

what not, have not been determined (so far as we recollect), but the range in time of the incidence of spawning suggests that the main factors might be readily discovered. In Hampshire, Gilbert White's earliest record of frogs spawning was February 28, his latest March 22; in Sussex, William Marwick's corresponding dates were February 9 and April 10; and in Cambridgeshire, Leonard Blomefield found a shorter range, March 4 to March 25, the average of nine years' records being March 16.

These observations relate to the common frog (*Rana temporaria*) in England, but in India spawning takes place about the same time, and the discovery of the eggs of *Rana afghana* in the Khasi Hills towards the end of March 1930, enabled Dr. S. L. Hora to describe the development of the curious sucker disc by which the tadpole adheres to rock surfaces in the rapid streams in which it lives (*Trans. Roy. Soc. Edinburgh*, 57, 469; 1932). The sucker is formed from the posterior lip of the tadpole, a lunate callous band on the under surface of the body, and lateral folds of skin which at first include the cement organs, although these disappear as the disc becomes functional. Dr. Hora thinks that the origin and development of the sucker can be explained by a series of small and gradual changes induced by recognisable factors in the environment, such as the speed of the current in which the tadpoles found themselves. The stages in the development of the disc are not necessarily correlated with the size of the specimens, as if the relative swiftness of the stream at different points provided the stimulus for the development of the disc.

Fish Cultivation in the Philippines

During April and extending to June or July occurs the spawning season of the most important of the sixteen hundred species of fishes recorded from the Philippines—the bañgos or milk-fish (*Chanos chanos*). It is by far the most common fish in the Manila market, and that because it is the product of a fish-pond industry in which a vast amount of capital, estimated at 45 million pesos, has been expended. Somewhat resembling a herring in shape and colour, though far exceeding it in size, this shiny silvery-white fish with pale steel-bluish back owes its value to a combination of qualities. It grows rapidly and may reach a length of three to four and a half feet; it is amongst the most prolific of fishes—a 30 in. female contained a little more than 3,000,000 eggs, a 44 in. specimen 5,700,000 eggs; it is wholly vegetarian and highly palatable; it is one of the few marine fishes adaptable to artificial cultivation in salt- and brackish-water ponds; and its fry is easily captured in enormous numbers (Adams, Montalban and Martin, *Philippine J. Sci.*, Jan. 1932, p. 1).

The first fish-ponds were tidal and were cut off from the sea except for an opening through which fry could enter but could not return to the sea. That uncertain method of stocking has been replaced in the more advanced fish-ponds by deliberate collection and transference of fry to specially designed ponds. A 10-hectare fish farm should accommodate 25,000–30,000 fry, at the rate of 50 fish to a square metre of pond; from these about 15,000–18,000 will reach the fingerling stage, which is transferred to growth ponds; and the final harvest may be reckoned at 9,000–11,000, or 900–1,100 per hectare. Although the bañgos reach quite a large size in the ponds, they never become mature, and breed only in the open sea.

Societies and Academies

LONDON

Physical Society, Feb. 3. F. J. W. WHIPPLE: Relations between the combination coefficients of atmospheric ions. The principal object of the paper is to put forward for consideration a formula, $\eta_{12} - \eta_{10} = 4\pi ew_1$, which indicates that the combination coefficient η_{12} for small ions and large ions of the opposite sign exceeds the coefficient η_{10} for small ions and uncharged nuclei, and further that the difference between the two coefficients depends on the mobility w_1 of the small ions. The experimental evidence for the formula is discussed as well as possible applications. G. P. THOMSON, NORMAN STUART and C. A. MURISON: The crystalline state of thin sputtered films of platinum. Films of platinum sputtered in various gases have been examined by the method of electron diffraction. They often show patterns which indicate that the small crystals are oriented with one face parallel to the surface of the specimen, the crystals being otherwise at random and in many cases the crystals are very small, of the order 5×10^{-7} cm. Some films of platinum dioxide showed crystals of the order 2×10^{-7} cm. E. V. APPLETON and R. NAISMITH: Weekly measurements of upper atmospheric ionisation. The ionisation is 2·2 times as intense on a summer noon as on a winter noon, and, in general, was slightly less in 1932 than in 1931. This reduction is due to the approach of sunspot minimum, and, with other evidence, suggests that the ionising agency from the sun varies by as much as 60 per cent during the 11-year solar period. Although ultra-violet light is accepted as the major ionising agency, thunderstorms most probably constitute one of the subsidiary causes, as previously suggested by C. T. R. Wilson. J. A. RATCLIFFE and E. L. C. WHITE: An automatic recording method for wireless investigations of the ionosphere. The Breit and Tuve method is employed, and both the transmitter and the time base at the receiver are synchronised with the A.C. mains. Some specimen records are reproduced and are used to illustrate the normal diurnal variation of equivalent height. Attention is directed to a common 'abnormal' occurrence of increase of ionisation in the lower (E) region, during the hours of darkness, without a corresponding increase in the upper (F) region, due possibly to storm clouds, as suggested by C. T. R. Wilson.

