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Academies.

National Institute of Sciences of India.

At the first ordinary general meeting of the National Institute of Sciences of India held in the rooms of the Asiatic Society of Bengal, 1, Park Street, Calcutta, at 11 a.m. on the 8th January 1935, the papers mentioned below were read :

(i) "Synopsis of the Pre-Vindhyan Geology of Rajputana," by Dr. A. M. Heron, D.SC., F.R.S.E. (ii) "Physiology, Bionomics and Evolution of the Air-Breathing Fishes of India," by Dr. S. L. Hora, D.SC., F.R.S.E., F.A.S.B. (iii) "Problems of the Solar Corona," by Prof. M. N. Saha, D.SC., F.R.S., F.A.S.B. (iv) Ionospheric Height Measurements at Allahabad," by Mr. G. R. Toshniwal (communicated by Prof. M. N. Saha). (v) "On the Electron Theory of Metals," by Dr. R. C. Majumdar, PH.D., University of Lahore (communicated by Prof. M. N. Saha). (vi) "On Symmetrical Space with Minimum rate of expansion," by Prof. N. R. Sen. (vii) "New facts regarding infection of Citrus by *Colletotrichum glecsp roides*," by Dr. H. Chaudhuri, Lahore. (viii) "Synthetic Enzyme." by Prof. H. K. Sen and Mr. Sobhanlal Banerji. (ix) On the question of the Expansibility of Zero in the series of Legendre functions having non-integral parameters," by Prof. Ganesh Prasad. (x) "On the Cataphoretic Speed and Inorganic Colloids," by Prof. J. N. Mukherjee, Mr. S. G. Chaudhuri and Mr. B. N. Ghosh. (xi) "On Mon and Munda in India and beyond," by Dr. J. H. Hutton, C.I.E., M.A., D.SC., F.A.S.B., I.C.S.

Physiology, Bionomics and Evolution of the Air-Breathing Fishes of India. By Dr. S. L. Hora, Zoological Survey of India.—The fresh-water fishes of ponds, pools and marshes in this country, as in the tropics generally, are subjected, as a result of the marked periodicity of the dry and wet seasons, to extreme conditions of drought for prolonged periods. The shallow waters become very foul and are often liable to complete desiccation. As a result a number of fishes have adapted themselves to aerial respiration, so that the deficiency in the oxygen contents of the water does not affect their lives to any very great extent.

The fresh-water air-breathing fishes of Bengal have been extensively studied since 1830 and have been the subject of considerable experimental work. Fishes kept in aquaria and prevented from coming to the surface to breathe air were "drowned" in the earlier experiments, but if a larger vessel is employed or the water is kept

thoroughly aerated, "drowning" does not occur in the majority of cases. Fishes like *magur* (*Clarias*) and *singi* (*Heteropneustes*) can live indefinitely under water provided suitable conditions for life are established. In *koi* (*Anabas*) and *saul* and *lata* (*Ophicephalus*) the air-chambers are in the form of cavities in the head so that when these fishes are subjected to "drowning" experiments, a certain amount of air is locked up in the chambers and the fishes die of asphyxiation. If, however, this air is squeezed out and replaced by water in some way, the fishes can live under water indefinitely provided the water is kept well aerated.

Cuchia (*Amphipnous*) is a highly specialised fish in which regular "lung-like" chambers are developed for breathing air. This specialisation makes it impossible for the fish to live indefinitely under water.

In the dry season, hill-streams become cut up into series of pools in which the oxygen content of the water falls considerably as compared with that of rushing torrents. Here again the fishes are forced at times to resort to aerial respiration.

In tidal creeks of the estuaries and of the sea-shore, the tide plays an important part in the lives of certain fishes, specially the shore-living gobies and blennies. At times they are immersed under water and breathe by means of their gills, while at other times they are left high and dry and at such times they must resort to aerial respiration.

It is thus seen that in India the evolution of air-breathing fishes has taken place in four different habitats: (i) Marshes and ponds. (ii) Hill-streams. (iii) Estuaries, and (iv) Sea-shores. The habit of breathing air seems to have been acquired independently by groups of species living under different environmental conditions and it seems that while the simplicity of a structure is no criterion of its low organization or primitive nature, its utility appears to be the sole guiding principle in its evolution.

