

Obituary.

Prof. G. C. Bourne, F.R.S.

WE regret to announce the death of Prof. Gilbert Charles Bourne, Emeritus Professor of Zoology and Comparative Anatomy in the University of Oxford, on March 8, at the age of 72.

After finishing his studies at Oxford and Freiburg he was elected a Fellow of New College and later its Tutor. He was then appointed as the Director of the new Marine Biological Laboratory at Plymouth, but after two years returned to his old University of Oxford, and in 1906 succeeded Prof. Weldon in the Linacre Chair of Zoology and Comparative Anatomy, which he occupied with distinction till his resignation in 1921.

Prof. Bourne besides publishing a large number of original papers on various subjects such as the Anatomy of a Millipede, the Structure and Growth of various Corals, the Anatomy of the Neritacea and other gastropods, an elaborate study of the crabs of the family Raninidae, was the author of one of the best elementary text-books on Compara-

tive Anatomy entitled "An Introduction to the Study of the Comparative Anatomy of Animals" and contributed several parts to Lankaster's well-known "Treatise on Zoology".

Prof. Bourne was a brilliant teacher, of a friendly and generous disposition and was well known for his work as a rowing coach in the University of Oxford. He served in the Boer War, and during the World War was engaged in the training of recruits. Since 1919 he took a very active part in the work of the Advisory Committee on Fishery Research to the Development Commission of which he became the Chairman in 1931. He also did valuable work in connection with the Water Pollution Research Board of the Department of Scientific and Industrial Research.

He was elected a Fellow of the Royal Society in 1910, and was President of Section D (Zoology) of the British Association at Sheffield in the same year.

Research Notes.

Vivipary on the Sea-Shore.

A NEW explanation of the prevalence of the viviparous habit in the mangrove forests along the sea-shore, based on recent ecological work, is suggested by Mr. A. C. Joshi in the last number of the *Journal of Ecology* (Vol. XXI, No. 1, Feb. 1933). The author in his paper shows how the old hypotheses of Guppy, Schimper, Warming, Haberlandt, etc., are unacceptable in the light of present knowledge. His own explanation is as follows: "Recent experiments have shown that while many plants can grow in a saline soil, their seeds cannot germinate in such a soil—the salt solution hindering water absorption which is always essential for the germination of the seeds. The seeds of most inland halophytes germinate, most probably, only after good rains when the soil solution is very much diluted, but such a thing is not possible in the mangrove swamp and on the sea-shore. Rains make no difference there and the salt-content of the soil remains high and approximately uniform throughout the year. Vivipary or

the germination of the seeds on the parent trees themselves is the only method by which the injurious action of the salts of the soil on the seeds, preventing them from germination could be avoided and it appears that this is the reason that plants with a viviparous habit have gradually become grouped on the sea-shore. The habit probably arose independently in the different plants in different localities as a variation from the normal due to environmental effects or some other unknown causes, as is fully proved by the occasional occurrence of vivipary in land plants in places remote from the sea. Of these species, the halophytic gradually shifted to the sea-shore where this habit proved really useful and, under the uniformly warm and saturated atmosphere of the tropical littoral lands, the original variations became a regular habit with the species. This habit is still very strong in the various mangrove species because it is really useful to them in tiding over one of the greatest obstacles in their environment."

Quadrics of Revolution through a Pair of Skew Lines.

IN a paper published in the *Jour. of the Indian Math. Soc.*, Vol. 17 by A. Narasinga Rao, a study was made of the metrical structure of the system of quadrics of revolution through a given conic, by obtaining an image of the system in line space, each quadric being represented by its "axis" of revolution. It was shown that the system was composite, the "axes" lying in one or other of two planes, the distinction corresponding to that between "prolate" and "oblate" spheroids.

In a sequel to the above, in the *Annamalai University Journal*, Vol. II, No. 1, the study is extended by A. Narasinga Rao and N. S. Srinivasachari to quadrics through two skew lines L_1, L_2 which may be taken to be $y = mx, z = c$; and $y = -mx, z = -c$ ($|m| < 1$). The system has one degree of freedom and is again composite, breaking up pointwise into two quadratic sub-systems. The axes of revolution corresponding to them are the two reguli on the paraboloid $xy \sin \theta \cos \theta + cz = 0$, ($m = \tan \theta$). There are obviously no cones, but there are 5 members which are doubly degenerate (pairs of planes), of which 3 belong to each sub-system. In each sub-system there are pairs of congruent quadrics, while if L_1 and L_2 are perpendicular, we have sets of 4 congruent members 2 belonging to each sub-system. The locus of points for which the two quadrics of either system coalesce, is the same rational ruled quadric having L_1, L_2 for directrices and another double generator at infinity.

