is expended, can ever be consulted; (2) the serious time lag between field-work and publication, especially important where problems of economic geology are being investigated.

L. DUDLEY STAMP.

Tercentenary of Samuel Pepys

By T. E. JAMES

THE three hundredth anniversary of the birth of Samuel Pepys, a moving, dramatic figure in the political and social annals of the Restoration period, falls on February 23. Born either at Brampton, near Huntingdon, or in London (so records say), he was educated at St. Paul's and Magdalene College, Cambridge, graduating there in 1660. In 1655, Pepys married and had, for some time, to face comparative poverty. He was favoured, however, with the patronage of Sir Edward Montagu, and was employed as secretary to the expedition for bringing Charles II from Holland; this leading to permanent and official employment at the Admiralty. In 1679 Pepys was committed to the Tower on a State charge, but was incontinently released.

Pepys's "Diary" was begun on January 1,1659-60. It was written in great secrecy. The final entry was made on May 31, 1669. The "Diary" itself was not published until 1825. Therein, the high intent, the ignoble, and the frailties of Pepys's own life resolve into an inexplicable, baffling display of inwardness.

Not the least monument to Pepys, where memory is deep and lasting, was the bequest of his library and MSS. collections (by preference) to Magdalene College, Cambridge. An excellent general account of the Pepysian Library has been given by H. B. Wheatley (1880).

During the early part of Charles II's reign, the Royal Mathematical School of Christ's Hospital, still part of the major foundation, was established. Pepys, as a governor, took a lively interest in its efficient administration. On February 15, 1661–2, Pepys was made a younger brother of the Trinity House and in 1676, Master of the Trinity House. He was elected Master of the Clothworkers' Company in 1677.

Readers of NATURE will be more particularly interested in the association of Samuel Pepys with the Royal Society of London in its early days, particularly with those men who had been most active in its institution. In course of time we witness Pepys's own inclusion in the organisation; ultimately, his assumption of the office of president.

We need entertain no doubt that Pepys was cognisant of the various steps that were taken to establish the Society. He had friends of quality, who would relate what had happened, whilst Pepys himself, Clerk of the Acts (Navy), was favoured in the Restoration Court circle, where news spread apace. Hence, on January 9, 1664–5, Pepys is able to record that the Royal Society's charter book had been brought to Whitehall, and that the founder's signature and that of the Duke of York were duly inscribed. Indeed, he had not long to wait for acceptance amongst the philosophers. On February 8, 1664–5, "Samuel Pepys, Esq., was proposed candidate by Mr. Povey", the business prior to this being the election of Edward, Earl of Clarendon, the famous Lord Chancellor. Mr. Pepys found himself in excellent company. Thomas Povey, it may be mentioned, was an original fellow. He had mechanical gifts and for many years proved serviceable to the Society. Evelyn considered him to be "a nice contriver of all elegancies".

On February 15, 1664–5, Pepys was duly elected, signing the charter roll then and there. Going home, Pepys recorded his experience thus:—

> "With Creed to Gresham College, where I had been by Mr. Povy; and the last week proposed to be admitted a Member, and was this day admitted, by signing a book and being taken by the hand by the President . . . and some words of admittance said to me. But it is a most acceptable thing to hear their discourse, and see their experiments. After this being done they to the Crowne Taverne, behind the 'Change, and there my Lord and most of the company to a club supper; . . . Above all, Mr. Boyle to-day was at the meeting, and above him Mr. Hooke, who is the most, and promises the least, of any man in the world that ever I saw."

Pepys chronicles, as also amongst the company, Sir Paul Neile, Sir Robert Moray, Dr. Clarke, Dr. Whistler, and Dr. Goddard. On March 1, following, the subjoined entry occurs:—

> "At noon I to dinner at Trinity House*, and thence to Gresham College, where Mr. Hooke read a second very curious lecture about the late Comett†; among other things proving very probably that this is the very same Comett that appeared before in the year 1618, and that in such a time probably it will appear again, which is a very new opinion. . . . Then to the meeting. . . ."

In the following week (March 8), Pepys goes to the weekly meeting as a fellow. A letter was read from Huyghens to Sir R. Moray, containing first his desire to be more particularly informed about the pendulum watches committed to Major [later Sir Robert] Holmes. Mention was thereupon made of Holmes's relation of the performances of pendulum watches on his voyage to Guinea, and doubts were cast. Accordingly, Mr. Pepys was asked to inquire into the matter for the satisfaction of the Society. On March 15, Pepys gave an account of information that he had obtained from the master of the Jersey ship who had sailed with Holmes on the Guinea voyage. Something additional devolved on Pepys. He was desired to bespeak a man at Deptford for diving. The diver was to be sent to Robert Hooke to be instructed by him concerning the use of "air-boxes" under water. Later, in May, Lord Brouncker reminded

* The Navy Office, where Pepys resided, lay between Crutched Friars and Seething Lane, by the Tower.

† See in this connexion, NATURE, Feb. 7, 1884, p. 345, article in "Our Astronomical Column".

Pepys of this commission, as the season was favourable. On March 22, the subject of Holmes's watches arose, and Pepys was requested to procure the journals of those masters of ships who had been with Holmes in Guinea and differed from him.

The incidence of the Plague and the Great Fire which followed were periods of intensive public anxiety and apprehension, and we lose contact with the College world for some time. But on November 14, 1666, Pepys records that Dr. Croone had told him that at that night's meeting, "which, it seems, they now have every Wednesday again", there were experiments on blood transfusion. A year later (November 21, 1667), there is another reference :—

. . . "I to the office, where did much business till after candlelight, and then my eyes beginning to fail me, I out and took coach to Arundell House, where the meeting of Gresham College was broke up ; but there meeting Creed, I with him to the taverne in St. Clement's Churchyard."

On November 30, 1667, Pepys tells us that he went to Arundel House to the election of officers of the Royal Society for the next year ; that he was near being chosen, but glad that he was not, for he could not have attended, but took it as a mighty respect to have been named. Also, that the company was great, the elections long.

On April 2, 1668, Pepys mentions a visit to the Royal Society, with Lord Brouncker, and of being "forced to subscribe" to the building of a College ; and that he "did give forty pounds". Pepys held views adverse to the scheme, and these may have reflected themselves in a partial withdrawal of interest, for not until November 30, 1674, do we again pick up the threads of association with the Society. But it is with enhanced prestige. At the anniversary meeting, Mr. Pepys is among ten new members chosen for the council. His ally, Sir Joseph Williamson (P.R.S., 1677), was also of the number. Pepys attended the meeting on December 3, when a resolution was taken that every member of council should provide an experimental discourse for the Society, to be made within the year, either by himself or by some other member of the Society ; *or*, "to pay forty shillings". Pepys promised a discourse.

On December 17, Pepys is placed upon a committee to consider how Dr. Wilkins's legacy of £400 might be laid out. Also, he was joined with Sir R. Southwell and the president in an application to Prince Rupert "concerning the mischief which his glass-house does to Chelsea College". In January ensuing the president announced his discourse. Mr. Pepys, he said, had offered to make his the next week after his own ; it does not appear, however, that Pepys held to his offer.

On February 18, 1674–5, "Mr. Isaac Newton" was admitted a fellow. Since Pepys was a member of council, there is a presumption that he was present on this particular occasion. Pepys was irregular in his attendances, however, during the year, and he was not continued on the council. But his light was only temporarily dimmed, for on November 30, 1676, he re-appears as one of ten new members, and among these were Sir Christopher Wren and John Evelyn. Again Pepys served twelve months.

In the politically stormy year of 1680, "far away at Newmarket, Pepys was taking down, at the dictation of his sovereign, the tale of that miraculous escape from Worcester of twenty-nine autumns before" (Bryant).

We now pass to the year 1681, when Pepys re-appears in the Royal Society. At the anniversary meeting on November 30, he enters the council, and with him, Evelyn and Flamsteed ; Sir Christopher Wren is president. Hooke was a colleague. Pepys served for one year. Coming to 1684, at the anniversary meeting on December 1 (St. Andrew's Day falling on a Sunday), Sir John Hoskyns in the chair, Samuel Pepys, chosen for the council, is also elected president of the Society. Notwithstanding that his attendances were infrequent, he was, in 1685, continued in the presidency for yet another year, this nomination marking the closing and final period in that office.

Here it may be mentioned that at a council on June 2, 1686, the first book of Newton's "Principia" was ordered to be printed. Pepys was not present, nor on June 30, when it was ordered that the president be desired to license the book. Sir John Hoskyns occupied the chair. Pepys's imprimatur was given on July 5.

Samuel Pepys was never a very healthy man, and he died at Clapham on May 26, 1703. He was buried in St. Olave's Church, Crutched Friars. His portrait, by Kneller, and his own gift, adorns the apartments of the Royal Society.

Obituary

Prof. Harlan W. Fisk

THE science of terrestrial magnetism has lost an outstanding investigator and the staff of the Carnegie Institution of Washington an esteemed member by the sudden death, on December 26, of Prof. Harlan Wilbur Fisk, chief of the Section of Land Magnetic Survey of the Institution's Department of Terrestrial Magnetism. During his long period of service with that organisation, extending over more than a quarter-century, he contributed much to the success of the world magnetic survey both by personal participation in the observational work and by planning and supervising the work at repeat-stations for obtaining data where most needed for investigations in his complex field.

Prof. Fisk was born at Geneva, Kansas, on September 25, 1869, but his youth was spent in Minnesota where he received his fundamental scientific training at Carleton College, Northfield. Here his enthusiasm for mathematics and

astronomy was awakened by contact with such inspiring teachers as W. W. Payne and H. C. Wilson. In 1899 he was appointed professor of mathematics at Fargo College (North Dakota). It was here that the problem of terrestrial magnetism first engaged his attention and he devoted his summer vacations (1904–6) to magnetic observations for the United States Coast and Geodetic Survey in the north-central and western States. His interest in this field grew so rapidly that in October 1906 he adopted it as his life work when he became associated with the Department of Terrestrial Magnetism.

Here Prof. Fisk focused his activities on the land magnetic survey—one of the major undertakings of the Department. He made two detailed surveys of the Bermuda Islands, in 1907 and 1922, and in 1908 conducted magnetic expeditions in Central America, in the West Indies, and in the northern countries of South America. He was also greatly interested in the investigations of possible eclipse effects on the earth's magnetic field and participated in several eclipse expeditions of the Department—the last was on the occasion of the eclipse of August 21, 1932, when he was in charge of three observing parties in New England. He took a prominent place in the instruction of many of the Department's most active observers and in the laborious observations during many years in Washington, D.C., relating to the control of instrumental outfits and the determination of the provisional international magnetic standards.

Prof. Fisk's chief research contribution was the investigation of secular changes in the earth's magnetism and of the shifting of isoporic foci disclosed by magnetic data obtained at strategic repeat-stations by observers under his supervision. Mature deliberation led him to infer that secular changes in the earth's magnetism determined by observations on its surface might reflect changes within the earth's crust or interior. At the time of his death, he had in preparation an exhaustive paper on this subject.

Besides membership of a number of scientific societies, Prof. Fisk was an active worker in the American Geophysical Union, being secretary of its Section of Terrestrial Magnetism and Electricity in 1929–32. Because of an unusual breadth of culture extending far beyond the confines of his scientific activity, it was his pleasure and privilege to render important service to his community in its civic and religious life. His quiet disposition, generous nature, and helpful counsel, won him the esteem of his colleagues and friends. Those who shared his acquaintance and work, will mourn with his widow and four children his premature passing. H. D. HARRADON.

MR. B. H. SOULSBY

MR. B. H. SOULSBY, who died at Reading on January 14, aged sixty-eight, was for nearly thirty-eight years in the service of the Trustees of the British Museum, first at Bloomsbury and later at South Kensington. He was educated at Cheltenham College and at Corpus Christi College, Oxford, and also studied at Göttingen. He entered the service of the Trustees as a second-class assistant in the Department of Printed Books in 1892, and became successively superintendent of the Map Room, of the Copyright Office, and finally deputy superintendent of the Reading Room. During his time at Bloomsbury, he catalogued the library of the Grand Priory of the Order of the Hospital of St. John of Jerusalem in England, and translated some early geographical works. In 1902 he published a small pamphlet on the earliest two maps which bear the name America.

In 1909 Mr. Soulsby was transferred to the Natural History Museum as assistant in the Director's office, and in January 1921 he was appointed librarian in succession to the late Mr. B. B. Woodward. His principal official duty was to continue Woodward's Catalogue of the Natural History Library, a monument of bibliographical care and research and a mine of information, the value of which was recognised far beyond the limits of the Library to which the work refers. Woodward had compiled six volumes and one supplementary volume, and at the time of Mr. Soulsby's retirement, the second supplementary volume was well on the way to completion.

At the time of his death, Mr. Soulsby was seeing through the press the final stages of a revised, second edition of the "Catalogue of the Works of Linnæus . . . in the British Museum". The first edition, which was compiled by B. B. Woodward and W. R. Wilson, was a quarto publication of 27 pages, comprising some 580 entries. The second edition will contain about 300 pages of text, with nearly four thousand entries, accompanied by bibliographical notes, plates and an index.

It was upon this index that Mr. Soulsby was engaged, with his accustomed industry and enthusiasm, at the time of his death. The forthcoming publication of this Linnæan Catalogue is a matter of great interest to librarians in Sweden, from several of whom Mr. Soulsby obtained considerable assistance in its preparation. The compiler used to claim that the collection of Linnæana at South Kensington was second only in richness and importance to that at the Royal University Library of Uppsala, and if this is so, it is largely due to Mr. Soulsby's great generosity, inasmuch as ever since he undertook the work of producing a second edition of this catalogue, he was continually presenting rare and costly Linnæana to the library at South Kensington.

MR. J. L. S. HATTON

JOHN LEIGH SMEATHMAN HATTON, who died on January 13, aged sixty-seven years, was the first principal of East London College and, at the time of his death, Vice-Chancellor of the University of London. He was born at Street Aston on May 27, 1865, the son of the Rev. J. L. S. Hatton,

rector of West Barkwith, Lincolnshire. He died at his home at Sanderstead, Surrey, and is survived by his widow and two sons.

Mr. Hatton entered Oxford with a scholarship at Hertford College and obtained a first class in the school of mathematics in 1889 and a second class in natural science (physics) in 1890. He acted for a short time as demonstrator in the Clarendon Laboratory and was called to the Bar by Lincoln's Inn.

In 1892, Mr. Hatton began to organise the day and evening teaching work of the People's Palace in Mile End Road, and by his unremitting effort and enthusiasm, supported by the interest and encouragement of the Drapers' Company, he built up an institution which, in 1907, became East London College, a school of the University of London, with day courses leading to degrees of the University in the faculties of arts, science and engineering. Mr. Hatton became a member of the Senate of the University in 1903, representing the faculty of science, and continued in this office until on the reconstitution of the University, he became a member *ex officio*.

Mr. Hatton's work for the University was as thorough and valuable as that for his own College. He was dean of the faculty of science from 1922 until 1926, chairman of the Board of Studies in Mathematics for many years, was elected deputy Vice-Chancellor in 1930, and assumed the office of Vice-Chancellor last September. He was for many years head of the Mathematical Department at East London College, and was appointed University reader in geometry in 1927 on his retirement from this post. He was the author of several mathematical works, including "The Theory of the Imaginary in Geometry", but his main interests were in teaching and administration.

MR. WILLIAM H. V. WICKES of Bristol died on February 2, aged eighty-six years. Wickes was a well-known local geologist and had been guide, philosopher and friend to many of the older school, British and foreign. He wrote short papers on the Rhætic bone-bed and the mineral beekite and made a varied collection, passing his best things on to the British and the Bristol Museums.

WE regret to announce the following deaths:

Prof. Johan van Baren, professor of geology and mineralogy in the Agricultural University of Wageningen, Holland, an authority on soil mineralogy, on February 7, aged fifty-seven years.

Lieut.-Col. J. C. G. Kunhardt, formerly of the Indian Medical Service, who did valuable work on plague prevention in India, and also in the advancement of the rubber industry, aged fifty-seven years.

Prof. A. G. Leonard, professor of geology in the University of North Dakota and State geologist, on December 17, aged seventy-seven years.

Sir Daniel Morris, K.C.M.G., assistant director of the Royal Botanic Gardens, Kew, in 1886–98, and president of Section K (Botany) of the British Association in 1919, aged eighty-nine years.