EDINBURGH

Royal Society, March 6. J. B. SIMPSON: The late-glacial re-advance moraines of the Highland border west of the River Tay. Following upon the westward retreat of the last general ice-sheet from the central valley of Scotland and an incursion of the sea when the land level was at least 90 ft. lower than now, considerable re-advances of the ice occurred on at least two occasions. The first of these is described in detail for the district between Dunblane and Perth. From varved clays the period between the retreat and the re-advance is estimated at 640 years. This re-advance is correlated with the Ra moraines of Scandinavia. A later re-advance is marked by striking terminal moraines in the Upper Forth Valley and Loch Lomond areas. E. B. BAILEY: Help from America in reading Scottish tectonics. It is now

often possible, by adopting American technique, to determine on mere inspection whether a particular rock is upside down or right way up. This possibility exists wherever a rock shows graded bedding, since in each individual bed with a contrasted coarse and fine margin, the coarse margin is the older. Also wherever current bedding involves an erosional contact, the eroded rock is the older. Many fruitful applications of these two principles during recent years in Scotland and Northern Ireland were outlined. Among other discoveries it has been revealed that thinning, in the Ballachulish district, has taken place preferentially in the normal limbs of large-scale recumbent folds. This opens a new department of tectonics, wherein drag is more important than thrust. T. KERR : The pituitary in *Lepidosiren* and its development. Development is peculiar in that the external rudiment (ectophysis) of the gland originates as in teleosts and amphibians in the form of a solid ingrowth, but unlike these, later develops a cavity. The cavity persists in the adult, dividing the anterior lobe from the intermediate and posterior lobes. The adult organ is unlike that of any other class; its structure and histology are considered.

PARIS

Academy of Sciences, Feb. 20 (C.R., 196, 523-580). C. MATIGNON and M. SÉON : The action of steam on heavy petroleum oils and on certain cyclic hydrocarbons. Zirconia was used throughout these experiments as catalyst. Details of the results obtained with metaxylene, cyclohexane, cyclohexene, gas oil and mazout are given. The object of the work was to find an economical means of preparing hydrogen. A. BIGOT : The deformations of the Cambrian grits containing shingle in the neighbourhood of Cherbourg. PAUL DELENS and JACQUES DEVISME : Certain differential forms and associated metrics. N. ARONSAJN : The decompositions of uniform functions. E. KOGBETLIANTZ : Laguerre's series. L. SANTON : Some results obtained with a supersonic blower. Study of the methods of measuring the velocities of air currents higher than the velocity of sound. With the hot wire anemometer, as the air velocity increases, the power dissipated first increases, passes through a maximum, and then decreases. J. LERAY : The movement of a viscous liquid filling space. JEAN LOUIS DESTOUCHES : Superquantification and mechanics in abstract spaces. F. HOLWECK and P. LEJAY : Contribution to the compensation of the European gravimetric network. J. DELSARTE : The binary ds^2 and the problem of Einstein. PAUL LE ROLLAND and PIERRE SORIN : A new method of determining the moduli of elasticity. MME. M. QUINTIN : Study of the temperature coefficient of the chain : copper, copper sulphate; mercurous sulphate, mercury. Data are given for a temperature range of 0° - 46.5° C. J. E. GARSSEN : The magnetic susceptibility of some mixtures of substances of large electric moment. The magnetic susceptibility of acetone-nitrobenzene and acetone-paranitraniline mixtures is not a linear function of the concentration. Whilst a chemical combination is not impossible, it is pointed out that another explanation is possible. PIERRE AUGER and GABRIEL MONOD HERZEN : The emission of neutrons by aluminium under the action of the α -particles. Mme. Irène Curie and F. Joliot have recently shown the presence of neutrons in the radiation emitted by aluminium under the influence of the α -rays, the proof being based on the measure-