It is surprising that when L_1 and L_2 are conjugate imaginary lines, the quadric system contains neither ellipsoids nor hyperboloids of two sheets—quadrics which one associates with imaginary generators. The reason for this is that conjugate imaginary lines on such quadrics belong to opposite systems and are hence *not skew* unless L_1 and L_2 are conjugate isotropic lines ($y = \pm ix, z = \pm ic$) a case in which the correspondence itself becomes singular as the system contains a sphere whose "axis" is indeterminate.

The Biological Oxidation of Carbohydrate Solutions.

USING a percolating filter of special design, S. H. Jenkins (*Biochem. J.*, 27, 245, 258, 1933) observed that the rate of decomposition of carbohydrates was not

influenced by the nature of the nitrogenous compounds that were added, nearly the same amount of sucrose being oxidised per day, in all the cases. There was considerable loss of nitrogen from solutions having C:N ratios of 8.4:1 and 4.2:1 irrespective of the form in which nitrogen was supplied. Experiments with large-scale filters using beet-sugar factory effluents showed that the C:N ratio of the solutions was approximately 20:1 and that the loss of total nitrogen was over 20 per cent. When such filters were supplied with ammonium salts as the source of nitrogen neither nitrite nor nitrate could be detected in the effluent. When the source of nitrogen was mainly organic, no ammonia or any of its oxidation products could be detected. It would appear, therefore, that the liberation of nitrogen from ammonia or different organic compounds of nitrogen occurs entirely within the cells of micro-organisms concerned in the disposal.

The foregoing observations are of much practical significance with reference to the conservation of nitrogen in effluents of the type which the author worked with. The results would not, however, appear to be applicable to either domestic sewage or other forms of industrial wastes which are not so rich in carbohydrate matter.

How can Super-conductivity be Explained?

L. BRILLOUIN, in *Comptes Rendus*, 196, 1088, 1933, has given an interesting discussion as to the manner in which super-conductivity can arise. The curve connecting the energy with the momentum of the electrons in crystals shows discontinuities for certain values of the momentum p , but in general the energy E is an increasing function of the momentum. It can, however, happen in the case of certain crystals with a face-centred cubic lattice—and super-conductivity has been observed only in such materials—that at two symmetrical points A, A' the curve shows minima. In this case most of the electrons will be in states represented by the rising portions of the curve (which are symmetrical about the energy axis) B, B' , but there will also be a small number in the states represented by A, A' . The current is given by $\frac{\delta E}{\delta p}$ (R. Peierls, *Ergebnisse der Exakten Naturwissenschaften*, p. 274, 1932). The total current is zero because of the symmetry of the curve giving $\frac{\delta E}{\delta p}$. But if by

some agency as for example, a sufficiently strong electric field, the numbers n_A and $n_{A'}$ of electrons in the states A and A' are made unequal, there will be a resultant current. This current will persist for a long time since the electrons cannot go from the state A to A' or to B since they will then have to pass through a state of maximum energy and at extremely low temperatures the vibrations of the crystal lattice cannot impart the requisite energy to them. If the temperature is increased to the point when the lattice vibrations can give the necessary energy, the superconductivity is destroyed. The fact that the current in a state of superconductivity has a maximum value is explained by the fact that the difference $n_A - n_{A'}$ has an upper limit. If an electric or magnetic field having a magnitude above a certain limit be applied, the electrons will be made to pass from A to A' or B and the symmetrical distribution being restored, the super-conductivity vanishes, as is actually observed. Since a thermal gradient cannot take the electrons from one state to another so as to produce the required inequality of n_A and $n_{A'}$, the fact that there is no thermal super-conductivity finds a ready explanation.

Development and Probable Evolution of the Suctorial Disc in the Tadpoles of *Rana afghana* Gunther.

AN examination of a series of larval stages of *Rana afghana* has led Dr. S. L. Hora (*Trans. Roy. Soc. Edin.*, Vol. LVII, Part II, 1932-33, No. 15) to conclude that the evolution of the sucker in *Rana afghana* would be in the same line as that in Garra where a similar disc is found. The disc makes its appearance first in tadpoles of 9 mm. length where it is in the form of a light coloured area along the anterior lower border of the yolk mass. It gradually increases in development and becomes transformed into a fold of skin. The cement organs which are functional till now disappear after the disc is well formed though in some cases the two may co-exist when one is accessory to the other. The disc is essentially an organ developed as a consequence of the rapid streams in which the tadpoles live, necessitating a more powerful organ of attachment than the cement organ.

The Positive Electron.