Prof. Ormond Stone, director of the McCormick Observatory and professor of practical astronomy in the University of Virginia from 1882 until 1912, on January 17, aged eighty-six years.

Sir J. Arthur Thomson, formerly regius professor of natural history in the University of Aberdeen, who was widely known as a writer and lecturer on natural history, on February 12, aged seventy-one years.

News and Views

Gold in Kenya

THE debates on the amendment of the Kenya Native Lands Trust Ordinance in both Houses of Parliament on February 8 did little to remove apprehension as to the manner in which the exclusion of land from the reserves is likely to affect the native population. The motion for papers moved by Lord Lugard in the House of Lords was withdrawn; and the amendment of Mr. Lunn to Mr. Donner's original motion, approving the action of the Government of Kenya in the steps taken to develop the goldfields and safeguard the interests of the natives, was defeated by a majority of 151. The case against the amendment of the Ordinance, as accepted by the Kenya legislature, was stated lucidly by Lord Lugard, who was ably seconded by the Archbishop of Canterbury; while in the House of Commons Sir Robert Hamilton gave an emphatic, but temperately phrased, expression to the feeling of uneasiness which has been aroused by the manner in which the Government has handled the situation. It cannot be said that the Government has given a satisfactory reply to its critics. The main contention, that the exclusion of land from the reserve without a compensating grant of additional land is a breach of faith and will be detrimental to tribal life, has not been met. However convincingly it may be argued on this ground or on that that there has been no real departure from the undertaking of the Ordinance, either in letter or in spirit, it is the native point of view that counts in this connexion. As Sir Robert Hamilton said, if the confidence of the native in the good faith of the Government be shaken, "in the long run we shall lose more than will be repaid by all the gold in Africa".

THE voting in the House of Commons was no doubt largely affected by the stress laid by Sir Philip Cunliffe-Lister on the small number of individuals and the relatively small area of land affected by the present proposals, as well as by the anxiety of the Government and of the local administration to make it clear that it is their desire not only that the native should not suffer, but rather that he should benefit from the stream of prosperity which will flow

in his direction. On these points two comments may be made. First, that it was unfortunate that Sir Alfred Kitson's report on the applications for concessions now under consideration did not come within the terms of the debate. This report shows that ultimately an area of at least five thousand nine hundred square miles will be in question; and now it would appear that part of Kikuyu may be affected. On what terms will the development of these areas be undertaken? Secondly, a prosperity which is detrimental is illusory. The prosperity to come was contrasted by one speaker in the House with the miserable conditions of the natives to-day. But if, apart from a temporary economic crisis, the present-day conditions are in harmony with tribal traditions, a sudden accession of prosperity, for which the social organisation is not yet ready, will give rise to graver problems, similar to those now the cause of anxiety elsewhere in Africa. We are asked to trust the goodwill of those on the spot, whose relations with the native are said to be excellent. Goodwill is of little avail when question arises of interference with native custom, unless it accompanies scientific knowledge, such as can only be gained, as any anthropologist will point out, after prolonged and intensive study. Without such knowledge, modification of tribal custom always involves the danger of detriment to the social organism as a whole. Yet it is on the preservation and gradual development of that organism that the future of the native population depends.

New Record for Non-Stop Flight

A FAIREY long-range monoplane (Napier Lion engine), flown by Squadron-Leader O. R. Gayford and Flight-Lieut. G. E. Nicholetts, beat the world's long-distance non-stop flight record on February 6–8, flying from Cranwell, Lincolnshire, to Walvis Bay, 781 miles north of Cape Town. The distance of 5,340 miles was covered in 57 hours 25 minutes. The previous record was 5,012 miles from New York to Constantinople. The machine followed approximately the shortest great circle course, making detours to avoid the Atlas mountains in Northern Africa and the Ahaggar plateau in Central Sahara. The ideal weather conditions of a westerly wind at Cranwell for take off, and a following northerly wind for the rest of the journey, with clear weather and a full moon over Africa, were experienced for the first part of the journey. Later, unfavourable weather and winds over Nigeria and Duala hindered progress sufficiently to make it impossible to reach Cape Town because of lack of petrol and the approach of dusk.

As equipped for this flight the monoplane carried about 8,000 lb. of petrol and weighed about 17,000 lb. total weight. A specially prepared run-way of one mile was used at Cranwell, the machine running 1,600 yards in 58 seconds before taking off. It was fitted with an autogyroscopic control which not only relieves the pilot of the strain of continuous flying, but assists accurate course keeping. This broke down during the latter part of the flight. A short wave (33·71 cm. wave-length) wireless transmitting set was used to report progress but no receiving set was carried. This gave variable results; messages were picked up over considerable distances but some were undecipherable. The flight was carried out by the Royal Air Force as part of a general policy of development of long-distance air transport for strategic purposes. Not only will the behaviour of the aircraft, engine and instruments be carefully examined, but the medical department is investigating the effects of such flights upon the personnel engaged. The special food carried was chosen by the medical authorities.

John Thompson

CHARLES HUTTON, when engaged in editing the "Diarian Miscellany" in 1775, regretted the insufficiency of biographical material for the lives of the mathematicians responsible for the problems that appeared every year in the eighteenth century almanacks known as the "Gentleman's" and "Ladies'" "Diaries", which were edited by Henry Beighton of Griff from 1714 until 1744, with the assistance of Anthony Thacker, and later by Robert Heath, 1745–53. One of their collaborators was John Thompson of Witherley Bridge in Leicestershire, the hundred and fiftieth anniversary of whose death falls on February 25. By good fortune his surveying instruments, until recently in the possession of his descendant, Mrs. Alkin of Atherstone, are still extant and have been presented by the Friends of the Old Ashmolean to the Lewis Evans Collection at Oxford. They show that Thompson was a practical inventor and improver of instruments as well as a mathematician. It is stated in Nichol's "History of Leicestershire" that Thompson, on leaving Atherstone School, had been intended by his father for the farming and grazing business, but the boy's innate love of mathematics was so strong that, with the collusion of his mother, he surreptitiously purchased a few mathematical books and studied them where and when he could, generally at night. He was helped by Beighton and Thacker, and contributed articles to various journals. When Atherstone common fields were enclosed in 1765, an error by the Commissioners led him to propose a prize question (No. 290) in the "Gentleman's Diary" for 1766. It had been agreed that the small cottages should have a plot known as Cottagers' Piece in the shape of two trapezia to contain 100 acres. Thompson was asked to resurvey it and found it three acres too large, on which he based his prize question, as he said, "that the error of these unmathematical Bunglers may be known".

THOMPSON'S instruments include two levels by Thomas Wright, one dated 1724, a cross head by J. Search with one quadrant graduated, an early Gregorian telescope, chains, and the usual slide rules, scales and drawing instruments, and, most interesting of all, a superb plane-table and tripod designed by John Thompson himself, and inscribed "Made by G. Adams in Fleet St. London. Inst: Makr: to His Royal Highness the Prince of Wales." It is surrounded by inlaid brass scales, and measures 18¾ in. across.

By a special tilting arrangement the table can be adjusted at any desired angle. It is provided with marginal sights, and adjustable rules which can be raised by screws or depressed level with the surface of the board. The magnetic compass box is of the shape of a figure 8, and the card is only graduated for 45° on each side of the north-south line. It is the most perfectly designed and executed plane-table which we have seen. Two note-books show that he was instructing his sons Ralph and Samuel in the art of surveying in 1773 and 1778 respectively. Ralph Thompson also became an accomplished surveyor, and an example of his work made in 1812, a survey of the Roman town of Manduessedum on Watling Street, is reproduced in Nichols's "Leicestershire".

Nest-Building of Brush-Turkeys

An early visit to the gardens of the Zoological Society of London is recommended in order to inspect the initial stages in the nest-building of the brush-turkeys, on the north bank of the Canal. The labour of forming the vast mound of leaves, in the centre of which the eggs are laid, is performed by the male. Here they are left until they hatch by the heat generated by the fermentation. The eggs being of great size in proportion to the size of the bird, the early, 'nestling-down', stage is passed within the shell, the down being shed before hatching. By the time this takes place the birds are strong enough to force their way out, and emerge with fully developed flight-feathers. This singular phase in the infancy of birds is confined to the Megapodes, of which there are many species. But some bury the eggs in hot sand, instead of decaying vegetation. The recently added 'piping-crows' from Australia, which are more nearly related to the drongos and swallow-shrikes than to the crows, and that singular fish the climbing-perch (*Anabas*), are also worth a visit.

Physical Nature of the Nerve Impulse

At the Friday evening discourse held at the Royal Institution on February 10, Prof. A. V. Hill discussed the physical nature of the nerve impulse. The properties of the nervous system are based upon a certain transmitted wave which is known as the nervous impulse. This wave, which is a few centimetres long, travels in nerve fibres of the order of 0·01 mm. in diameter with velocities varying from a few centimetres to 100 m. per second. Its nature is not yet understood, but it possesses certain well-defined physical characteristics. The chief difficulty in investigating it is the minuteness of the changes involved in its passage: there is, for example, a rise of temperature, but this is only of the order of one ten-millionth of a degree for each impulse, while the chemical changes which accompany this are at present altogether beyond detection. Fortunately, owing to the development of modern electrical methods, the electrical accompaniments of the wave can be accurately recorded, and the study of the so-called 'action current' has thrown much light on the process. The nature of electrical excitation has been discussed for many years, and it seems that 'activity' is produced when the current through the nerve fibre surface exceeds a certain value at the cathode. The 'activity' seems to consist of an alteration in the physico-chemical properties of the surface layer, allowing reaction to take place momentarily between inside and outside. The change is rapidly reversed, and the nerve is then ready to transmit another impulse. The passage of the wave involves the liberation of energy during, but chiefly after, the active process. Recovery lasts 30–50 minutes and requires oxygen. In other respects, however, the nerve impulse possesses wave-like properties, and its further investigation by physical means is likely to lead to a far greater understanding of nervous processes and of the phenomena of living activity in general.

Scientific Progress and Ethics

In the *Journal of the University of Bombay* (Sept. 1932), under the title "Is Man Ethically Fit for the Bounties of Science?" Prof. D. D. Kanga of Gujarat College, Ahmedabad, comments on a convocation address by Sir C. V. Raman on the study of science. Asserting that true scholarship goes hand in hand with research, independence of thought and original thinking, Sir C. V. Raman said that the function of a university is the encouragement of the human intellect and the human spirit in their highest manifestations. The greatest value of science lies not so much in the imparting of knowledge about natural phenomena and the laws of Nature, as in the teaching of the scientific method which has served as a powerful weapon in the hands of man in the discovery of truth and has given him a new view of the universe he lives in. If the same method were used in the problems of daily life, whether political, industrial, social, educational, or religious, it would usher in a new era of progress and enlightenment in all the departments of life. Prof. D. D. Kanga, reviewing the sabotage which has accompanied increased productivity consequent upon the application of modern science, directs attention once more to the problem of distribution, which he reminds us is largely a matter of the individual will. It is the duty of every university to see that the advance of science and the spread of scientific culture go with a parallel advance in man's ethical and spiritual development. The motto of science should be truth and service, and the alumni of a university should be characterised alike by their ability to apply the scientific method in all problems of life and also, in Prof. Kanga's view, by their readiness to share their knowledge, wealth, power and possessions with others, of whatever race or country, for the common good.

Persepolis

The archæological expedition to Persepolis of the Oriental Institute of the University of Chicago, one of the eleven expeditions of the Institute now at work in the East, has achieved some remarkable results in its second season's work on the site. Indeed, Dr. J. H. Breasted, director of the Institute, in a comment appended to an abstract of the report by

Dr. E. Herzfeld, field director, which appears in the *Times* of February 4, says that no discovery like it has ever been made anywhere in western Asia. A magnificent series of sculptures, dating back to the time of Cyrus, has been discovered in the area of the palace burnt by Alexander the Great in 330 B.C. The size alone, without taking into account the technique and the informative detail, is overwhelmingly impressive. One panel, 5–6 ft. high, is no less than 1,000 ft. long. The carvings are as fresh as when executed and show rulers, footmen, horsemen, charioteers, servants and burden-bearers in full equipment—material of the greatest historical value. One panel preserved in peculiarly favourable circumstance still shows the colours of the royal garments. A find of no less importance to the prehistorian is recorded in an account of a stone age village which was found under a low mound within two miles of Persepolis. It is dated at about 4000 B.C. and would appear to be in an excellent state of preservation. The mud-brick walls of the houses still stand to a height of 5–7 ft. and the interior surfaces show mural paintings in red water colour. The polychrome pottery, Dr. Herzfeld reports, exceeds in beauty and age that found in Babylonia, marking "a new chapter in the history of prehistoric art".

International Congress of Ethnological and Anthropological Sciences

CONSIDERABLE progress has been made in the discussion of the proposal to institute an international congress of the ethnological and anthropological sciences. Arrangements are now being made for a preliminary conference for further discussion to be held in Basel on April 20–22 next. Invitations to the conference are being issued by the Royal Anthropological Institute of Great Britain, while the local arrangements are in the hands of Dr. Felix Speiser, director of the Museum of Ethnology, Basel. The conference will be welcomed on behalf of the City and the Education Committee, and its sessions will be held in the Burgeratsaal. The subjects for discussion by the conference are the scope of the proposed congress and its relation to existing congresses of like character, such as the International Congress of Americanists and the International Congress of Prehistoric and Protohistoric Sciences; constitution and procedure; and the date and place of the first meeting. On this last point, it has been suggested that meetings should take place in years alternate to those of the Prehistoric and Protohistoric Sciences Congress and coinciding once in every four years with the European meetings of the Americanists' Congress.

Insect-Eating in Siam

INSECT-EATING habits of monkeys have persisted, and still persist, not only amongst the most primitive races of mankind, like Australian aborigines and the African pygmies, but even in many races which have reached the agricultural stage. An interesting example is offered by the Laos of Siam, whose habits of eating insects and other invertebrates have been recently studied in some detail by Mr. W. S. Bristowe (*Trans. Entom. Soc. Lond.*, 1932). The list of animals used as food by the Laos includes many species and exhibits a great variety, but certain of them are considered as special delicacies. Here belong, for example, giant water-bugs (*Lethocerus indicus*), measuring about two inches in length and fetching up to 4*d.* a piece on the markets; large spiders, *Nephila maculata* and *Melopoeus albostriatus* ('bird-eaters'); eggs of king crab, *Tachypleus gigas*, which look like caviare, but taste like potato; larvæ, pupæ and adults of the dung beetles, *Oryctes rhinoceros* and *Helicopris sp.*; a large cicada, *Dundubia intemerata*; etc. There is no reason to think that insect-eating habits of the Laos were acquired owing to the lack of other food, since the Siamese living under the same conditions do not eat insects to such a great extent. On the other hand, it is interesting to note that the Laos are considered to possess greater stamina and to be harder workers than the Siamese; this may be due to the extra protein obtained by the Laos from their animal food. The average diet of a Siamese includes fish as practically the only source of protein; the protein content of fish is 18–23 per cent, and that of roasted spiders is so high as 63·4 per cent.

Fauna of the Swiss National Park

THE area of mountain, forest and valleys comprising the Nature reserve which forms the Swiss National Park is a tract of country that is rigidly preserved. Its fauna and flora are subjected to the minimum of interference on the part of man and for this reason afford many problems of special interest to the biologist. Under the auspices of the commission for the scientific investigation of the Swiss National Park, a series of quarto memoirs on researches undertaken in that area is being published. The sixth memoir in that series has recently come to hand and deals with the forest insects of the Park ("Les Insectes Forestiers du Parc National Suisse". Pp. 50 + 24 plates. Aarau: H. R. Sauerländer et Cie. 12 francs). Its author, Dr. Aug. Barbey, mentions that the circumstances in which these insects were studied were purely economic and were in connexion with the ravages they cause among the forest trees. The life-history, mode of life and economic status of the more important species of insects are described. Various stages in their life-cycle, their larval burrows in wood and bark and other phases of these insects are admirably portrayed in the series of plates that accompany this memoir. Their ecological relations are also dealt with whether they be destructive forms, parasites or predators.