Dr. B. Prashad mentioned that he had watched Dr. Hora's experiments, which were carried out in the laboratories of the Zoological Survey of India, and had made such suggestions as had occurred to him at the time. He added that Dr. Hora's results are faithful records of his observations and mark a considerable advance on our knowledge of the physiology of respiration of the air-breathing fishes of India. Dr. Hora's suggestions regarding the mode of origin of the air-breathing habit in the fishes of different habitats offer a very promising field for further work and it is hoped that future workers will try to elucidate the various factors operating in these habitats more precisely.

Professor P. R. Awati enquired if the author had done any work on the vascular system of the air-breathing fishes so as to correlate the structural adaptations with consequential modification in the blood supply to the respiratory organs. In reply Dr. S. L. Hora referred Professor Awati to a number of works already published on the vascular supply of these fishes and added that further morphological work is, at his suggestion, being carried out at Cambridge and Lucknow to amplify the author's experimental results.

Indian Academy of Sciences.

The Sixth Scientific Meeting of the Indian Academy of Sciences was held on the 26th January at the Indian Institute of Science, Bangalore. Sir C. V. Raman, Kt., F.R.S., N.L., the President of the Academy, was in the Chair. 43 scientific papers representing various branches of science and communicated by scientists from all parts of the country were listed for discussion.

The following papers have been published in the 7th Number of the Proceedings.

SECTION A.

S. BHAGAVANTAM AND A. VEERABHADRA RAO: *Distribution of Intensity in the Rotational Raman Spectra of Gases.*—The relation between the apparently different types of intensity distribution in the rotational Raman Spectra of Liquids and Gases is experimentally followed up by compressing N_2O and CO_2 at temperatures below their critical point. The absence of a maximum in the rotational wing and concentration of intensity in the close neighbourhood of the Rayleigh line which are regarded as specially characteristic of the liquid state, are now also observed in gases, although at high pressures. M. RAMANADHAM: *The Principal Optical Polarisabilities of the Napthalene Molecule.*—A new method of evaluating the optic moments of a molecule based on a knowledge of the orientation of the molecules and the refractive indices in the crystalline state, is presented. THE LATE A. N. MELDRUM AND P. H. PARIKH: *Synthesis of Phenylacetic acids from Gallic acid and its Methyl ethers.* THE LATE A. N. MELDRUM AND P. H. PARIKH: *Synthesis of* m-*Hemipinic acid.*—A new synthesis starting from veratric acid is described. AZHAR ALI KHAN, P. N. KURIEN AND K. C. PANDYA: *The Condensation of Aldehydes with Malonic acid in the presence of Organic Bases. Part II. The Condensation of Salicylaldehyde.*—The effects of a number of organic bases other than pyridine and piperidine such as lutidine, quinoline, cinchonine, etc., are quantitatively studied. K. VENKATACHALIENGAR: *The method of finding the class-number and the structure of the class group of any algebraic field.* I. CHOWLA: *The representation of a Positive Integer as a Sum of Squares of Primes.* S. L. MALURKAR: *Effect of variation on the Transmission of Temperature Discontinuity.* B. RAMAMURTI: *Linear Complexes related to a Rational Norm Curve.*

SECTION B.

HARI RAMAN BHARGAVA: *Contribution to the Morphology of* Eclipta erecta *Linn.* B. M. JOHRI: *Studies in the Family* Alismaceæ. *II. Sagittaria sagittifolia* L. COL. I. FROILANO DE MELLO: *A Contribution to the Study of the Blood Parasites of some Indian Birds.*—The following parasites of Indian birds found in Goa are described or recorded:—(1) *Herodias intermedius* Wagler: a *Giardia* abundant also in the intestine and which will be described later on; *Plasmodium herodiadis* n. sp.; *Hæmoproteus* n. sp.?; a *Microfilarium*. (2) *Gallinula chloropus* L. *Plasmodium gallinulæ* n. sp. (3) *Machlolophus xanthogenys* (Vigors): *Hæmoproteus machlolophi* (Plimmer, 1912). (4) *Chloropsis aurifrons davidsoni* Baker: *Plasmodium chloropsidis* (Scott, 1925); *Leucocytozoon chloropsidis* n. sp.; a *Microfilarium*. S. S. PATWARDHAN: *On the Structure and Mechanism of the Gastric*