IN *Physical Review*, 43, 491, 1933, C. D. Anderson described a number of photographs of cosmic ray tracks taken with a vertical Wilson chamber designed by himself and R. A. Millikan, employing a magnetic field of 15,000 gauss. Some of the tracks could only be interpreted as being due to positive particles of the same mass as an electron. All other possibilities that suggested themselves had to be ruled out and the existence of a positive electron was thus rendered highly probable. P. M. S. Blackett and Occhialini (*Proc. Roy. Soc., A*, 139, 699, 1933) were able to secure a large number of photographs of tracks of penetrating radiation by means of a new automatic device which makes the high speed particles associated with cosmic rays start the expansion required for the photographing of their own tracks, and after examining a large number of these photographs they have been led to the same conclusion as Anderson. The existence of positive electrons is predicted by Dirac's theory of the electron, but they are likely to combine with other particles to form nuclei or more probably combine with electrons to be converted into radiation so that they have not been observed in former experiments. According to Blackett and Occhialini the positive electrons might have been produced by the disintegration of neutrons: their occurrence in the experiments of Madame Irene Curie and F. Joliot would then be explicable. These investigators have re-examined their old photographs and taken fresh ones and report their interesting observations in *Comptes Rendus*, (196, 1105, 1933). With a magnetic field of 1100 gauss they found 2.83 positive electron tracks and 1.76 doubtful ones for every 10 negative electron tracks coming from the lead sheet used in their apparatus. At 640 gauss they found 4.5 positive electron tracks and 3.6 doubtful ones for every 10 negative electron tracks. When an aluminium plate was substituted for the lead plate, the positive electron tracks dwindled to 0.53 per 10 negative electron tracks, thus showing that the positive electrons came from the lead; when a lead screen of 2 cm. thickness was interposed between the plate and the source of neutrons, the positive electron tracks were reduced to half their original number. Since the neutrons are absorbed by the lead screen only to the extent of 12% while the accompanying γ -rays are very

much more absorbed, it follows that the positive electrons must have been disengaged from the lead plate by the γ -rays. This fact supports the hypothesis of Blackett and Occhialini that the emission of positive electrons is responsible for the anomalous absorption of highly penetrating γ -rays by heavy elements. Gapon (*Zs. f. Phys.*, 82, 404, 1933), however, explains the anomaly by taking into account the neutrons within the nucleus.

Meiotic Phenomena in *Oenothera*.

S. HIDAYETULLAH (*P.R.S.*, No. B 780, Series B, Vol. 113, May 1, 1933) describes for the first time the meiotic phenomena in *Oenothera missouriensis*. In the leptotene the chromatin threads are irregularly running and the threads of the early leptotene gradually concentrate and bend round. The free ends of the folding threads are less in number than the early leptotene stage. The ends approach each other and form seven free bivalent ring pairs in diakinesis. The method of synapsis involved is acrosynapsis (telosynapsis). The nucleolus never attaches itself to the nuclear membrane in the early stages, but later moves and attaches itself to the nuclear membrane and finally disappears in late diakinesis. Reduction division is normal and regular and no non-disjunction of the chromosome pairs has been observed.

Leaf-curl in *Zinnia elegans*.

THE above investigation by R. N. Mathur, (*Indian J. Agri. Sci.*, 3, 89, 1933) presents a unique instance of an insect carrier of a virus disease literally "walking into the net"! The small white-flies (*Bemisia gossypiperda*) which are the vectors of the disease passed the 20-mesh sieve employed by the author and transmitted the infection presumably from without. The disease closely resembles the leaf-curl of cotton: the vector of the infection is also closely allied to the carrier of the cotton disease. As distinct from Kirkpatrick's observations in the case of cotton, the Aleurodids concerned in the spread of the *Zinnia* disease had to be fed on diseased plant before they became infective.

The investigation was undertaken with a view to throwing some light on the mechanism of insect transmission of the spike-disease of sandal. The latter, however, has

so far eluded all methods of insect transmission though readily communicated by artificial infection with the diseased tissue.

Permeability of Human Skin.

A. G. R. WHITEHOUSE and Hugh Ramage describe in an interesting article (*P.R.S.*, B.780, 1933) about the permeability of human skin to electrolytes. It is well known that the human skin, besides being a protective investment, acts also as an impermeable membrane for many foreign objects. The authors of the present paper point out that the skin was subjected to the action of a kation like Lithium. When the urine of the subject was tested after the experiment spectrographically no appreciable difference in the Lithium content was noticed. The anion Iodine in the form of KI solution was tried and estimated chemically; no difference in the iodine content was noticed after the experiment. This definitely proves that the human skin is impermeable to electrolytes in simple solutions. On the other hand, un-ionised iodine (in the form of an ointment) is rapidly absorbed by the skin.

The Quality Factor in Feeding Stuffs.