Reduction of Chimney Emissions

THE Technical Committee appointed by the Electricity Commissioners in 1930 to consider the methods that should be taken to prevent the emission of soot, ash and grit from the chimneys of electric power stations has now published its report (London: H.M. Stationery Office, 5*s.*). A sub-committee made

a thorough investigation, visiting many foreign stations which have adopted preventive measures. In 46 of the 111 British selected stations no grit extraction plant has yet been installed. The sub-committee regards grading by sieves as unsatisfactory, as it is impossible when the mesh is too small and untrustworthy for larger values. Particles below 20 microns (1 micron is a thousandth part of a millimetre) when discharged into an air stream are sufficiently diffused to avoid creating a nuisance. The only satisfactory way of testing the efficiency of dust extraction plant is to weigh the dust in unit volume of the gases at as high a point in the chimney as practicable. In Germany, where the power stations are generally larger than in Great Britain, electrostatic precipitation together with very high chimneys is favoured. The main conclusions arrived at by the Committee are that dust nuisance is avoidable with new stations, but the application of means for its prevention to all existing stations may not be practicable. There is an urgent need for standardisation of good methods of testing dust extraction plant. For pulverised fuel installations the electrostatic precipitator is the most suitable type to use. Water for dust extraction is not to be commended. The minimum height of chimneys should be at least two and a half times that of the highest point of the generator station buildings. Photographs are given of the filters used for separating ash and grit particles and of plant for multiple-cyclone dust extraction.

Gaseous Tubes for Lighting

THE study of the discharge of electricity through gases has led to many important practical developments, the latest being the invention of vacuum tubes for lighting. If discharge tubes are filled to the same gaseous pressure with different gases such as helium, neon, argon, hydrogen and nitrogen, it is found that a certain definite voltage must be applied to the terminals of the tube before luminous effects are produced. This voltage depends on the nature of the gas and the pressure in the tube. In general, neon produces a luminous effect at lower voltages than the other gases and then comes helium. In some cases a mixture of gases becomes luminous at a lower voltage than any of the pure gases forming it. In a lecture to the Preston Scientific Society given on December 2, 1932, J. N. Addington gave an interesting account of the progress made in developing gaseous tubes for lighting and signalling purposes. In an Osglim lamp, which takes only a small fraction of the power taken by a filament lamp, the electrodes are of nickel or iron placed about 2 mm. apart and the neon gas filling has a definite low pressure. At 160 volts the lamp becomes luminous. These lamps operate from alternating current mains. Neon valves which operate traffic signal devices have now been developed at the Preston lamp works of Messrs. Siemens Brothers and Co. The red neon signs which are now familiar to all dwellers in cities have iron or nickel electrodes and the illumination is produced from the positive column. The intensity of illumination per unit area is relatively low in these lamps, which are called cold cathode tubes. In 'hot cathode tubes' currents nearly a hundred times as great can be obtained. The electrodes are coated with mixtures of alkaline earths and have a very high electronic emission when heated to 1,200° C. The use of metallic vapours like sodium, cadmium and magnesium has still further increased the efficiency of these tubes, but the colours at present obtained leave much to be desired when compared with daylight.

Gifts to Science

SIR DUGALD CLERK, who died on November 12 (see NATURE of December 24, p. 953), bequeathed £3,000 to the Institution of Civil Engineers; £2,000 to the Royal Society; £1,000 to the Royal Institution; £1,000 to the Royal Society of Arts; £1,000 to the Institution of Mechanical Engineers; £1,000 to the University of Glasgow; £1,000 to the University of Leeds; £1,000 to the University of St. Andrews; £1,000 to the University of Manchester; £1,000 to the University of Liverpool. The residue of the property is to be divided into thirty-one parts; three of these parts are to go to the Institution of Civil Engineers; two to the Royal Society; one to the Royal Institution; one to the Royal Society of Arts; one to the Institution of Mechanical Engineers; and one each to the Universities of Glasgow, Leeds, St. Andrews, Manchester, and Liverpool.

Entomological Society of London

THE Entomological Society of London will celebrate its hundredth anniversary on May 3, and a preliminary programme of the centenary celebrations on May 3–4 has recently been published. On May 3, a general meeting will be held in the rooms of the Royal Geographical Society at 3 P.M. and a scientific conversazione at 8.30 P.M. A reception has been arranged for May 4 at 9.30 P.M. This will be held at Lancaster House, St. James's, S.W.1, when the Right Hon. Walter Elliot, Minister of Agriculture and Fisheries, will receive the guests. Further information can be obtained from the Secretary, 41 Queen's Gate, London, S.W.7.

Chadwick Public Lectures

THE next series of Chadwick Public Lectures begins on February 21, with a discourse on "The Hippocratic Tradition" by Dr. Matthew B. Ray. The lecture will be given in the hall of the Royal Society of Tropical Medicine, 26 Portland Place, W.1, at 5.15. The second lecture will be given by Dr. E. Killick Millard on "Housing", on March 9 at 8 P.M. at the Royal Sanitary Institute. How to secure a pure milk supply is the question chosen by Dr. J. Walter Carr, for his lecture—"Cows' Milk" in March at the Royal Society of Tropical Medicine. In it, he will discuss the relative benefits of human and bovine milk for infants, the value of milk in adult life and how to render cows' milk a safe food. In May, Mr. P. W. Coombe will lecture on "Port of London Sanitary Administration". The actual processes and details of the organisation and maintenance of port and river hygiene will be discussed. Another lecture

projected for May will be on the "Preservation of Health in the Navy" by Vice-Admiral Bond, and early in June the annual open-air lecture in the Chelsea Physic Garden will be given by Prof. J. G. Hill, on "The Green Leaf". Further information concerning these and other Chadwick public lectures can be obtained from the Secretary, The Trust Office, 204 Abbey House, Westminster, S.W.1.

Climate of Hong-Kong

COL. E. GOLD points out that, in the article entitled "Climate of Hong-Kong" (NATURE, Jan. 21, p. 104) the statement "much of it [mist and fog] is due to dynamical cooling of advancing damp southerly winds" requires amplification. Damp air moving from the south and rising to the higher levels of Hong-Kong about 1,500 ft. above the level of the Observatory and 1,600 ft. above sea-level is cooled by expansion as it rises and so causes much of the fog and mist at these higher levels. The fog and mist at sea-level, when it occurs with a warm southerly current of air, is due to the cooling of this current by the surface of the sea—or the surface of the land.

Announcements

THE Council of the Iron and Steel Institute has awarded the Bessemer gold medal for 1933, to Dr. W. H. Hatfield, director of research in the firm of Messrs. Thos. Firth and John Brown, Ltd., in recognition of his distinguished services in the advancement of metallurgical science, and of his valuable researches in connexion therewith.

HIS MAJESTY THE KING has approved the award of the Royal gold medal of the Royal Institute of British Architects to Sir Charles Peers, president of the Society of Antiquaries and chief inspector of ancient monuments and historic buildings, in recognition of his distinguished services to architecture and archæology.

THE annual May lecture of the Institute of Metals will be delivered on May 10 by M. Albert M. Portevin. The subject of the lecture will be "Quenching and Tempering Phenomena in Alloys". It is also announced that the silver jubilee meeting of the Institute will be held at Birmingham on September 18–21.

THE Sir Henry Trueman Wood memorial lecture of the Royal Society of Arts will be delivered on February 22, by Sir William B. Hardy, director of food investigation, Department of Scientific and Industrial Research, who will take as his subject "Industrial Research with Biological Material".

IT is announced in *Science* that F. Trubee Davison, Assistant Secretary of War in charge of aeronautics, has been elected president of the American Museum of Natural History to succeed Prof. Henry Fairfield Osborn. Prof. Osborn, who has been president of the Museum for twenty-five years, has been elected honorary president.

AT a meeting of the International Congress of Americanists in La Plata in December last it was resolved that the next meeting of the Congress, which, under the statutes, must be held in Europe in 1934, should take place in Spain. It was decided that an invitation to hold the Congress in Seville be accepted.

AT the annual meeting of the Royal Astronomical Society held on February 10, the following officers were elected: *President:* Prof. F. J. M. Stratton; *Vice-Presidents:* Sir Arthur S. Eddington, Mr. John Evershed, Dr. H. Knox-Shaw, and Dr. W. J. S. Lockyer; *Treasurer:* Mr. J. H. Reynolds; *Secretaries:* Mr. W. M. H. Greaves and Dr. W. M. Smart; *Foreign Secretary:* Prof. Alfred Fowler.

THE annual meeting of the Association of Technical Institutions will be held at the Cordwainers' Hall, Cannon Street, London, E.C.4, on February 24–25, under the presidency of Sir Hugo Hirst. Several papers of technical interest will be read at the meeting and a discussion on "Policy in Technical Education" will be opened by Dr. Percival Sharp and summarised by Principal J. C. Smail. Further information can be obtained from the Secretary, Association of Technical Institutions, Loughborough College, Loughborough, Leicestershire.

A GENERAL discussion on "Liquid Crystals and Anisotropic Melts" has been arranged by the Faraday Society and will be held at the Royal Institution, Albemarle Street, London, W.1, on April 24 and 25. The introductory paper will be given by Prof. C. W. Oseen (Uppsala). The following foreign visitors will contribute papers: Prof. L. S. Ornstein and Dr. W. Kast (Utrecht), Prof. V. Freedericksz (Leningrad), Prof. M. Jezewski (Cracow), Prof. G. van Iterson (Delft), Prof. D. Vorlander (Halle-on-Saale), Prof. H. Zocher (Prague), Prof. K. Hermann (Berlin-Charlottenburg), Prof. T. Rinne (Freiburg i. Br.), Prof. G. Foëx (Strasbourg), Prof. G. Stewart (Iowa), and Prof. J. J. Trillat (Paris). Prof. Hermann Mark (Vienna) and Dr. E. Friedel (Strasbourg) also hope to attend the discussion. The meeting is open to non-members.

A SERIES of eight lectures and demonstrations on tropical hygiene, which are intended for men and women outside the medical profession proceeding to the tropics, will be given by Lieut.-Col. G. E. F. Stammers at the London School of Hygiene and Tropical Medicine on March 6–15. This course, in addition to providing simple rules for guidance in regard to personal hygiene and preparation for life in the tropics, will also embrace a short account of some of the more common diseases, with advice in regard to measures of protection and self-treatment. Further particulars can be obtained from the Secretary, London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—An assistant lecturer in engineering at the University of Manchester—The Registrar (March 1). A staff lecturer and demonstrator (woman) in the Department of Chemistry at the Royal Holloway College, Englefield Green, Surrey—The Principal (March 15).

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.*]

Electron Diffraction by Films of Grease

IN the course of some experiments on the diffraction of electrons by thin films of spluttered platinum, a curious pattern of straight lines with a few diffuse spots (see Fig. 1) was observed by one of us, quite unlike the usual circles of a Debye-Scherrer pattern.

Further investigation has recently shown that it was due to the accidental presence of a layer of tap grease on the specimen. A number of waxes and greases give similar effects when smeared on to a solid and used to reflect a beam of electrons.

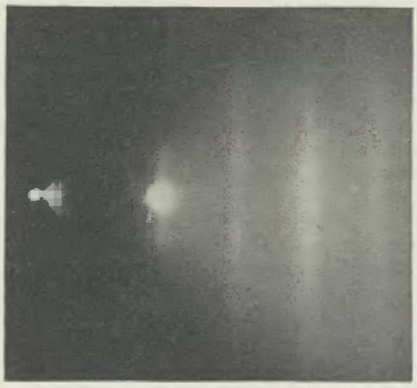

FIG. 1.

The patterns observed can be explained by supposing that the diffracting atoms occur in regular layers parallel to the surface, the layers being equally spaced, but the atoms in each layer being almost at random. Such a distribution would be produced by long-chain molecules normal, or equally inclined, to the surface, like those studied by N. K. Adam. The successive layers are the planes through successive carbon atoms of the chain. It will be noticed that alternate lines are darker than the others; this may be due to the zig-zag nature of the carbon chains which makes alternate atoms different from their neighbours. The spacing corresponding to the distance between a weak and strong line is 2·54 A. which agrees well with Müller's value of 2·537 A. for the distance between alternate carbon atoms.

Sometimes spots appear on the lines. These can be explained as due to a quasi-regularity of arrangement of the chains such as would occur if they were closely packed together.

The distance apart calculated on this assumption agrees fairly well with the cross section found by Müller.

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Jan. 25.

Convention and Fact

THE work of electrical commissions was one of the first, and remains one of the most successful, examples of international co-operation. The main reason for their success, where so many analogous bodies have failed, is that they confined themselves strictly to the establishment of conventions concerning matters (such as units and symbols) to which conventions are appropriate. Dr. Ezer Griffiths's article in NATURE of December 31, p. 987, shows that the International Union of Pure and Applied Physics does not intend to be bound by any such limitation. Although the title of his article suggests that its inquiries concern only units, it is plain that the Union proposes to discuss, if not to decide, matters of an entirely different nature, to which the conceptions of truth and error are applicable. This new policy demands far more attention than he has given to it.

Dr. Griffiths's second issue does, indeed, involve a matter of pure convention. It is agreed that there are at least two distinguishable magnitudes to which the name *permeability* and the symbol μ have been attached by various writers in the past. Everyone would welcome a decision to which of these magnitudes the name and the symbol are to be confined in the future, and a suggestion for the name and the symbol to be used for the others. But Dr. Griffiths, in stating this issue, asserts by implication two propositions that are not universally accepted and the validity of which is not a matter of convention. They are (1) that every quantity either has dimensions in length, mass and time or is a pure number, (2) that quantities not of the same kind have different dimensions. If it decided that these propositions were true or false, the Union would go far outside the sphere to which its predecessors have confined themselves. But I will not insist greatly on this matter, because it is not clear that the Union is really proposing to make such a decision; the propositions may have been introduced without authority by Dr. Griffiths in an attempt to state the issue concisely.

But there is no doubt of this kind about the first issue. The Union most certainly is trying to establish "a basis on which a connected account of electromagnetic phenomena should rest". For what purpose is this connected account required? Is it education, the statement of a logically complete theory, the formulation of 'consistent' units, or the experimental identification of the units formulated? Is it certain that a single connected account will serve adequately each and all of these purposes? Must the lecturer in electrical engineering work to the same syllabus as his colleague who is instructing mathematicians; and are the Diracs and Eddingtons of the future (or even of the present) to be forbidden to choose a 'starting point' for a theory of the universe inappropriate to immature minds? And what is a connected account? An answer to that question can only be based on some view of the logical structure of science, of the relation between fact and theory and between experiment and calculation. It must involve a choice between the views of this difficult matter taken by (say) Jeffreys, Reichenbach and Bridgman; none of these writers could possibly accept a connected account drawn up by another.

I submit that an International Union can do nothing but harm in even discussing questions that require a decision on such matters. An authoritative

committee is the right body to establish a convention, because in conventional matters agreement is more important than any kind of truth. Of course there may be differences of opinion as to which convention is best; but the establishment of a convention does not require the acceptance of the committee's views on this point. A convention might be defined as something that a reasonable and conscientious man can accept and support loyally, although he believes that it is the worst of all possible alternatives. But where truth is more important than agreement, a committee can achieve nothing. If agreement actually exists, its pronouncements are superfluous; if it does not exist, a pronouncement, however authoritative, will not bring it into being. In spite of the increasing weight of authority in the realms of politics and religion, most scientific workers would surely still not deny that even an International Union may sometimes be unable to arrive at the truth.

It will be replied, I suppose, that the Union does not pretend to decide any of these questions, and that it is merely collecting the best opinion concerning them. If that is so, what does Dr. Griffiths mean by saying: "The British view is that . . ."? The discussion of the British National Committee apparently took exactly the course that might have been anticipated. Those who were known to have definite views on these matters each brought forth his 'King Charles's head' and said exactly what was expected of him. Those who had not thought about them deeply before offered opinions that really could not stand any serious argument. The publication of the whole discussion might possibly serve some useful purpose; but the selection from it of a "British view", formulated without argument, can lead to nothing but disaster. It is quite certain that the "views" of some other nations, formulated in the same manner, will differ from the British view; only two consequences can then follow. A fictitious agreement will be reached which will involve the public profession by some members of the Union of views on scientific questions that they do not really believe; or no agreement will be reached, and the cause of international co-operation will receive another setback from the failure of yet another conference—and all because the leaders of the scientific world cannot distinguish between convention and truth!

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Components of the Atmosphere and Synthetic Gases in Relation to Animal Life

IT was found several years ago in our experiments that small animals such as rats, pigeons, cats, guinea pigs, monkeys, etc., can live in a medium of air under control, but cannot live in pure oxygen under similar conditions, but will die within two to five days[1].