ment of the relative absorption in lead and paraffin. These results have now been confirmed by Wilson's method. The emission of neutrons by aluminium is much rarer than that of beryllium under the same conditions, but the general characters are the same. H. MURAOUR and G. AUNIS : The laws of combustion of colloidal nitrocellulose powders. LIGOR BEY, REZAT BEY and GABRIEL VALENSI : The titrimetric determination of the sugars. Systematic study of the effects of variations of the working conditions in the titration of sugars with ammoniacal copper solutions. A. TRAVERS and LU : The volumetric determination of lead. The lead is precipitated by sodium hypochlorite as the dioxide and the latter determined iodometrically. PIERRE LÉVY : The halogen indices of the aleurite oils known as China wood oils. L. ROYER : The difference which exists between a mica and a clay with respect to the possible orientation of crystals deposited on them. PAUL GAUBERT : The properties of crystals of phlorizoside (phlorizine). MME. M. COLANI : Artificial ridges of the valves of lamellibranchs (Northern Annam). It is concluded that twenty deposits of shells of *Placuna placenta* found in Annam have been caused by neolithic man. MME. VORMS : The anatomical characters resulting from the arrest of development in galls. S. MAHDIHASSAN : The different symbionts of the cochineal insects producing and not producing wax. PIERRE GAVAUDAN : A certain correlation between the reversibility of the phenomena of cytoplasmic instability and the spontaneous disappearance of the vital colorations of the vacuome in *Ascoidea rubescens*. RAOUL LECOQ : The rôle of Bavitaminosis and of the food equilibrium in the utilisation of lactose by the rat. RAOUL P. MAY : The modifications observed in the spinal cord in the case of grafting or ablation of a rudimentary posterior paw in the embryo of *Discoglossus pictus*. MAURICE LECAMP : The induction of limbs and region of regeneration in *Alytes obstetricans*. PAUL WINTREBERT : The existence, in the blastula of amphibians, of a centre of mitogenetic induction, regulating development. ETIENNE WOLFF : A new direct teratogenic method allowing the production of monsters by means of electrolytic lesions. L. LEMATTE and E. KAHANE : Silica in the organism and the siliceous particles of the blood. It is probable that a part, at least, of the silica in the blood is of respiratory origin and that it is composed of siliceous dust resisting attack. G. DELAMARE : The generators of the primary helix of the body of the polyspiral spirochætes.

SYDNEY

Royal Society of New South Wales, Nov. 2. ALMA G. CULEY : Notes on the mineralogy of the Narrabeen series of New South Wales. The percentage of heavy minerals in the Narrabeen sediments is generally low. Zircon, rutile, tourmaline and picotite are constant constituents, while magnetite and ilmenite are commonly present. Garnet, apatite, monazite, spinel and hypersthene are peculiar to the northern sediments. Galena occurs in sandstones from Mount Victoria. Authigenic minerals recognised are : anatase in perfect crystals, accompanied sometimes by brookite, leucoxene and some secondary rutile, idiomorphic barytes, chalcopyrites and pyrites. Spherulites of calcite and siderite are present in several specimens. A sandstone from Bulli Pass has perfect quartz crystals developed in capillary