Mill in Decapoda. II.—A Comparative account of the Gastric Mill in Brachyura.—The gastric mill is essentially typical in all cases of Brachyura examined. S. S. PATWARDHAN: *Nematodes from the Common Wall-Lizard* Hemidactylus flaviviridis *(Ruppel).*—Examination of the intestines of several specimens of the common wall-lizard *Hemidactylus flaviviridis* (Ruppel) revealed the presence of two species of Nematodes: (1) *Thubunea asymmetrica* (Baylis, 1930); and (2) *Thelandros hemidactylus* sp. nov. a new species of the genus *Thelandros* Wedl. 1862. C. R. HARIHARA IYER, G. S. SIDDAPPA AND V. SUBRAHMANYAN: *Investigations on the Rôle of Organic matter in Plant Nutrition, Part VI. Effect of minute quantities of certain forms of organic matter on plant growth and reproduction.*—Injection of minute quantities of certain organic extracts into mature sunflower plants led to not only better growth but also greatly increased flowering and seeding. The best results were obtained in the case of plants receiving extracts of yeast or farmyard manure. Comparative trials with inorganic salts which were fed directly to pot or plot cultured French beans or barley did not lead to any marked improvement.

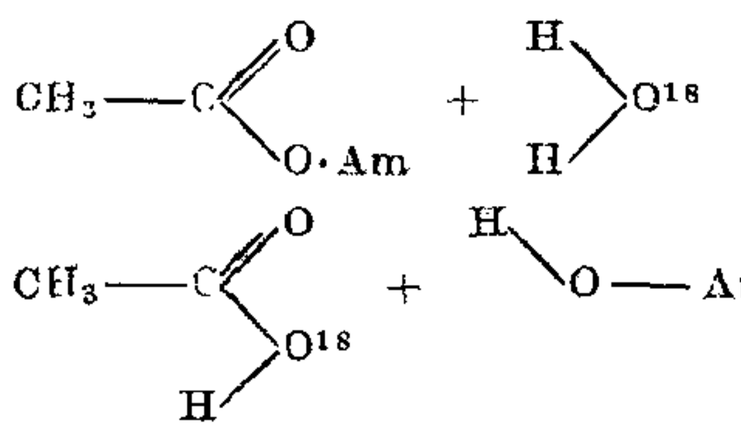
Heavy Water in Chemistry.

IN a lucid exposition before the Royal Institution, Prof. M. Polanyi (*Nature*, **135**, 19) points out that the new isotope of hydrogen is viewed so differently from other isotopes that some chemists consider its discovery to be possibly the greatest advance in chemistry made in this century. In fact this structural isotope does not behave as an isotope at all and can be separated from the normal hydrogen by chemical means. In general, compounds of heavy hydrogen (D) react more slowly than the corresponding ordinary hydrogen (H) compounds, heavy water reacting 20 times more slowly. These differences cannot be sufficiently accounted for as a mass effect. The compounds of the two hydrogens differ actually in their energy content, and this can be explained according to the Law of Uncertainty, a principle of Nature recently discovered by Heisenberg. According to this, every molecule has a kind of permanent energy called the "uncertainty energy", and it can be calculated that for ordinary water the energy is 13,097 cal., while for heavy water it is only 9527 cal. Thus ordinary water requires a much smaller quantity of energy to split it into hydrogen and oxygen than does heavy water. This permanent energy is greater the tighter the bond which holds the atoms in position and the corresponding contrast between the two hydrogen compounds also becomes more marked. The consequence is that D prefers to exchange places with H wherever it is more tightly bound, with a resulting release of some energy as in

$$HF + DI = HI + DF + 700 \text{ Cals.}$$

Such interchange reactions have been the object of numerous studies in recent years. According to the relative preference which a compound gives to D over H, a rather intimate knowledge of the permanent energies in the compounds is obtained. Further, this capacity of some compounds to accumulate a comparatively higher quota of D present in a mixture, can be utilised to work out a cheaper method of manufacturing pure D_2. The interchange reaction can be used to prepare more complicated compounds of heavy hydrogen, such as C_6D_6. It also throws a considerable light on the mechanism of chemical reactions, such as hydrogenation. Again, it may be possible to utilise the lowered reactivity in synthetic chemistry as hydrogen compounds which ordinarily are readily oxidised or otherwise decomposed,—might become more stable if H is replaced by D.

Heavy isotopes of other important elements, such as O^{18}, N^{15}, and C^{13} can also be made similarly useful. Thus, the hydrolysis of amyl acetate with water containing H_2O^{18} and examination of the OH of the resulting alcohol showed that the oxygen in the alcohol does not come from the water used in the saponification and the actual reaction mechanism is



It is likely that the greatest stimulus of all will be given to the chemistry of living matter when such labelled carbon, hydrogen, oxygen and nitrogen atoms will become more generally available.

M. A. G.