With a synthetic mixture of 79 per cent nitrogen and 21 per cent oxygen leaving out the 1 per cent rare gases such as argon, helium, neon, krypton, and carbon dioxide, it was found that the animals (white mice) would die within ten days to three weeks. The experiments were repeated ten times. These experiments led to the conclusion that the rare gases are vital to the normal respiration of life. By varying the percentage of oxygen from 25 to 60 with nitrogen the animals were under control from ten days to three weeks without any signs of ailments. In a number of cases it was found that synthetic atmospheres could be prepared that supported life in white mice more effectively than the normal air that we breathe every day.

For different gases alone it was found in a series of experiments that animal life would cease after two to five days in pure oxygen; in pure hydrogen, 36 minutes; in nitrogen, 6 minutes; in argon, 3 minutes; in neon, 1 minute and 40 seconds; in helium, 2 minutes and 40 seconds; in nitrous oxide, 10 minutes; and in carbon dioxide, 55 seconds.

By using 79 per cent helium instead of nitrogen and 21 per cent oxygen, an atmosphere is formed in which animal life will exist normally, or in some cases, apparently better than in a normal atmosphere. By varying the percentage of helium from 79 to 50 with oxygen the animals in every case appeared to be normal or better than in our natural atmosphere.

By using 0·03 per cent carbon dioxide, the amount that is normally present in the atmosphere, with 99·97 per cent of oxygen, the average time of life was found to be about the same as with pure oxygen. With a synthetic mixture of 1 per cent carbon dioxide and 99 per cent oxygen the average time of life was 3 days and 9·8 hours. With 5 per cent carbon dioxide and 95 per cent oxygen the average time of life was 4 days and 10·7 hours; with 10 per cent carbon dioxide and 90 per cent oxygen 2 days and 4·2 hours. The optimum mixture seems to be approximately a mixture of 5 per cent carbon dioxide and 95 per cent oxygen.

The chief principle of this therapy is that of using a mixture of oxygen and carbon dioxide. Carbon dioxide is used to stimulate the respiratory mechanism to full deep breathing, to flush and flood the blood in the lungs with oxygen, and to ventilate out of the blood any volatile toxic substance. To combat respiratory failure in this way is to use Nature's own agency to assist Nature towards recovery. Acapnia or deficiency of carbon dioxide in the blood and tissues, is a condition closely related to asphyxia or deficiency of oxygen in the tissues. Either of these deficiencies disturbs the respiratory processes of the tissues, and each involves a considerable degree of the other. Experimentally, a slight degree of acapnia may be induced by over-ventilation of the lungs. Inhalation of carbon dioxide affects a restoration of the alkali bicarbonates and carbon dioxide content of the blood.

Inhalation of carbon dioxide, by counteracting acapnia and inducing deeper breathing, inflates the lungs and prevents the development of pulmonary collapse (atelectasis). It is thus a specific preventive of the post-operative pulmonary complications that lead to pneumonia.

With all of the synthetic atmospheres experimented upon with animals, oxygen was always found to be necessary as one of the gases, but with oxygen alone, the animals would die.

This is really only one phase of the work that might be investigated. It would be desirable to have some other criteria than life as a test, for example, rate of growth, metabolism, activity, why the animals die in oxygen, etc.

In the field of practical applications of synthetic atmospheres there is a wide range of commercial uses and values. In deep sea diving, mines, and submarines, foul air is encountered and there is often a lack of sufficient pure air to sustain life. Aeronauts

may carry a supply of prepared atmosphere aloft with them, and it may be provided for large factory and office buildings with more satisfactory results than when natural air from outside is used.

As suggested by Dr. Edward Fidlar[2] the chemist and physicist understand very little the rare gases in relation to animal life. The use of the oxygen tent in the treatment of pneumonia is a well established medical practice to-day. Other diseases may yield to a helium and argon tent. The widest field probably will be in pathological applications. Research work is just beginning in this direction.

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[1] NATURE, 122, 684, Nov. 3, 1928.
[2] *Science*, 62, 296, No. 1864; 1930.

Infra-Red Absorption Spectrum of Nitrogen Dioxide

THE infra-red absorption spectrum of the equilibrium mixture of NO_2 and N_2O_4 was investigated in the region of comparatively short wave-lengths by Warburg and Leithäuser in 1907 and 1909, and again in 1910 and 1913 by von Bahr. Preliminary experiments on the spectrum of nitrosyl chloride indicated N_2O_4 as a troublesome impurity, and it was decided to repeat the earlier work and to extend the observations as far as 18μ.

At room temperature a complicated spectrum with bands at 15·6, 13·4, 7·92, 6·17, 5·75, 3·22, and 2·91μ is obtained. The absorption tube was then placed between the source of radiation and the spectrometer, and heated to 100° C.; the maximum of radiation emission characteristic of this temperature is beyond 20μ, and it was found with this arrangement that disturbances of the thermopile due to fluctuations of temperature in the absorption tube were avoided. The interesting observation was made that all the bands disappeared with the exception of those at 15·6 and 6·17μ, the two latter remaining with undiminished intensity, and having a doublet structure with a separation of 35 cm.$^{-1}$ and 32 cm.$^{-1}$ respectively. They may accordingly be ascribed to NO_2, and the simplicity of the spectrum renders it highly probable that the molecule is rectilinear and symmetrical. The N–O force constant is approximately 7×10^5 dynes per cm., the deformation force constant being some 6×10^{-12} dyne cm., and the calculated moment of inertia is 66×10^{-40} gm.cm.^{2}, with an interatomic separation of 1·1 A. If ν_3 is 6·17μ, and ν_2 is 15·6μ, then the position of the inactive fundamental ν_1 may be calculated as approximately 11·1μ.

Further confirmation of the suggested structure may be obtained in a very neat way. The determined force constant for NO_2 corresponds to a single bond between each oxygen and the central nitrogen atom. If one more electron is available as in the case of the ion $[NO_2]^-$, the previously odd electron takes part in bond formation and we should have double bonds between the central and each external atom, with a corresponding elevation of the force constant to 14×10^5 dynes per cm., and, if the ion preserves the rectilinear structure, the Raman spectrum of the solution of an inorganic nitrite should provide a strong line with a separation giving the frequency of the inactive fundamental. Making the allowance for the difference in the force constants, we can calculate the approximate position of this line as 1328 cm.$^{-1}$, and experimental results show that aqueous solutions of inorganic nitrites have in fact an intense line at 1303 cm.$^{-1}$, the corresponding force constant being 14×10^5 dynes per cm.

Consideration of the manner in which given numbers of electrons available for bond formation may be allotted to definite electronic molecular proper-functions shows that in the case of $[NO_2]^-$, which has eight such electrons, it is probable that alternative states with near-lying energy levels are possible, and that reversion from the rectilinear structure characteristic of the ion in aqueous solution to an isosceles triangular form with a vertical angle of some 120° is rendered easy: the latter seems to be the structure of the ion in the crystalline nitrites.

Finally, where, by the establishment of a covalent link as in the case of the nitro- group, only six electrons are available for binding the atomic centres, the triangular form as above with the obtuse vertical angle (we may call this the SO_2 structure) is obligatory: and Dadieu and Kohlrausch from the results of Raman measurements find that the force constant for the NO link in $:NO_2$ is 9×10^5 dynes per cm. and the angle ONO is approximately 110°. As regards N_2O_4, the structure is probably best represented by Hendricks's suggestion of two plane nitro-groups at right angles to each other.

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Jan. 11.

Unusual Occurrence of Pelagic Organisms

IN NATURE of October 29, 1932, there appeared a letter from Messrs. Russell and Kemp, describing how large numbers of *Velella* and *Ianthina* had been cast up in the late summer, on the shores of Cornwall and south-west Ireland, and commenting upon the causes that might have led to this unusual abundance of planktonic organisms rarely present in the locality described.

It is very curious that far away here in New South Wales, we might have written an exactly similar letter about six weeks ago. Four miles off this coast on one rather calm day, I sailed through literally millions of large *Physalia*, *Velella* and *Ianthina*, and my crew were so intrigued at the sight that they proceeded to catch the *Velella* in cups and jars, whilst endeavouring to escape contact with the dreaded Portuguese man-of-war—not at all an easy matter. The invasion of these pelagic species lasted a fortnight or so, and was so great that the dried bladders of *Physalia* and *Velella* and the blue shells of *Ianthina* strewed the ocean beaches over a stretch of many miles.

It will be noticed that our season was spring-time, the English season was summer, but the dates (August in England and October here) not so far apart. Presumably, the explanation of these two unusual occurrences at about the same time (it is years since such an invasion was noted here), is merely coincidence. It is difficult to regard it otherwise, seeing that we are in the Southern Pacific and the British swarms came from the North Atlantic. One *might* wonder whether some peculiar cycle of circumstances had led to an unusual development of the organisms in question in tropical ocean waters,

like the numeral fluctuations so well known in more confined terrestrial species. But it is difficult then to account for a simultaneous abundance in species so far removed zoologically as *Physalia* and *Ianthina*.

Perhaps, therefore, we had better assume that the happening is just coincidence due to a like sequence of meteorological conditions in the two regions concerned.

Our Government Meteorologist has very kindly given me a comparison of the winds prevailing off this coast during the past three months with the average of eighteen years. From this, it would appear that sea breezes (winds with an easterly component) were not only more frequent than usual, but also the velocities were greater. Since a tropical current passes southward along the coast of New South Wales, it seems reasonable to suggest that a greater tendency for an easterly surface drift has brought shorewards organisms which are only infrequently stranded in such numbers.

It would be interesting to know whether any similar conditions were noted elsewhere during the year 1932.

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Dec. 14.

RECENT letters by Dr. Kemp and Mr. F. S. Russell[1] and Mr. A. C. Stephen[2] have directed attention to the occurrence of Atlantic organisms on the coasts of Great Britain and Ireland. It may be of interest to add another example to the list. While the Fishery Cruiser *Muirchu* of the Department of Lands and Fisheries was engaged in taking physical observations off the south-west coast of Ireland, fifty miles south-south-west of Fastnet Light, on August 9, 1932, considerable numbers of a large salp, 3–8 cm. long, were noticed drifting a few feet below the surface and some were captured. These proved to be the sexual stage of *Cyclosalpa bakeri*, Ritter. Several other specimens occurred in a tow-netting taken on the same station, and also in another taken seventy miles south-south-west of the Fastnet, suggesting that the shoal may have been twenty miles across. *Cyclosalpa bakeri* appears to be mainly a tropical species and I do not know of any previous record from British or Irish waters.

Another possible indication of abnormal conditions in 1932 was the unusual number of blue sharks (*Carcharias glaucus*) noticed during the same cruise along the south coast of Ireland. Frequently, when the ship was stationary, two or three might be seen swimming round and devouring the offal thrown to them.

Velella was not noted during the cruise in any unusual numbers. A few, living, were seen about thirty-five miles north of Horn Head, Co. Donegal, a few, dead, seventy miles south-south-west of the Fastnet and one, living, thirty miles south of Ballycottin, Co. Cork. It seems probable, judging both from recorded observations and reports received from lay sources which cannot always be verified, that *Velella*, and possibly also *Ianthina*, occurs almost every year off the west coast of Ireland, but it is only when they are drifted shorewards by a favourable wind in unusually large numbers that attention is directed to them.

The assumption is sometimes made that the presence of Atlantic organisms is an indication of an abnormal influx of Atlantic water, and their absence of a contrary condition, but such an inference ought to be received with caution unless supported by hydrographic records. Possibly the abnormality lies in the occurrence of conditions exceptionally favourable to the development of the organisms in some distant locality whence the Atlantic drift is derived, rather than in any acceleration of the drift or recognisable increase in the salinity or temperature of the water impinging on our coasts.

G. P. FARRAN.

Department of Lands and Fisheries,
Dublin.
Jan. 23.

[1] NATURE, 130, 664, Oct. 29, 1932.
[2] NATURE, 130, 889, Dec. 10, 1932.

Sexual Reproduction in Copepods

AMONG the lower groups of Crustacea, namely, the phyllopods, cladocera and ostracods, parthenogenesis is a well-known phenomenon and in many cases it is the only one known by which reproduction takes place. It is therefore remarkable that the process has only been recorded once within the free-swimming copepods[1].

Now copepods are probably better known than any other group of Entomostraca, and within it one division at least, the genus *Cyclops*, is remarkable for the cosmopolitan distribution of many of its species. Since resting eggs, which can be hatched from dried mud, and parthenogenesis go so naturally together among the Cladocera and ostracods, one might reasonably expect *Cyclops* to possess both these properties. This would be the simplest way of accounting for this world-wide distribution of the species. A natural conclusion is that parthenogenesis really does occur among copepods but for some reason it has been overlooked, and a considerable amount of evidence should be forthcoming before one can deny its existence.

During the last ten years, breeding experiments have been carried out almost continuously with different species of *Cyclops* at Marlborough, and although parthenogenesis has been sought time after time, it has never been found. The most obvious experiment is that of obtaining a brood of nauplii and separating each at an early stage and rearing them to maturity. This has now been done with several species and in no case has a single female produced living offspring. Eggsacs may be produced, and they nearly always are, but they simply drop off in time and the eggs decompose. On one occasion on looking at my cultures for the last time on the last night of term, I found three female specimens of *Leptocyclops agilis* each with a perfectly normal pair of eggsacs. I was obliged to motor the next day to a place in Sussex, just 150 miles away, but managed to return the same night hoping to see living nauplii. These were not there, but in each case the eggsacs had just fallen off and were lying at the bottom of the vessel where they gradually decomposed.

Yet further evidence is obtainable from direct experiment. A male is placed with a number of adult females which have been isolated from birth, and the male is left with them for a limited period and then removed. In these circumstances it is usual to find that more than one female gives rise

to living offspring, and the female may produce as many as three broods of nauplii, but she will cease to function unless coition is again allowed to take place.

From this it seems safe to conclude that in many species of *Cyclops* parthenogenesis has not escaped notice. It does not occur.

A. G. LOWNDES.

[1] Roy, J., "Sur l'existence de la parthénogènese chez une espèce de Copépodes (Elaphoïdella bidens)." *C.R. Acad. Sci.*, **192**, 558–575; 1931.

Abnormal Movability of the Heart

IT has been found that 9 per cent of 124 healthy soldiers and 26 per cent of 53 healthy high-school girls possess abnormally movable hearts. The criterion of movability taken was the displacement of heart apex due to change of body posture from standing to right lateral positions plus the displacement due to change from standing to left lateral positions. Frequency distribution as regards the movability is shown in the following table:

Movability in cm.	Frequency	Remarks
1 and 1·5	1	Normal heart.
2 2·5	133	
3 3·5	18	
4 4·5	0	
5 5·5	0	
6 6·5	0	
7 7·5	5	Cor mobile.
8 8·5	6	
9 9·5	6	
10 10·5	3	
11 11·5	3	
12 12·5	2	
13 and more	0	

To this distinctly separated group of abnormal movability of heart, I propose to refer by the term 'cor mobile', although this expression has been assigned to some rare cases of abnormal movability of heart of rather indefinite nature.

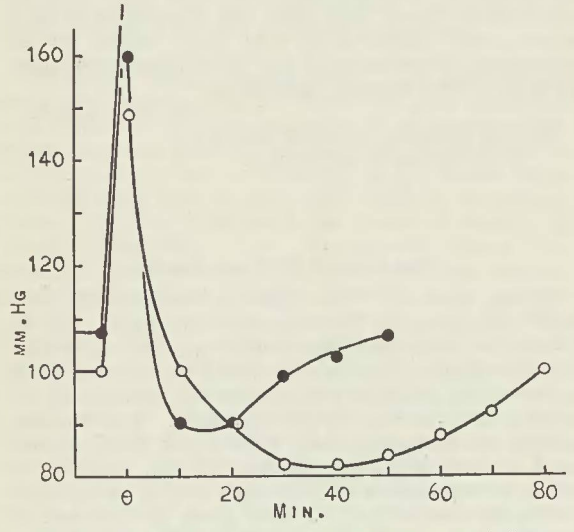

FIG. 1.—Effect on blood pressure by running 100 m. in two cases of 'cor mobile'.