cavities, and also imperfect quartz crystals resulting from the enlargement of quartz grains. A mineralogical relationship between the Narrabeen series and Kamilaroi system is suspected. F. P. DWYER and D. P. MELLOR : A note on the occurrence of β -cristobalite in Australian opals. Powder photographs have shown the existence of β (high) cristobalite in Australian opals of both the precious and common varieties. In only three cases, precious opal (*Tintenbar*), wood opal and altered diatomaceous earth, does the complete pattern of β -cristobalite appear. In all others a single broad band in the position of the most intense line of the β -cristobalite pattern appears. In these specimens the crystallites are extremely small. Scarcely any change in the diffraction pattern appears when the latter class of opal is heated at approximately 1,000° C. for several hours. When heated in the presence of potassium chloride, the crystals appear to grow, since after this treatment the broad band disappears and gives way to the sharp line pattern of β -cristobalite. M. B. WELCH : Moisture content of wood. It is essential, in order to avoid gaping joints and cracks, that wood should be thoroughly seasoned before use, and the only true indication of this condition is obtained by determination of the moisture content of the wood. Wood is continually in a state of swelling and shrinkage due to absorption or loss of moisture from the atmosphere, but only within small limits. The result of a large number of tests indicates that for Sydney an average moisture content of 13.5-14 per cent denotes properly seasoned timber. V. A. BAILEY. The quantitative theory of interaction between different species of animals. A mathematical theory of animal populations, arising out of the biological analysis of Dr. A. J. Nicholson, is described in outline. The fundamental equations of the theory are stated and certain of their consequences, biologically interesting, are mentioned. The variations of the animal densities near the steady state in a special non-continuous case are determined and shown to be represented by functions of the form $Ae^t \sin(\lambda t + B)$, where A and B are constants dependent on the initial densities, and c and λ are simple functions of the host-species' power of increase F , with $c > 1$

Forthcoming Events

Saturday, April 8

GILBERT WHITE FELLOWSHIP, at 2.30—(Annual General Meeting in the Hall of the Art-Worker's Guild, 6, Queen Square, W.C.1).—At 3, Sir John Russell : "Modern Trends in Agricultural Science".

Monday, April 10

ROYAL GEOGRAPHICAL SOCIETY, at 5.—Discussion on "The Use of the New Grid on Ordnance Survey Maps", to be opened by Brigadier H. L. Winterbotham.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6 (Joint Meeting with the Institute of Transport).—C. J. Spencer : "Electric Trolley Omnibuses".

Wednesday, April 12

SOCIETY OF GLASS TECHNOLOGY, at 2—(in the Mappin Hall, The University, Sheffield).—Annual General Meeting.

Official Publications Received

GREAT BRITAIN AND IRELAND

Annals of the Solar Physics Observatory, Cambridge. Vol. 3, Part 2 : Microphotometry of the Solar Spectrum from 4040 to 4390 Å. By Dr. R. V. D. R. Woolley. Pp. v+79+118. (Cambridge : At the University Press.) 7s. 6d. net.

Report of the Marlborough College Natural History Society for the Year ending Christmas, 1932. (No. 81.) Pp. 72+7 plates. (Marlborough.) To Members, 3s.; to Non-Members, 5s.

Researches published from the Wards and Laboratories of the London Hospital during 1932. 29 papers. (London : H. K. Lewis and Co., Ltd.) 7s. 6d. net.

City and County of Bristol : Bristol Museum and Art Gallery. Report of the Museum and Art Gallery Committee for the Period October 1st, 1931, to December 31st, 1932. Pp. 28+4 plates. (Bristol.) 2d.

Proceedings of the Edinburgh Mathematical Society. Series 2, Vol. 3, Part 3, February. Edited by Prof. H. W. Turnbull and Dr. E. T. Copson. Pp. 151-230. (London : G. Bell and Son, Ltd.)

National Joint Industrial Council for the Flour Milling Industry. Technical Education Series, Pamphlet No. 9 : The Wheats of Commerce. 1 : General Considerations. By Dr. E. A. Fisher and Dr. C. R. Jones. Pp. 51. 6d. net. Technical Education Series, Pamphlet No. 10 : The Wheats of Commerce. 2 : Commercial Wheat Classes. By Dr. E. A. Fisher and Dr. C. R. Jones. Pp. iii+53-104. 6d. net. (London.)

Biological Reviews and Biological Proceedings of the Cambridge Philosophical Society. Edited by H. Munro Fox. Vol. 8, No. 2, April. Pp. 107-240. (London : Cambridge University Press.) 12s. 6d. net.

OTHER COUNTRIES

Proceedings of the Imperial Academy. Vol. 9, No. 1, January. Pp. ii+30. (Tokyo.)

Japanese Journal of Physics. Transactions and Abstracts, Vol. 8, No. 2, February 10. Pp. iv+57-108+21-52. (Tokyo : National Research Council of Japan.)

Journal of Science of the Hiroshima University. Series A (Mathematics, Physics, Chemistry), Vol. 3, No. 1, December. Pp. 136. (Tokyo : Maruzen Co., Ltd.)