IN this paper, J. A. Murray (*J. Agric. Sci.*, 23, 185, 1933) attempts to define the significance of the highly elusive factor, the quality, and to show its bearing on problems of animal nutrition. The nutritive value of a feeding stuff may be attributed to two factors, 'quantity' as indicated by the gross energy and 'quality' as represented by the coefficient of availability ($D/T-0.35$) where T is total and D digestible organic matter. The author applies his formula to the results of a number of feeding experiments and draws the conclusion that the nutritive value of the total organic matter depends almost entirely on its digestibility and except in the case of cakes, only to a negligible extent upon its chemical composition. Nutritive value is not proportional to digestibility but a linear function thereof. In substances of low digestibility, slight change in digestibility may cause manifold alteration in nutritive value.

It would be of much interest to extend the above observations to different types of animals, fodders raised on various kinds of soils and manures, and to feeding stuffs made up in diverse ways.

The Easter Meeting at Bangalore.

UNDER the joint auspices of the South Indian Sciences Association, Bangalore, the Society of Biological Chemists, India, and the Madras Branch of the Indian Chemical Society, a three-day meeting was held in Bangalore during the last Easter Week. The programme commenced on the 15th April with the Presidential Address of Dr. S. Subba Rao, B.A., M.B.C.M., L.R.C.P., etc., Senior Surgeon to the Government of Mysore, when he addressed the gathering on the place of the medical man among the scientists and pleaded for an application of the study of physics and chemistry to the problems of medicine and surgery. This was followed by the reading of several original papers on organic and physical chemistry under the presidency of Dr. P. C. Guha, D.Sc., Professor of Organic Chemistry, Indian Institute of Science, Bangalore. In the evening Sir Mirza M. Ismail, Dewan of Mysore, opened in the presence of a large distinguished gathering, the Sciences Exhibition organized by the Societies. In a felicitous speech Sir Mirza pleaded for a wider study of science in its application to humanity. The precincts of the Central College were *en fete* and the Mysore Government Electrical Department had flood-lighted the central buildings of the College in honour of the occasion. This exhibition which demonstrated the fundamental principles of Physics, Chemistry, Botany, Zoology, Geology, Medicine and Pathology, Radio, Engineering, Biochemistry, Dairying, Nutrition, etc., was visited by more than 2,500 members of the public during the four days when it was kept open.

On the 16th there was a symposium on the "Ghee Problem in India" under the presidency of Dr. S. Subba Rao when the following papers were read and followed by an interesting discussion :*

Dietetic value of ghee	Mr. N. C. Datta and Mr. B. N. Banerji.
Adulteration and Analysis	Mr. Y. V. Srikanteswaran.
Ghee substitutes, their manufacture and trade	Dr. R. Bhattacharjee.
Chemical aspect	Mr. P. Ramaswami Ayyar.

In the evening Rao Bahadur B. Viswanath, F.I.C., Government Agricultural Chemist, Coimbatore, delivered a public lecture on Plant and Animal when Sir C. V. Raman, Kt., F.R.S., N.L.,

presided. He said that the plant and the animal in their co-operative existence in nature bring about the marvellous round of events in which the inorganic is shaped into the organic which, passing through successive changes and displaying manifestations of life, pass again into the inorganic state only to resume the organic form. In this round of events he referred to the wonderful power of plants to build up their tissues from simple substances, and contrasted this with the helplessness of animals to utilize the same substances till they are made ready into a more suitable form by plant agency. He pointed out that although the structure and functions of the body parts of plants and animals have little in common, the recent contributions made to the biochemistry of plant and animal show that many of the typical functions of the cell are capable of being expressed in terms of simple chemical formulae or equations, leading ultimately to the simplification of phenomena and to the view that in its fundamentals the physiological mechanism of the two organisms is similar. From the epoch-making work of Willstatter and his collaborators similarity and relationship is visible between the vital centres of plants and animals, through their pigments chlorophyll and haemoglobin from both of which aetioporphyrin can be obtained. Likewise instances were shown in which considerable similarity is revealed in the chemical changes underlying the metabolic and katabolic processes. While recognizing that analogies should not be stretched too far, the available evidence would justify consideration of the plant in terms of the animal in certain directions, and the lecturer showed how on the basis of such considerations it is possible to use the plant as an index or test organism in the solution of certain problems connected with animal life, such as nutritional, immunological and pharmacological studies.

On the 17th Dr. V. Subrahmanyam, D.Sc., F.I.C., Professor of Biochemistry, Indian Institute of Science, Bangalore, presided over the reading and discussion of original papers of biochemical interest. Dr. Gilbert J. Fowler, D.Sc., F.I.C., addressed on the Ern and Technocracy under the presidency of Prof. C. R. Narayan Rao, M.A., L.T.*

There was a number of delegates from Coimbatore and other places who contributed largely to the success of the Session.

* See page 400.

* Summary of this address has appeared in *Current Science*, 1, 11, 366, 1933.