It is interesting to note that the 'cor mobile' individual is liable to show a subnormal phase of blood pressure after strenuous exercise. A group of 14 normal soldiers and another of 14 soldiers with 'cor mobile' were taken at random. After running 100 metres, they were submitted to frequent observations of blood pressure. The result was that 6 out of 14 (43 per cent) normal soldiers showed a more or less marked subnormal phase, while all the 14 'cor mobile' subjects gave a marked, often conspicuous one (Fig. 1). In view of these findings we should like to direct the attention of investigators of the subnormal phase to the fact that the results of experiments may be expected to vary according to the number of subjects possessing 'cor mobile'.

Röntgen photographs of 'cor mobile' are being reproduced elsewhere.

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Dec. 20.

'Raw' Weather

REFERRING to Mr. Beckett's letter in NATURE of January 28, p. 132, by cold moist air I meant air which *feels* moist, and contains particles of water whether visible or invisible. For equal volumes, water has some 3,000 times the thermal capacity and 200 times the conductivity of air. To convert 1 gm. of water at skin temperature into vapour about 600 calories of heat must be supplied. Thus we see how particles of cold mist cool down the skin surface where they touch, and produce the sensation of cold.

Mist and cloud also cut off the radiant heat of the sun. A piece of black fur may be warmed by the summer sun 30° C. more than the air. I found that a coat hung out for four hours in a mist gained $3\frac{1}{2}$ oz. in weight. The water in such damp clothes must be so evaporated by body heat. Thus, as Mr. Beckett says, clothes come into the question. Wet ground is cooled by evaporation, and is not warmed by the sun; and the wind blowing over it is chilly, and entering houses through chinks and crannies may increase the damp of the walls and contents. The cooling power of wind exerted on the body, as shown by the katathermometer, may be very great. Thus a man lying in bed may feel the change of weather

There is, I think, no convincing proof that ionisation or de-ionisation of air such as occurs in ordinary rooms, or out of doors, has any physiological effect. On the other hand, there is abundant evidence that exposure to cold and certain radiations affect the feeling and produce reflex effects on the deeper organs.

Referring to Prof. Russ's letter in the same issue of NATURE, changes of barometric pressure which affect the body equally all over have no mechanical effect upon it. I have observed men under a pressure of even ten atmospheres, and other men, given oxygen to breathe, submitted to a pressure reduced to 170 mm., and no sign of discomfort. Prof. J. Barcroft and his co-workers, however, found that climbing at a pressure of 170 mm. produced pain in the joints, and this in spite of breathing oxygen. The pains, probably, were such as those felt by an athlete after a race, and were due to a local oxygen want. In the case of the athlete, they may be set aside by breathing oxygen before and after the race. At 170 mm., even the breathing of oxygen does not secure a supply sufficient for hard work.

It is probably that local changes of the circulation

brought about reflexly by cold, moving, moist air, and want of radiant heat, may produce pain in joints which are not normal, but exposed to some toxic agent the power of which is increased by a lessening of the oxygen supply. In those living a sedentary life, the circulation is very deficient in muscles and joints which are very little used.

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Distribution of the Polychæte Worm, *Syllis ramosa*, McIntosh

IT is generally admitted that one of the most remarkable forms of life discovered by the *Challenger* expedition is the polychæte worm, *Syllis ramosa*, in which the body branches laterally, these branches again sending off shoots into the passages of the sponge in which the worm lives. The result is an intricate net-work (except that, of course, the branches do not anastomose), and as each branch ends in an anus there is a large number of ani to one head. The two specimens obtained by the *Challenger* lived in the bases of hexactinellid sponges found at 140 fathoms depth in the Arafura Sea and in the Philippines at 95 fathoms.

Mr. C. C. A. Monro of the British Museum, in a letter to me, writes: "I have not searched the literature thoroughly but as far as I know, *Syllis ramosa* has not been seen since the 'Challenger' except off the Japanese coast, where it appears to be moderately common. It was found by Izuka in Sagami Bay in about 100 fms. and in Struga Bay in 90 fms., usually in a Hexactinellid sponge (*Crateromorpha meyeri rugosa*)."

Its appearance in the northern Red Sea at a depth of one fathom is therefore worth noting. I obtained it from a small sponge about 10 mm. in diameter which was attached to a dead branch of the coral *Lobophyllia corymbosa*, on the edge of a small coral reef about 100 yd. from the laboratory of the Biological Station of the University of Egypt, at Ghardaqa (known to the oil companies, and marked on some maps, as "Hurghada"), just south of the entrance to the Gulf of Suez.

The method of its discovery is also worth describing, as it is the only way in which the bulk of the smaller fauna inhabiting any material can be obtained. A bucket full of the material, in this case, dead branches of *Lobophyllia*, is kept overnight in water to which a handful of magnesium sulphate is added as a narcotic. This causes burrowing and cranny-loving forms to emerge, and on going over the material, 12 to 24 hours later according to the temperature, these may be rinsed or picked off each piece of stone, shell, coral or weed. At the bottom of the bucket remains a considerable bulk of small life, principally Crustacea and Polychæta, with Mollusca, planarians, small echinoderms, sipunculids, etc. This can be washed in old spirit, decanted from sand, and bottled for future examination. As an indication of the difference which would have been made to the older collections had this method been used, I may mention the Staurocephalidæ, small and particularly beautiful Polychæta, which figure in about one collection in twenty. Here, and elsewhere, I have found them in one or two cases by ordinary collecting, but by 'washing out' I find them frequently in fair numbers. In the present case on finding in my 'washing' two small pieces of *Syllis ramosa*, I worked over the material again and soon found the little fragile siliceous sponge in which is the remainder of the worm. I have not attempted to dissect out the head and have not found any sexual buds, preferring to make a thorough search when I have more material. Of its specific identity with *Syllis ramosa*, I have no doubt.

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Jan. 24.

A Dodecapodous Pycnogonid

IN a letter published in NATURE for July 28, 1910, I directed attention to Prof. E. L. Bouvier's discovery of *Pentapycnon* and discussed its relation to the other two genera of decapodous Pycnogonida. I am now able to announce the even more surprising discovery of an antarctic pycnogonid with *six* pairs of legs.

A few days ago, Sir Douglas Mawson handed over the Pycnogonida obtained on his latest antarctic expedition to be worked out by my colleague, Dr. Isabella Gordon. Among these is a magnificent specimen spanning 19 inches from tip to tip of its outstretched legs. So far as our preliminary examination has gone, it appears to differ from the two species of Decolopoda in no important respect except that it has an additional pair of legs. Exact particulars of the locality where the specimen was taken are not yet available, but it was dredged at a depth of 219 metres in the region of the antarctic lying to the south of Australia.

Dr. Gordon and I propose to describe this remarkable new form in detail elsewhere and to discuss its bearing on the problems of pycnogonid phylogeny. It need only be said at present that it appears to offer no obstacle to the view, which I have previously advocated, that the decapodous (and now the dodecapodous) Pycnogonida have been derived from octopodous forms, and that the Pycnogonida as a whole may conceivably owe their origin to an analogous disturbance of the established metameric pattern of the normal Arachnida.

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Feb. 13.

The Second Piltdown Skull

IN his work on "The Skeletal Remains of Early Man" (Smithsonian Miscellaneous Collections, vol. 83, 1930), Dr. Aleš Hrdlička doubts my statement that the late Charles Dawson discovered the isolated lower molar tooth of *Eoanthropus* with the remains of the second skull in the Piltdown gravel. Fortunately, among old correspondence, I have just found a postcard of July 30, 1915, written by Mr. Dawson, in which he announces his discovery of this molar tooth "with the new series". I have given the postcard to the Geological Department of the British Museum (Natural History), so that the record may be preserved and made available for reference.

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Research Items

Eskimo Culture Sequence. Stratigraphical evidence from Point Barrow, Alaska, obtained by the latest Alaskan expedition of the Smithsonian Institution, Washington, D.C., would appear to have gone far towards establishing a sequence of Eskimo cultures and determining the place and character of the 'Thule' civilisation of the eastern Eskimo. Hitherto it has been impossible to investigate the oldest 'ivory' culture of Point Barrow by excavation, owing to the short period during which the waters are open; but Mr. James A. Ford, archæologist of the Smithsonian Institution, elected to stay in Alaska during the winter 1931–32, in order to begin digging in June last as soon as the ground thawed. By excavating the 'ivory' culture burials—the settlements have disappeared owing to land subsidence—and the later settlement-mounds, he found that the 'ivory' culture was immediately followed by the 'Birknirk' culture in the graves and that the 'Birknirk' culture was the oldest stratum in the settlement-sites. It was here followed by a transitional stage to the 'Thule' culture, which in turn was followed by a stage scarcely to be distinguished from present-day Eskimo. It is thus shown that not only is the 'Thule' culture to be derived from the ancient Eskimo, which had been doubted; but also that it is relatively recent, and not, as had been thought, of high antiquity. Now at St. Lawrence Island, the 'Birknirk' culture has been found as a variant sequel to the Old Bering Sea culture, the latter being more usually followed by the 'Punuk' culture, a simpler form, which in the course of many centuries degenerates into the crude art of the modern Eskimo. As Ford found both the Bering Sea culture and the 'Birknirk' stage in the Point Barrow graves, it would appear that here the folk were colonists from the Bering Sea population, especially as an outpost of the 'Punuk' was found as the oldest stage of a settlement about sixty miles from Point Barrow. The details of evidence, upon which the summary of conclusions recently issued by the Smithsonian Institution is based, will be published in full in due course.

The Copper Age in Ancient China. The existence of stone and bronze ages in China has been admitted with certainty but the existence of an intermediate copper age has been questioned. A copper age in Egypt has long been established and it would have been expected that it must have existed in ancient China. In the *Bulletin of the Chemical Society of Japan* (December, 1932), Tsurumatsu Dono has described the chemical analyses of three ancient spear heads which closely resemble the objects recently found on the Yin site in the Ho-Nan province. These contain no appreciable amount of tin, which was detected only by the spectroscope. One specimen was nearly pure copper, with about 3 per cent of lead, whilst two others were lead bronzes, with 22·4 and 26·8 per cent of lead, respectively. If these specimens belong to the Yin dynasty, the copper age existed in that period and was in transition to a bronze age, which passed into an iron age about the end of the Han dynasty. Although Dr. Dono does not refer to the fact, it is significant that these lead bronzes of ancient China are similar to those of Sumerian Mesopotamia, and this would seem to lend support to the suggestion made some time ago that a connexion existed between the Sumerian and ancient Chinese civilisations. Only one specimen contained arsenic, and that only 0·8 per cent, whereas the ancient Egyptian bronzes often contained appreciable amounts of arsenic. All three specimens contained 1–2 per cent of iron.

Vocational Guidance and Health. The *Human Factor*, vol. 6, No. 10, contains an article by Mr. Angus Macrae on "Vocational Guidance and the Health of the Industrial Worker". The writer reviews the rôle of the physician in industry and the whole field of vocational guidance. He urges that the physician should exert a constructive influence and make recommendations based on the examinee's physical capacity instead of merely giving negative advice occasioned by some physical deficiency. Most general practitioners make inadequate, if any, reference to the 'mental' condition of the patient. The recent development of the psychologist's technique and the admitted success of various tests make a clearer diagnosis possible. Mr. Macrae refers to most of the work of importance achieved along these lines, surveys the influence of various specific environmental conditions, and concludes with a plea for greater co-operation between the doctor, psychologist and school staffs. He also recommends guidance for leisure as well as work, a more detailed supervision of the juvenile worker and the extension of vocational advice to those already in industry. The comparatively new idea that the supervisor, no less than the worker, may be a misfit is also stressed.

Development of *Gyrocotyle*. Of 93 examples of *Chimæra monstrosa*, examined by J. S. Ruszkowski (*Bull. Internat. Acad. Polon.*, Sci. et Lettres, B.2 (1931), 1932) in the summer of 1927 and 1929 at the Biological Station at Herdla near Bergen, all but one contained in the spiral valve the unsegmented cestode, *Gyrocotyle urna*. The much convoluted uterus of these cestodes was filled with eggs so that abundant material for the study of the development was available. The egg, which is oval and operculate and contains the egg cell surrounded by numerous yolk cells, develops satisfactorily in sea-water in Petri dishes at laboratory temperature. By about the twelfth day the embryo exhibits feeble movements which gradually become more pronounced and ten crotchets appear at the end of the embryo away from the operculum. About a month after the eggs have been laid, the operculum is raised and the ciliated larva with its ten posterior crotchets escapes. It swims actively at first but its movements become slower and after a day almost cease; the larva can live for six days. Attempts to infect bivalve molluscs with the larvæ were negative. On examination of the contents of the intestine of *Chimæra* the author found four young worms 4–10 mm. long. The extremity of the worm with the sucker has been regarded by some authors as anterior, while others have held that the opposite extremity with the rosette is anterior. The crotchets appear at the end which later forms the rosette and this therefore ought to be regarded as the posterior end.

Trematodes of Marine Mammals. Emmett W. Price (*Proc. U.S. Nat. Mus.*, vol. 81, Art. 13, 1932) has brought together the descriptions of all trematodes recorded from marine mammals, has made emenda-

tions or additions to the previous descriptions of ten species, based on examination of specimens, and has described a new genus and two new species. He reports that a specimen from *Orcinus orca* (*Orca gladiator*) so closely resembles *Fasciola hepatica*, except in body size and in having a slightly smaller egg, that it must be referred to this species. *F. hepatica* has been recorded also from *Balænoptera acutorostrata*. The trematodes known from marine mammals comprise 31 valid species belonging to nine families. Keys are given to the families, genera and species, a list of hosts and their trematodes is appended and figures of all the species except one are provided on the twelve plates at the end of the paper.

Bacterial Detoxification. The historical and theoretical aspects of bacterial detoxification have recently been summarised by Robert S. Harris and John W. M. Bunker (*Proc. Amer. Acad. Arts and Sci.*, vol. 67, No. 5, p. 147, June, 1932). A list of the agents that have been found to be detoxifiers is given, with full bibliography. Most of these agents depress surface tension, but detoxification is not considered to be due to this depressant action alone, or to any particular anion or cation, but to the configuration of the molecule as a whole. One of the best detoxifying agents is sodium ricinoleate, and in suspension in a three per cent solution of this substance the *Staphylococcus aureus* does not produce abscess formation, or the tubercle bacillus infect, on inoculation into animals. This protective action against the bacteria is not due to germicidal action of the detoxifiers.

British Columbia Douglas Fir Timber. One of the difficulties which would-be users of Empire timbers, both conifers and hard-woods, have experienced has been due to the absence of grading in imported stocks. In connexion with soft-woods, it is held that the best hopes for a big market lie with British Columbian Douglas fir. The appearance of a small pamphlet (H.M. Stationery Office, 6*d*.), entitled "Empire Timbers for Structural Design. British Columbia Douglas Fir", from the Forest Products Research Laboratory at Princes Risborough, is particularly opportune. This pamphlet directs attention to the developments which have taken place in recent years in the grading of structural timbers in Canada. The closer selection of timber with reference to the occurrence of defects, both natural and accidental, leads to much economy through the use of smaller sizes and longer spans. Probably no other timber has of late received so much attention as Douglas fir, for its characteristics have been studied in the forest products laboratories of Canada and of the United States of America, and its application in industry has been systematically developed by several commercial associations. Special classifications of British Columbian timbers have been made to meet the market in Great Britain and quite recently new grades of Douglas fir have been standardised to meet its particular needs. Tables are included in the pamphlet giving safe loads for each of a number of sections supported on varying spans to assist those who wish to employ Douglas fir as joists or rafters in buildings.

Palæozoic Brachiopods. An important monograph by C. Schuchert and G. A. Cooper ("Brachiopod Genera of the Sub-Orders Orthoidea and Pentameroidea", *Mem. Peabody Mus. Nat. Hist.*, 4, 1, 1932) deals with two extinct groups which are found abundantly in Palæozoic deposits. The Orthoids are the most primitive forms of articulate brachiopods and are considered to contain the stock from which all other articulates have evolved. Thus the Pentameracea and Strophomenacea appear to have been derived from the Orthacea. The authors first give a detailed account of the morphology of the shell in the Orthoids and Pentameroids. The table defining briefly but clearly the numerous terms employed will be helpful to students, but it is to be regretted that the widely used term 'cardinal area' is replaced by 'interarea' and 'palintrope' (apparently synonymous). In the Orthoids and Pentameroids, 135 genera and sub-genera are now recognised. The main part of the work is devoted to the description of these genera and sub-genera, their distinguishing features, phylogeny and distribution, with a list of the American and European species which the authors can definitely assign to each genus. British palæontologists will be interested in the suggestion that the well-known genus *Stricklandia* belongs to the early Rhynchonellacea and not, as hitherto thought, to the Pentameracea. Another work on Palæozoic brachiopods, by C. O. Dunbar and G. E. Condra ("Brachiopoda of the Pennsylvanian System in Nebraska", Nebraska Geol. Surv., Bull. 5, ser. 2, 1932) deals with the Middle and Upper Carboniferous brachiopods of Nebraska but mainly from a faunal point of view.