The Tôhoku Mathematical Journal. Vol. 36, Part 2, January. Pp. ii+189-397. (Sendai : Tôhoku Imperial University.)

University Observatory, Oslo. Publication No. 5 : On the Theory of the Chromosphere and the Corona. By Svein Rosseland. Pp. 37. (Oslo : A. W. Bregger Boktrykkeri A.-S.)

Publications of the Observatory of the University of Michigan. Vol. 5, No. 4 : The Elements and Ephemeris of Comet Dodd-Warford-Forbes (1932n). By Allan D. Maxwell. Pp. 39-42. (Ann Arbor, Mich.)

State of Connecticut. Public Document No. 24 : Fifty-fifth Report of the Connecticut Agricultural Experiment Station, New Haven, for the Year 1931. Pp. xii+850+74. (New Haven, Conn.)

Geological Survey of Uganda. Memoir No. 3 : The Volcanic Area of Bufumbira. Part 1 : The Geology of the Volcanic Area of Bufumbira, South-West Uganda ; with Notes on the Petrology and Economic Geology. By A. D. Combe and W. C. Simmons. Pp. xi+150+12 plates. (Entebbe : Government Printer.) 15s.

Forest Bulletin No. 80 : List of Trees and Shrubs for the Kashmir and Jammu Forest Circles, Jammu and Kashmir State. By W. J. Lambert. Pp. v+40. (Calcutta : Government of India Central Publication Branch.) 12 annas ; 1s. 3d.

The Science Reports of the Tôhoku Imperial University, Sendai, Japan. Fourth Series (Biology), Vol. 8, No. 1, February. Pp. 74+4 plates. (Tokyo and Sendai : Maruzen Co., Ltd.)

Meddelelser om Grönland udgivne af Kommissionen for Videnskabelige Undersøgelser i Grönland. Band 79, Nr. 4 : The Gothaab Expedition 1928—Alyconaria, Antipatharia and Madreporaria. By P. L. Kramp. Pp. 20. (København : C. A. Reitzels Forlag.) 1.00 kr.

Report of the Aeronautical Research Institute, Tôkyô Imperial University, No. 92 : On the Transmissibility of Visible Light through a Cloud of Particles. By Daizo Nukiyama and Atsushi Kobayashi. Pp. 307-338. 35 sen. No. 93 : Hôbutumen no Onkyôgakutekino Seisitu ni tuite (On the Acoustical Properties of Parabolic Reflectors), Part 2. By Kôzô Satô and Masaaki Saso. Pp. 339-356. 25 sen. Tôkyô : Koseikai Publishing House.)

Scientific Papers of the Institute of Physical and Chemical Research. No. 409 : Vitamin C in Japanese Green Tea. By Masataro Miura and Michiyo Tsujimura. Pp. 129-144. 20 sen. No. 410 : On the Antiscorbutic Factor in Commercially Sterilized Milk and Japanese Green Tea—An Experiment upon Monkey. By Masataro Miura and Nagayo Okabe. Pp. 145-161. 25 sen. Nos. 411-413 : On the Minor Constituents of Thermoluminescent Calcite, by Shin Hata ; The Absorption Spectra of Naturally Coloured Fluorites, by Jun Yoshimura ; Reactivation of the Blood Forming Action of Liver by Constituents of Gastric Mucosa, by Fumito Inukai and Waro Nakahara. Pp. 163-188. 40 sen. (Tokyo : Iwanami Shoten.)

Canada : Department of Mines : Mines Branch. Anhydrite in Canada : Occurrence, Properties and Utilization. By L. Heber Cole and R. A. Rogers. (No. 732.) Pp. v+89+5 plates. (Ottawa : F. A. Acland.) 20 cents.

CATALOGUES

Microscopical Preparations : Zoological and Botanical Material. (Catalogue A, eighth edition.) Pp. 112. (Manchester : Flatters and Garbett, Ltd.)

Colorimetry and Nephelometry. (Section E33.) Pp. 15. Moll Thermopiles and Vacuum Thermocouples. (Thermo 33.) Pp. 4. (Delft : P. J. Kipp and Zonen.)

Books on Various Subjects in New Condition at much Reduced Prices. (No. 465.) Pp. 24. Catalogue of a Portion of the Library of the late G. Lowes Dickinson. (No. 466.) Pp. 24. (Cambridge : Bowes and Bowes.)