Submarine Faulting in Kimmeridgian Times. Among the normal sediments of the Kimmeridgian coastal strip of the Helmsdale district of east Sutherland a series of boulder beds is interstratified, the origin of which has long been problematical. A careful redescription of the evidence has been given by Prof. E. B. Bailey and Dr. J. Weir (*Trans. Roy. Soc. Edinburgh*, vol. 57, 1932–33, pp. 429–67), and as a result of their investigation they have reached the conclusion that the beds in question are the result of submarine landslips, precipitated by earthquakes along the line of an adjacent fault, and distributed by tsunamis or tidal waves. The fault-scarp was maintained by intermittent movement of the sea-floor, the aggregate movement exceeding two thousand feet. The Old Red Sandstone exposed in the fault-scarp furnished boulders that exceptionally reached a length of a hundred feet. The scarp separated a comparatively shallow-water facies of rounded pebbles and sand, with brachiopods, sea-urchins, corals, etc., from a comparatively deep-water facies, characterised by mud, with debris of land plants, ammonites, etc. The effects of earthquakes are registered not only by the spreading out of the landslips into graded boulder beds, but also by fissuring of the Kimmeridgian and the production of breccia along the fault. The local movements are shown to be contemporaneous with other movements in Britain. The interpretation of the boulder beds is like that already put forward by Bailey, Collet and Field to account for the Palæozoic boulder beds near Quebec. Other analogues in Britain, Switzerland and the United States are briefly discussed. The paper is an important contribution to world geology as well as a model of geological description and interpretation.

Sources of Light for Interferometer Work. Such work as the determination of the metre in wave-lengths of light demands a source of light which is very homogeneous and capable of exact specification. The Michelson cadmium lamp has been generally used for

this purpose, but its manipulation is inconvenient. Messrs. Rolt and Barrell, working at the National Physical Laboratory, have examined the suitability of a new type of lamp for such purposes. The lamp is made by the Osram laboratories in Germany and consists of an A.C. discharge between electron-emitting filaments in argon. Some cadmium is present in the tube and when the lamp is running steadily the cadmium spectrum alone is excited. The spectral lines were examined by a variable Faby-Perot etalon, and within the accuracy possible, which was limited by the temperature control of the latter, no difference could be established between the two lamps when the Osram lamp was run with the (reduced) current of 1 amp. With 2 amp. the blue and green lines showed increased complexity, which may be due to self reversal, and the red line itself showed some evidence of inhomogeneity. The authors intend to repeat the work with an invar mounted interferometer.

Gaseous Combustion at High Pressures. The January *Proceedings of the Royal Society* contains a series of papers on the part played by nitrogen in carbon monoxide and hydrogen combustions. In the experiments made by Bone, Newitt, and Townend, explosions of carbon monoxide–air and hydrogen–air mixtures were made in a wire-wound steel bomb under initial pressures of 500–1,000 atmospheres, and the explosion pressures were recorded continuously by a Petavel manometer. As in previous experiments at lower pressures, a liberation of heat was observed for some time after the explosion of a $CO–O_2–N_2$ mixture, which was ascribed to nitrogen molecules activated by the burning carbon monoxide. This effect reached a maximum for initial pressures of about 500 atmospheres. The explosions, both of hydrogen and carbon monoxide, were slightly slowed by the higher pressures, but a hydrogen–air mixture at 750 atmospheres detonated very violently. At the higher pressures, $CO–O_2$ mixtures containing carbon monoxide to replace the nitrogen of the air—carbon monoxide mixtures deposited some carbon on explosion, presumably because the high pressure favoured the reaction $2CO \rightarrow CO_2 + C$. In a paper by Newitt and Outridge, the formation of nitrogen oxides in $CO–O_2–N_2$ explosions was investigated. The products of explosion were liberated into an expansion chamber by the bursting of a steel disc; and the gases thus suddenly cooled were analysed at leisure. Considerable quantities of nitrogen oxides were found and their formation was greatly helped by raising the pressure. The yield of nitrogen oxides was greatest when the disc burst after the maximum pressure had been attained, and the authors explain the formation of the oxides as due mainly to activated nitrogen produced in the explosion. In the third set of experiments, by Newitt and Lamont, carbon monoxide flames were burnt steadily in oxygen–nitrogen mixtures. Nitrogen oxides were formed, particularly at high pressures. The oxide formation is again ascribed to activation of the hydrogen, the mere temperature of the flame being of comparatively small importance.

Astronomical Topics

Earth's Influence on Sunspots. Many solar observers have noted an apparent earth effect in studying the number of spots that are born or disappear in different regions of the visible disc. Mr. P. R. Chidambara Aiyar, of the Kodaikanal Observatory, has collected all the spots of duration two days observed at Greenwich from 1874 until 1930 (*Mon. Not. Roy. Astr. Soc.*, Dec.); they are 1,395 in number. When plotted, they show maxima near the east and west limbs, and also near the centre of the disc, with minima at the intermediate zones, both east and west. There is also a graph of the longitude of birth of spots of two-day duration, from the Kodaikanal records. This shows a similar arrangement, but the minima are not quite so deep; only 389 spots are available, so the weight is smaller. It is difficult to form any plausible hypothesis to explain the falling off in numbers at the intermediate zones.

Comets. An interesting photograph taken by Prof. van Biesbroeck at Yerkes on November 28 and reproduced in *Popular Astronomy* for January shows the two periodic comets Faye and Brooks within half a degree of each other; Faye is distinctly the brighter, but both are easily seen, and have short tails. Comet Geddes, discovered in New Zealand last June, when near the south pole, has now come north, and was seen at Yerkes on December 18, in spite of moonlight. Observations from Tashkent are also to hand. There is an ephemeris in the B.A.A. Handbook.

Prof. van Biesbroeck also reproduces a photograph taken on December 20 of the new comet Dodwell-Forbes; it was of magnitude $9\frac{1}{2}$, 3′ in diameter, without a stellar nucleus or a tail. The period of nine years, given at first, is too short; it is probably a century or more. Mr. Forbes found this comet on December 15, which was probably before Mr. Dodwell saw it; but it was a public holiday in South Africa (Dingaan's Day) and that caused a delay in circulating the announcement.

The comet was seen in Devonshire with a 3-inch telescope, but is now fading.

Proper Motions in the Lund Zone of the Astronomische Gesellschaft Catalogue. Lund Meddelande, Ser. 2, No. 65, contains a discussion of the proper motions of the stars in this zone by W. Gyllenberg. This list, which is the second one published, contains 277 stars, the determination of their proper motions being made by a graphical method. In order to test the validity of the method, the proper motions of ninety-three stars were also investigated by a rigorous least-square method. This comparison revealed the fact that the graphical method introduced a systematic error which makes the proper motions determined by it numerically too large. An explanation of the discordance, based on the theory of errors, was found, and formulæ deduced for correcting the graphical proper motions. The error increases with the size of the proper motion and can be rendered small by doing the graphical process twice; in the second graph the observations are corrected for the approximate proper motion found by the first graph. The faintest stars in the catalogue are of magnitude 9·4; several of these faint stars have considerable proper motion. Incidentally, it was noted that much trouble would be saved by excluding the catalogues of Lalande and Bessel; these aimed at quantity rather than quality, and many of the positions in them are inexact.

Work of the Government Chemist

DECREASES in the number of samples examined during the year ended March 31, 1932, by the Government Laboratory at Clement's Inn Passage, at the Custom House branch, and at seaport chemical stations are, as is stated in the report of the Government Chemist (H.M. Stationery Office, 1932. 9*d*. net), a sign of the present state of industry generally. Nevertheless, the examination of nearly half a million samples, together with the research work continuously involved in the maintenance and increase of efficiency, form the substance of the report of a very active year's work.

The Government Laboratory, while providing various departments of the public service with analytical reports on samples submitted to it, and reporting on samples referred to it by magistrates under the Food and Drugs (Adulteration) Act, 1928, performs a considerable number of services of general interest and purely scientific value. Thus, sea-water samples are examined in connexion with a scheme of oceanographical research carried out by the Fisheries Department of the Ministry of Agriculture and Fisheries, and by the Fishery Board for Scotland, acting in concert with the International Council for the Exploration of the Sea. The objects of these investigations are to trace the influence of salinity on fish life, and to trace the movements of water, apart from tidal motion, from one part to another in the sea.

Attention has also been directed to the preservation of cinematograph films of national importance, and the development of such films is now being carried out under supervision and control. The Laboratory's advice was also sought with regard to the best method of preserving cinematograph films taken on the "Discovery" expedition. At the laboratory in the Geological Survey and Museum, complete analyses of fifteen rocks were made, and various other specimens were subjected to tests. Methods have been worked out in connexion with the analyses of igneous rocks, metamorphic rocks, and minerals, and the determination of alkalis in rocks has been studied with the view of increasing the accuracy of the results.

Reporting on the composition of imported cheese, the Government Chemist states that only 43 per cent of the samples had been prepared from whole milk, but remarks significantly: "As, however, there are no regulations relating to the marking of skimmed or partially-skimmed milk cheese, no exception could be taken to any of the importations." Similarly, most of the samples of cream contained only 19–35 per cent of fat, the group containing 45–55 per cent representing only 9 per cent of the total; but "since there is no standard for cream in this country, exception could not be taken to the samples in respect of low proportion of fat". Examples of investigations of industrial interest are quoted.

A sample of synthetic resin was examined for the Office of Works in respect of its suitability for varnishing pictures, but the material was rejected since it developed acidity with lapse of time. Various paints, oils, and thinners were investigated to discover the cause of the defective drying of paint applied to the walls of a building, and one of the fluids examined was found to contain nitrobenzene in quantity sufficient to inhibit the drying of the paint. An investigation for the Admiralty, at present in progress, is the search for a relation between the tendency of oilskins to become 'tacky' in humid climates and the nature and proportion of the driers present in the oil, and its treatment.

Many samples of cider were examined in connexion with a scheme for grading cider entitled to bear the National Mark; a commercial preparation recommended for preventing 'cider sickness' but not permitted for use in such cider was found to be a solution of phosphoric acid. During the year about 150 mgm. of partially purified radium was recovered from decayed luminous paint, and 242 milligrams of partially purified radium was converted into high-grade salt of 66 per cent purity.

For the Imperial War Museum ninety medals and plaques have been cleaned, restored, and lacquered for preservation, work which necessitated a preliminary investigation into the character of the corrosion product. The services of the Laboratory were also requisitioned in a number of cases of suspected fraudulent use of stamps and repayment claims.

Irish Woods and their Significance

THOSE who have endeavoured to study the past history of the forests of a country have quickly appreciated the great difficulties which present themselves. Assumed facts and widely held theories are discovered to be based on the slenderest evidence, and have afterwards been so often repeated in histories and so forth as to have become accepted as incontrovertible facts. Ireland presents a remarkable illustration. In the majority of histories dealing with Irish economics during the past two or three hundred years, the statement is either made or implied that the greater number of the native forests of the country were destroyed during the sixteenth and seventeenth centuries. The reasons assigned are usually the removal, by felling or burning, of the natural shelter of Irish rebels during the Elizabethan and Cromwellian wars, the smelting of iron by means of charcoal, the exportation of pipe staves, etc. In some cases even this assumed destruction is imputed to the mere presence of the English in the country, and it is suggested that the native Irish had a keen sense of forest preservation, whilst the various intruders were entirely devoid of this quality.

To the energy and enthusiasm of Mr. A. C. Forbes we owe the exposure of this myth. In "Some Legendary and Historical References to Irish Woods, and their Significance" (*Proc. Roy. Irish Acad.*, vol. 41, Sect. B, No. 3, Dublin, 1932) Mr. Forbes traces the past history of the forests of Ireland and has produced a treatise of considerable value, historical and economic, which it may be hoped will evoke similar essays for other countries.

The author took as his main study the writers of well-known histories, treatises and descriptions of the

country on one hand, and State papers on the other. As an example of the former Mr. Forbes quotes the following extract from Lecky's "History of Ireland in the Eighteenth Century": "A serious and enduring change passed over the material aspect of the country in the forty years that followed the revolution (of 1640) from the rapid destruction of its forest trees. The history of this destruction is a curious and melancholy one. When the English first established themselves in Ireland, no country in Europe was more abundantly wooded." Lecky then quotes the various authorities upon whom he relied for making "this extraordinary statement" as Mr. Forbes terms it. It is impossible to follow the author through his review of these authorities but he conclusively shows the absence of all proof for the statements made. The references made in or to State papers and memoranda yield more satisfactory data, but Mr. Forbes says they must be read with caution.

Mr. Forbes summarises his conclusions as follows:

(1) No trustworthy account of Irish forests as a whole during the medieval period is in existence. The occupation of the country by the Normans and Tudors had no material effect upon the wooded condition of the country, although considerable quantities of timber were cut for pipe staves, and for conversion into charcoal during the latter period.

(2) The forest laws of the Normans were applicable to Ireland in the same way as in England, but there is no evidence that they were enforced except in one or two cases, which the author deals with at some length. The various references to "forest" in the State papers pertained to the unenclosed or unappropriated land of the country, which was regarded as the property of the Crown. This forest had no definite connexion with woods or timber. Many similar instances are to be found throughout the British Empire at the present day.

(3) The annals, legends, and other documents relating to the prehistoric period suggest that the condition of Ireland for an unknown period was that of a huge grazing ranch, over which trees were scattered more or less generally. More thickly wooded districts doubtless existed, but no clear indication of the extent can be discovered from the translations made in modern times.

(4) The Irish forest flora does not appear to have changed during the last thousand years. While the pine (*Pinus sylvestris*) may have survived until comparatively recent times, all the reliable evidence on this point is entirely negative in character.

(5) The native forests were gradually destroyed by grazing and fire, continuing over a very long period, and not by any large scale or deliberate acts of destruction.

On the subject of the composition of Irish woods, the legends and annals relating to the early Christian period throw a good deal of indirect light upon the species of trees which were in existence between the thirteenth and fourteenth centuries, when the majority of the legends were first inscribed or transmitted to parchment or paper. Topography forms a prominent feature of these old tales and poems and references are made to plains, woods, lakes and mountains which suggest a general landscape very similar to that existing to-day, while the frequent references to cattle show that flocks and herds formed the chief wealth of Ireland, as is the case to-day. In a tale entitled "The Death of Fergus", the scene of which is laid before the historic period, the following list of trees is given: ash, green oak (which may distinguish it from the bog oak so common throughout the country), aspen, rowan, alder, holly, blackthorn, whitethorn, briar, willow, apple, elder, birch and yew. Woodbine is referred to as "the Monarch of Inisfail's forests", but pine and elm are not mentioned. The list is almost identical with one which might be drawn up to-day in any piece of native scrub.

Perhaps one of the most interesting problems presented by the forest flora is the disappearance of the pine as an indigenous tree. This disappearance would appear to have taken place before the historic period. It constitutes the most plentiful species in bog remains all over the country. Mr. Forbes suggests that the causes may be the competition of oak and ash on the better classes of soils and the burning by graziers on the mountain slopes. In the absence of any proof to the contrary, the suggestion would appear to be the most likely one.

The Extra-Galactic Nebulæ

A DECISION has been reached by the Council of the Royal Astronomical Society that in view of the fact that the gold medallist for the year is so frequently the same person as the George Darwin lecturer, the latter may be expected to explain in his lecture the work for which the medal has been bestowed; and the president should be free to choose a subject of his own for his address at the annual meeting. The retiring president, Dr. H. Knox-Shaw, at this year's annual meeting held on February 10, chose a subject with which the medallist, Prof. Slipher, is closely connected, but on which many others have laboured in recent years, resulting in a great increase in our knowledge; this is the problem of the nature and motion of the extra-galactic nebulæ. Slipher was a pioneer in the study of their radial velocities; these proved to be large (the first forty gave an average of 620 km./sec.) and mainly outwards, though some of the nearer ones were approaching. The latter velocities were diminished on correcting for galactic rotation.

The address went on to describe the various types of nebulæ, including elliptical, spiral, barred-spiral, and irregular; the differences arise partly from different angles of projection, but chiefly from differences in the stage of development. The subject of their distance was then examined; the first reliable determination was that by Dr. Hubble from his detection of Cepheid variables in the nearer spirals; a distance of some 900,000 light-years was deduced for the great nebulæ in Andromeda and Triangulum. The measures were pushed some distance further by the magnitudes of the stars in the nebulæ; when this failed, estimates were made by the total light and angular diameter of the nebulæ. From these methods Dr. Hubble deduced $-13{\cdot}8$ as the average absolute magnitude of the nebulæ; Dr. Knox-Shaw suggested the value $-14{\cdot}5$.

Going on to consider the radial velocities, Dr. Knox-Shaw suggested that it was best to take these as a true Doppler effect in the absence of any other probable hypothesis; this was strengthened by the

fact that the same radial velocity was indicated by lines in different parts of the spectrum.

A description followed of the special spectrograph by which Dr. Hubble has extended his study of radial velocities to the faintest and most distant nebulæ ; this is done by diminishing the scale of the spectrum and giving prolonged exposures ; recessions up to 19,000 km./sec. (equivalent to 200 angstroms for the *H* and *K* lines) have been found. The corresponding distance would be about 120 million light-years ; estimates from different groups of nebulæ gave the mean recessional speed as lying between 590 and 400 km./sec. at a distance of one megaparsec. Dr. Knox-Shaw made an estimate of the average peculiar radial velocity of a nebula, including the dispersion in absolute magnitude ; he found the value 140 km./sec. It is thus important for the nearer nebulæ, but a very small fraction of the whole for the distant ones.

In conclusion, Dr. Knox-Shaw said that the absolute magnitudes of the Cepheids, and all estimates of distance based upon them, are still subject to some revision. The original values were not corrected for the absorption of light in space ; there is accumulating evidence that some correction is needed, but the exact amount is still uncertain. The galaxy appears to be of such a complex character that the absorption in different regions is probably different.

A comparison was made between the components of nebular clusters and isolated nebulæ ; the former appear to be on the average fainter than the latter by amounts ranging from 0·5 to 0·9 mag. It will be seen that the address was not merely an account of the results obtained by others, but included personal discussion of the conclusions to be derived from them.

University and Educational Intelligence

BIRMINGHAM.—Dr. J. F. Brailsford has been appointed radiological demonstrator in anatomy and W. J. Rees temporary assistant lecturer in botany.

LONDON.—The Leathersellers' Company has decided to make a grant to the University of £1,000 in the shape of annual payments extending over a series of years. This benefaction will be applied towards meeting the cost of the new Ceremonial Hall to be erected on the University's site in Bloomsbury.

The Pilgrim Trustees have decided to make a grant of £1,500, payable in three equal annual instalments, towards the cost of the preparation and the revision of existing material for the "Victoria County History". It will be recalled that in November of last year the University accepted an offer received from Mr. William Page, the sole proprietor and editor, to give to the University the copyright and material of the "History".

READING.—The Council of the University has appointed Dr. R. H. Stoughton to be professor of horticulture. For two years Dr. Stoughton acted as mycologist to the Rubber Research Scheme of Ceylon, and for the past six years he has been a member of the research staff in the Department of Mycology at Rothamsted Experimental Station. The chair of horticulture at Reading has only recently been established and it is the first post of its kind in Great Britain. The training of students in horticulture has, however, been for many years a feature of university teaching at Reading and Dr. Stoughton will take over the whole charge of the Department of Horticulture. He will act also as director of the university Horticultural Station at Shinfield, where a garden of about 20 acres, including greenhouses and a well-stocked orchard, provides facilities for the instruction of students in the practice of gardening. The Station also affords opportunity for research in horticultural problems.

THE Society for Cultural Relations with the U.S.S.R. has decided to arrange an education tour for the Easter vacation of 1933, the suggested date of departure being April 8. The tour will cover about 21 days, 6 days being spent in and around Leningrad, and 8 days in and around Moscow. All types of educational institutions, urban and rural, will be visited. Opportunities for making contact with Soviet educationists will be provided. A Russian-speaking English educationist will lead the party. The cost, which includes travel to and within the U.S.S.R., hotel charges, tips, visits to museums, etc., will be approximately £37. Further particulars can be obtained from the Secretary, S.C.R., 1 Montague Street, London, W.C.1.

Two Lady Tata research scholarships, of the value of £400 a year each, will be open for award in June, 1933, to men or women in the British Commonwealth, exclusive of India, for research work in the subject of blood diseases, with special reference to leucæmias. Each will be tenable for a year, from October 1, 1933, and renewable up to a normal maximum tenure of three years. The scholarships will ordinarily be awarded on a whole-time basis, but a candidate holding a part-time teaching post may be allowed to retain this if his duties will not prevent him from giving his chief interests and energies to his proposed research work. Applications should be sent, on or before April 15, to the Secretary, Dr. H. S. Patel, Lady Tata Memorial Trust, Capel House, 62 New Broad Street, London, E.C.2, from whom forms of application may be obtained.

Calendar of Nature Topics

Sowing Agricultural Seeds

The drills will soon be at work sowing spring corn. Broadcasting by hand, firmly associated in literature with the committing of seed to the ground, was universal until the sixteenth century and only slowly gave way to drill husbandry. It is now almost a lost art in Great Britain, and even when local circumstances make broadcasting necessary, it is usually done by machine. The forerunner of the modern seed drill was devised by Jethro Tull in 1701 and its introduction together with the principle of inter-row cultivation, which was part of Tull's system, represents one of the historical land-marks of agriculture.

With centuries of mechanical improvement it might have been expected that the present-day seed drills would be practically perfect. This is not the case. The ideal implement, sturdy enough to stand the rough usage of the farm, yet capable of distributing seed at a uniform and accurately adjustable rate from each of its many coulters, has not yet been constructed. Recent detailed studies of the distribution of the plant population in fields of cereals and roots

have revealed a startling variation in density which is associated with equally marked differences in yield. Irregular sowing was found to be one of the main causes of this. There is no doubt that more uniform spacing of the seed in the rows would lead to higher yields, and when a demand for more accurate seed drills makes itself felt improved designs will be forthcoming.

Where do Flies go in Winter?

Gilbert White noticed that "in the decline of the year, when the mornings and evenings become chilly, many species of flies (*Musca*) retire into houses, and swarm in the windows", but he thought that they died there. There is, however, sometimes an interesting sequel to the autumn swarms of flies in houses. Generally in February, occasionally in January and March, householders in various parts of the country have complained about the appearance of swarms of flies. One such case was investigated in Edinburgh by Prof. J. H. Ashworth on February 22, 1916 (*Scot. Nat.*, 1916, p. 81). Swarms were then present in four rooms of a house, where for sixteen years they had congregated annually in September or October. Generally they disappeared before the end of November, but sometimes they persisted through the winter. The evidence suggests, however, that it was not a simple case of continuous persistence; for although Ashworth almost cleared one of the rooms on February 22, he found on March 7 that a considerable number of flies had again collected, as if they had emerged from crevices in which they had been hibernating. Only rooms with a southern aspect were affected, and at its largest the swarm in one room was reported to cover the bay-window and to have formed in addition a mass on the ceiling which resembled a thick coil of black rope some three inches in thickness.

Evidence of hibernation was more direct in the swarm which Major T. K. Gaskell observed at Lahill, Largo, Fife, in February 1915, for there he actually saw the small flies emerging from a crack behind the mantelpiece in his bedroom, which faced west. Probably their winter rest had been disturbed by the fire lit in the guest chamber. He collected in that, and the following year, some 700 individuals. Hever in Kent, Swindon in Gloucestershire, and other places have contributed all in one winter to the records of swarms of flies in houses, and show that the event is of wide occurrence.

Composition of Fly Swarms in Dwelling Houses

It is a remarkable fact that none of the swarms examined contained a single example of the common house-fly (*Musca domestica*). The swarms were really made up of a small anthomyid dipteron, *Limnophora septemnotata*, which was accompanied by odd individuals of muscid diptera, such as *Pyrellia eriophthalma*, *Muscina stabulans* and *Pollenia rudis*. A second interesting fact was that, in the two swarms fully analysed (Edinburgh and Largo), P. H. Grimshaw found all the specimens of *Limnophora* to be female. Ashworth's examination of ten specimens taken at random showed that all were impregnated, the receptacula seminis being crammed with active spermatozoa, presumably received in the previous autumn from males which had since died. The females alone carried on the race over winter, each survivor being ready, on the return of suitable conditions, to emerge from its winter quarters, feed, mature its ovaries, and produce eggs to be fertilised by autumn spermatozoa.

A third point of interest was that, as a rule, the dipterous swarms were accompanied by small hymenopterous parasites, the chalcid *Stenomalus muscarum*, the females of which are said to lay their eggs upon the larvæ of muscid flies. Moreover, all the hibernating chalcids of this species which Dr. James Waterston examined were females, and in describing the occurrence (*Scot. Nat.*, p. 140, 1916) he asked the pertinent question: "Is the occurrence of this Chalcid with the Diptera a fortuitous association to be explained simply on the ground that different species have selected the same winter quarters, or have we here an adaptation of habit on the part of the Chalcid enabling the parasite to oviposit most advantageously in the spring?"

Heredity and Hibernation in Insects

In his invaluable work on "Insects and Climate", B. P. Uvarov has summarised records regarding the hibernation of insects which suggest the existence in many species of a fixed seasonal life-cycle which may be disturbed by unusual temperature conditions but cannot readily be annulled by them (*Trans. Ent. Soc. Lond.*, 79, 105; 1931). Hibernation has become a habit which is fixed and is transferred with other heritable properties from one generation to the next. How has this habit become engrained in the course of evolution? It has been suggested that individuals in which the life-cycle was not properly adjusted to the conditions of environment would suffer and finally be eliminated, leaving only the well-adjusted to survive; in other words, that natural selection has been responsible.

Uvarov, however, refers to experiments carried out by Pictet on the caterpillars of the oak eggar moth which are very suggestive. His summary is as follows:— "Pictet (1913) himself bred caterpillars of *Lasiocampa quercus*, L., at 22° for six successive generations, with the result that, while in the first generation all caterpillars hibernated normally when the time arrived, in the fifth generation 52 per cent of the caterpillars were only inactive for one month, and 18·7 per cent developed without hibernation at all, and in the sixth generation practically all the caterpillars developed without hibernating. Under these conditions the adults can be obtained at almost any season, instead of in July–August, when they emerge normally, although about 50 per cent still tended to emerge at the usual time, owing to an adjustment in the length of the pupal period. Pictet used the results of his interesting experiment as an argument that the annual life-cycle is constant and hereditary, its origin being due to natural selection. They serve, however, to support even better the idea that the life cycle of a species can be directly influenced by the seasonal climatic cycle. Indeed, since only six generations were necessary to produce a substantial change in the life-cycle, in adjustment to new conditions, it is reasonable to suggest that a climatic cycle acting on a species for countless generations may make that species perfectly adjusted to it without the aid of natural selection." We have not seen Pictet's paper (*Bull. Soc. lépidopt. Geneve*, vol. 2, pp. 179–206; 1913) and do not know whether the possibility of mortality in the different generations of his caterpillars may affect the argument, but progressive adaptation in generation after generation suggests something very like the inheritance of an acquired modification in the habit of hibernation.

Societies and Academies

LONDON

Royal Society, Feb. 9. W. S. STILES and B. H. CRAWFORD: The luminous efficiency of rays entering the eye pupil at different points. It is commonly assumed that the apparent brightness of an object is proportional to the pupil area. This assumption is shown to be invalid, and measurements are described which give the relative luminous efficiencies of rays entering the pupil at different points. From these data, the overall luminous efficiencies of eye pupils of different diameters are computed, and checked by direct measurement. The effect may originate in the eye media or in the retina itself. R. J. LUDFORD: Differences in the growth of transplantable tumours in plasma and serum culture media. The malignant cells in tissue cultures of tumours can be distinguished from the non-malignant cells by the addition of trypan blue to the cultures, since the former do not segregate the dye like the latter. The two types of cells are further distinguishable by other characteristics. In plasma cultures, both malignant and non-malignant cells migrate from the explants. In serum cultures only non-malignant cells wander out from the explants. In serum cultures the explants of carcinomata soon become rounded and the explants of sarcomata tend quickly to disintegrate. The outgrowth of non-malignant cells in serum cultures is usually greatest when tumours are explanted at a time when they are not growing at their best *in vivo*. It is suggested that the different behaviour of malignant cells in plasma, and in serum, is the result of an alteration in their plasma membrane such that they are unable to adhere to glass, though able to use the fibrin network of a plasma clot as a support for their movement.

Mineralogical Society, Jan. 26. L. J. SPENCER: Meteoric irons and silica-glass from the meteorite craters of Henbury (Central Australia) and Wabar (Arabia). The meteoric iron from these two localities is of exactly the same type, namely, a medium octahedrite containing 7·3 per cent of nickel. At Wabar a 25 lb. mass and a few small fragments of iron were collected; but at Henbury thousands of masses of iron are scattered around the craters. In the smallest (10 yd.) crater a group of four masses (440 lb.) was excavated at a depth of 7 ft. Many of the smaller pieces scattered around the craters are curiously twisted and bent, suggesting that they were torn in a plastic condition from the main masses by the force of the explosions. Further, they show a partial obliteration of the lamellar structure with granulation of the kamacite, indicating that they reached a temperature of 850° C. The pieces of iron show different types of pitting resulting from subaerial and underground weathering, and they are all weathered remnants of larger masses, each consisting of a single crystal. (See also NATURE, 131, 117, Jan. 28; 172, Feb. 4, 1933.) A. BRAMMALL and S. BRACEWELL: Garnet in the Dartmoor granite: its petrogenetic significance. Seventeen occurrences prove to be manganiferous almandines containing 3–22 per cent of MnO. Two or more varieties may occur in a single hand-specimen of the granite. The more manganiferous varieties (7 per cent MnO) are restricted to the tor-horizons; the less manganiferous varieties occur (*a*) below these horizons, (*b*) in shale-contaminated facies of the granite, and (*c*) in xenolithic hornfelsed shale. Basic igneous inclusions are barren of garnet, and grossularite, *not* almandine, occurs in contact-altered spilites. The mineral is attributed to contamination of the granite by country-rock—probably deep-seated shales. Ten Lake District occurrences show a similar variation (1·3 per cent–7·3 per cent MnO). F. A. BANNISTER: The identity of mottramite and psittacinite with cupriferous descloizite (cuprodescloizite); (with chemical analyses by M. H. Hey). Oscillation, Laue and rotation photographs show that descloizite has an orthorhombic unit-cell with edges $a = 6{\cdot}05$, $b = 9{\cdot}39$, $c = 7{\cdot}56$ A. and space-group Q^{16}_h. The unit cell contains $4PbZn(VO_4)(OH)$. Powder photographs of descloizite, cuprodescloizite, mottramite, and psittacinite from the type localities are identical with each other. New chemical analyses and determinations of the water content at various temperatures together with the X-ray work show that all these minerals may be represented by the general formula Pb(Cu, Zn) (VO_4) (OH). The water of constitution is not evolved until a dull red-heat. Thin incrustations of minute black crystals on sandstone from Harmer Hill, Clive, near Shrewsbury, collected by Mr. Arthur Russell, are identical with mottramite from Mottram St. Andrew, Cheshire (H. E. Roscoe, 1876), that is, cuprodescloizite carrying little or no zinc.

EDINBURGH

Royal Society, Jan. 9. J. G. GRAY: Self-erecting gyrostats. The lecture was illustrated by experiments carried out with a large series of new gyrostatic tops and combinations invented by Prof. Gray and constructed with a view of demonstrating and explaining technique which he has developed for use in the practical applications of gyrostatics, notably in applications to the navigation of marine and aerial craft, and for use in the construction of stabilisers for use in such craft. J. E. MACKENZIE and H. W. MELVILLE: Experimental demonstrations of the measurement of the diffusion coefficients of bromine–hydrogen and bromine–carbon dioxide. This experiment is likened to a horse race in which all the horses have the same speed and colour (say chestnut), but each horse runs in a track differing in difficulty from the track of every other horse. Bromine molecules (chestnut horses) diffuse through tubes filled with hydrogen or carbon dioxide or other gas, and the distances covered by the bromine in each tube are measured visually at intervals of time. (See NATURE, 130, 322, Aug. 27, 1932.) H. S. RUSE: The measurement of spatial distance in a curved space-time. A definition of spatial distance in a general space-time obtained in an earlier communication by a purely mathematical argument is in accordance with the concept of 'distance' fundamental in relativity, namely, that determined by the use of rigid measuring rods.

PARIS

Academy of Sciences, Jan. 3 (196, pp. 1–71). H. DOUVILLÉ, M. SOLIGNAC and E. BERKALLOFF: The discovery of the marine Permian at Djebel Tébaga (extreme South Tunisia). ST. GOLAB: The conformal representation of Finsler space on Euclidian space. ÉLIE CARTAN: Remarks on the preceding communication. S. FINIKOFF: Pairs of surfaces the lines of curvature of which correspond, the

corresponding tangents cutting. ARNAUD DENJOY: The polygons of approximation of a rectifiable curve. S. MAZUR and W. ORLICZ: Linear methods of summation. N. BOTEA: Some partial differential equations. J. DIEUDONNÉ: Radii of *étoilement* and convexity of certain functions. TCHANG TE-LOU: The electrical and thermomechanical phenomena during ignition and combustion in an internal combustion motor. DELFOSSE and SWYNGEDAUW: Certain conditions of working of ball bearings. F. HOLWECK: Study of a sensitive elastic pendulum. Contribution to the establishment of a French gravimetric network. P. LEJAY: The establishment of the gravimetric map of the north of France. S. SOBOLEFF: The equation of the wave on the logarithmic surface of Riemann. FRANCOIS CANAC: Study of the mode of corrosion and of the susceptibility to corrosion of metals by the diffusion of light. R. DE FLEURY and A. CAILLON: The composition and mode of use of a flux assuring the protection of the metal, its refining and the elimination of chlorides in casting magnesium. E. AUBERT DE LA RUE: Some mineral deposits of the Saint-Pierre and Miquelon Islands. H. ARSANDAUX: The origin of the secondary dome of Mt. Pelée. L. GRIGORAKI: A new medium for preserving dermatophytes (pleomorphism, acquired characters, tissue specificity). F. VLÈS: Researches on the intervention of electrical conditions in the growth of children. CH. SANNIÉ and R. TRUHAUT: The mercury-reducing power of certain aminoacids. JAMES BASSET and M. A. MACHEBŒUF: Studies on the biological effects of ultra-pressures. Studies on immunity: the influence of very high pressures on certain antigens and antibodies. The toxin of tetanus loses its activity after exposure to a pressure of 13,500 atmospheres, but then possesses no immunising activity. It is not an anatoxin. At this high pressure antitetanus serum is precipitated as a jelly but the antitoxic power is not wholly destroyed. A. LACASSAGNE: Malignant tumours produced in the rabbit by the irradiation of inflammatory foci.

VIENNA

Academy of Sciences, Oct. 20. JOSEF KISSER and H. SCHMID: Investigations on the permeability of the seed coats of *Pisum* and *Triticum* to water and on the suction forces of the seeds. J. KISSER and J. SCHUBERT: The influence of treatment of seeds with chemical stimulants on the cell growth of the rootlets. When seeds of *Pisum* and *Triticum* are treated with alcohol, manganese sulphate or chloride, magnesium chloride or zinc sulphate in suitable concentrations and for suitable periods, considerable increase in root growth is produced. J. KISSER and R. FURTAUER: The influence of certain chemical agents on the carbon dioxide output of germinating seeds of *Pisum sativum* and *Triticum vulgare* under optimum germination conditions. In certain concentrations, alcohol enhances the production of carbon dioxide by *Pisum* seeds, but it is not certain if this effect is a true stimulative action or if it is due to the use of the alcohol as a nutrient. According to their concentration, magnesium chloride and manganese sulphate and chloride may either increase or diminish the output of carbon dioxide; the effect is influenced also by the presence or absence of the husk and by the phase of the germination when the salt solution is applied. J. KISSER and FR. ZEISEL: Physiological investigations on interrupted nutation. J. KISSER and R. PIEPE: Further investigations on the material foundations of tropistic curvature. J. KISSER and I. BEER: The chemotropic sensitivity of dicotyledonous seedlings. ANTON KAILAN and OTTO STUBER: The velocity of catalysed hydrogenations. The hydrogenation of oleic acid in presence of nickel and other catalysts supported on different carriers has been studied. FERDINAND STEINHAUSER: Temperature relations in Vienna during different seasons and at different times of the day (1931–1932). JOSEF SCHINTLMEISTER: The ionisation of H-rays in different gases. From the results as yet obtained, it must be concluded that this ionisation exhibits no abnormalities. ULRICH KHUNER: Experiments with space-acoustic models, and measurement of acoustic absorption coefficients. K. F. WENCKEBACH: The mechanism of sudden heart-failure in cases of beriberi. Observations made in the Dutch East Indies and Singapore indicate that the marked broadening of the right heart and the danger of speedy heart-failure accompanying beriberi depend on two factors, one cardiac and the other peripheral. These factors act from the beginning of the disease and are produced by the causes of the disease, but appear to differ essentially. EMIL ABEL and HERMANN SCHMID: Flow kinetics: model of photolysis. Certain special cases of flow kinetics, serving as a model of photolysis, are considered, and a kinetic interpretation of Beer's law of absorption is given. FRANZ HOLZL and WALTHER STOCKMAIR: The complex anion of Buff's compound and of Bunsen's salt. These compounds contain a common anion and are represented by the formulæ $(ROH.H)_6$ $[Fe(CN)_2Cl_2]$ and $(NH_4)_6[Fe(CN)_6Cl_2]$ respectively. MILOS MLADENOVIC: Elemic acid from Manilian elemi resin (6): A new oxidation product of α-elemolic acid. KONRAD FUNKE: Perylene and its derivatives (37): Oxidation of dinitro- and diaminoperylene. HANS KOPPER and ALFRED PONGRATZ: The Raman effect (24): The Raman spectrum of organic substances (molecules with cumulated double linking). The vibration spectrum of allene corresponds exactly with that of a symmetrical linear molecule with a C : C double bond. With allene derivatives, cleavage of the principal frequency $\Delta\nu = 1074$ cm.$^{-1}$ occurs, and for the isocyanate group the frequency $\Delta\nu = 1420$ cm.$^{-1}$ is characteristic. R. KREMANN, FRANZ GRIENGLand HELMUT SCHREINER: The viscosity of partially miscible liquid mixtures (1): The system phenol-water. ROBERT KREMANN, ESTER INGE SCHWARZ, and SIDY LE BEAU: Experiments on the electrolysis of fused iron-aluminium alloys and the degree of solubility of iron in molten aluminium at different temperatures. R. KREMANN and LUDWIG LAMMERMAYER: The electrolysis of aluminium alloys containing iron as a model of the electrolytic purification of molten aluminium from iron. During this electrolysis, the iron migrates towards the cathode, but this effect diminishes as the aluminium content increases and is very slight for nearly pure aluminium. It is, therefore, improbable that aluminium can be freed from iron electrolytically. LUDWIG LAMMERMAYER: Electrolysis of a fused beryllium-copper alloy containing 10 per cent of beryllium. ARTHUR PONGRATZ, FRANZ GRIENGL, and J. CECELSKY: Perylene and its derivatives (38): Heats of combustion. KARL LINSBAUER: Action of calcium and potassium solutions on the protoplasm of *Chara*. LUDWIG LAMMERMAYER: Plants on the basalts of eastern Styria. FRIEDRICH MORTON: Results of a botanical expedition to Abyssinia, Egypt, and the Quarnero district (1931–1932). RUDOLF WAGNER: The existence of Δ-Sichel sympodia.

Forthcoming Events

Saturday, Feb. 18

ROYAL INSTITUTION, at 3.—Lord Rutherford: "Detection and Production of Swift Particles" (succeeding lectures on Feb. 25 and March 4 and 11).

Monday, Feb. 20

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—J. Vincent: "The Namuli Mountains, Portuguese East Africa".

Tuesday, Feb. 21

CHADWICK PUBLIC LECTURE, at 5.15—(in the Lecture Hall of the Royal Society of Tropical Medicine and Hygiene, 26, Portland Place, W.1).—Dr. M. B. Ray: "The Hippocratic Tradition".

BRITISH MEDICAL ASSOCIATION, at 8—(Sir Charles Hastings Lecture at the Association's House, Tavistock Square, W.C.1).—Sir Henry Gauvain: "Sun, Air, and Sea Bathing in Health and Disease".

Wednesday, Feb. 22

ROYAL SOCIETY OF ARTS, at 8—(Trueman Wood Lecture).—Sir William B. Hardy: "Industrial Research with Biological Material".

Thursday, Feb. 23

BEDFORD COLLEGE, LONDON, at 5.15.—"Contemporary Developments in Science." Prof. T. M. Lowry: "Chemistry in Three Dimensions".

Friday, Feb. 24

ASSOCIATION OF ECONOMIC BIOLOGISTS, at 2.30—(in the Botany Lecture Theatre, Imperial College of Science and Technology).—Annual Business Meeting.

INSTITUTION OF PROFESSIONAL CIVIL SERVANTS, at 5.30—(in the Lecture Hall of the Royal Society of Arts).—O. G. S. Crawford: "Air Photography and Archæology".

ROYAL INSTITUTION, at 9.—Prof W. A. Bone: "The Photographic Analysis of Explosion Flames".

ELECTRICAL ASSOCIATION FOR WOMEN, Feb. 22–24.—South-Western Conference to be held at Torquay.

ASSOCIATION OF TECHNICAL INSTITUTIONS, Feb. 24–25.—Annual Meeting. Feb. 24.—Sir Hugo Hirst: Presidential Address. Also, discussion on "Policy in Technical Education" to be opened by Dr. Percival Sharp.

Official Publications Received

GREAT BRITAIN AND IRELAND

True Temperance Scientific Committee. Monograph No. 9: The Altered Biological and Sociological Aspects of the Use of Alcohol. By Prof. D. F. Fraser-Harris. Pp. 12. (London: Donington House.) 6*d*.

Proceedings of the Linnean Society of London, Session 1932–33. Part 1. Pp. 48. (London: Linnean Society.) 1*s*. 6*d*.

Transactions and Proceedings of the Botanical Society of Edinburgh. Vol. 31, Part 1, Session 1931–32. Pp. vii+243. (Edinburgh.) 10*s*.

Journal of the Royal Microscopical Society. Series 3, Vol. 62, Part 4, December. Pp. xvi+343–477. (London: Royal Microscopical Society.) 10*s*. net.

A Report on the Museums and Art Galleries of British Africa, by Sir Henry A. Miers and S. F. Markham; together with A Report on the Museums of Malta, Cyprus and Gibraltar, by Alderman Chas. Squire and D. W. Herdman, to the Carnegie Corporation of New York. Pp. ix+90. Directory of Museums and Art Galleries in British Africa and in Malta, Cyprus and Gibraltar. Pp. 61. (London: Museums Association.) With Report, 5*s*.

The National Institute for the Deaf. Memorandum by the Executive Committee of the National Institute for the Deaf on a Study of the Deaf in England and Wales, 1930 to 1932; being a Report by Dr. A. Eichholz to the Minister of Health and the President of the Board of Education, 1932. Pp. 9. (London.) 3*d*.

Journal of the Chemical Society. January. Pp. iii+114+x. (London: Chemical Society.)

The Joint Council of Qualified Opticians. Enquiry into the Manufacture of Gold-filled Spectacles. Pp. 34+12 plates. (London.)

War Office. Report on the Health of the Army for the Year 1931. (Vol. 67.) Pp. iv+158. (London: H.M. Stationery Office.) 2*s*. 6*d*. net.

Proceedings of the Cambridge Philosophical Society. Vol. 29, Part 1, 31 January. Pp. 164. Cambridge: At the University Press.) 7*s*. 6*d*. net.

(University of London): County Councils of Kent and Surrey. The Journal of the South-Eastern Agricultural College, Wye, Kent. No. 31, January. Edited by Dr. S. Graham Brade-Birks. Pp. 74. (Wye.) 2*s*. 6*d*.; to Residents in Kent and Surrey, 1*s*. 6*d*.

OTHER COUNTRIES

Bulletin of the Earthquake Research Institute, Tokyo Imperial University. Vol. 10, Part 4, December. Pp. 805–910+plates 92–98. (Tokyo: Iwanami Shoten.) 1.50 yen.

Seismometrical Report of the Earthquake Research Institute, Tokyo Imperial University. 1932, Part 2 (April–June, 1932). Pp. 7–11+plates 3–9. (Tokyo.)

Journal of the Faculty of Agriculture, Hokkaido Imperial University. Vol. 31, Part 3: Studies on the Proteins and Oil of Soy Bean. By Kenzo Nakajima. Pp. 165–356. (Tokyo: Maruzen Co., Ltd.)

Japanese Journal of Engineering. Abstracts, Vol. 8. Pp. xi+89. (Tokyo: National Research Council of Japan.)

Smithsonian Institution: United States National Museum. Report on the Progress and Condition of the United States National Museum for the Year ended June 30th, 1932. Pp. vi+181. (Washington, D.C.: Government Printing Office.)

République française: Ministère des Affaires étrangères. Procès-Verbal des séances de la deuxième Conférence Internationale pour les recherches antiacridiennes, Paris, 15 juillet–23 juillet, 1932. Pp. 29. (Paris: Editions de la Société Entomologique de France.)

Proceedings of the California Academy of Sciences, Fourth Series. Vol. 20, No. 10: *Agonostomus Hancocki* Seale. sp. nov. By Alvin Seale. Pp. 467–469. (San Francisco.)

Bulletin of the National Research Council. No. 87: Possibilities and Need for Development of Legal Medicine in the United States; with a Supplement on University Departments in the Field of Criminology. By Dr. Oscar T. Schultz. Pp. ix+135. 1.50 dollars. No. 88: Summary Information on the State Geological Surveys and the United States Geological Survey. Pp. iii+136. 1 dollar. No. 89: Report of the Committee on Sedimentation, 1930–1932. Pp. 229. 1 dollar. (Washington, D.C.: National Academy of Sciences.)

Proceedings of the American Academy of Arts and Sciences. Vol. 67, No. 8: The Pressure Coefficient of Resistance of Fifteen Metals down to Liquid Oxygen Temperatures. By P. W. Bridgman. Pp. 305–344. 75 cents. Vol. 67, No. 9: The Compressibility of Eighteen Cubic Compounds. By P. W. Bridgman. Pp. 345–375. 75 cents. Vol. 67, No. 10: The Saltatorial Rodent *Dipodomys*, the Functional and Comparative Anatomy of its Muscular and Osseous Systems. By A. Brazier Howell. Pp. 377–536. 2.20 dollars. (Boston, Mass.)

Proceedings of the Academy of Natural Sciences of Philadelphia, Vol. 84. South American Land and Freshwater Mollusks, 8: Collections of the Carriker-Roberts Peruvian Expedition of 1932. Pp. 387–402. (Philadelphia.)

Annual Report of the Naval Observatory for the Fiscal Year 1932. Pp. 22. (Washington, D.C.: Government Printing Office.)

Reprint and Circular Series of the National Research Council. No. 102: Directory of Research in Child Development. Compiled by J. Allan Hicks. Pp. 74. 50 cents. No. 103: Ninth Report of the Committee on Contact Catalysis. By J. N. Pierce. Pp. 42. 50 cents. No. 104: Doctorates conferred in the Sciences by American Universities, 1931–1932. Compiled by Callie Hull and Clarence J. West. Pp. 59. 50 cents. (Washington, D.C.: National Academy of Sciences.)

South Australia: Department of Mines. Mining Review for the Half-Year ended June 30th, 1932. (No. 56.) Pp. 80. (Adelaide: Harrison Weir.)

South Australia. Annual Report of the Director of Mines and Government Geologist for 1931. Pp. 8. (Adelaide: Harrison Weir.)

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Calendario del Santuario e delle Opere di Beneficenza Cristiana di Pompei, 1933. Pp. 288. (Pompei.)

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