

time definite evidence as to whether movement of the continents is now taking place. For one thing Wegener must be given the credit. He has provided a great stimulus to geological thought during recent years, and many of our present ideas on earth tectonics are directly attributable to him. The problem,

although essentially a geological one, is also one which can only be adequately solved with the help of all the sciences, and it is for that reason that I chose it as the subject of an evening lecture before the Indian Science Congress.

Research Notes.

Investigations on Magne-crystallic Action.

Part I.—Diamagnetism.

[K. S. Krishnan, B. C. Guha and S. Banerjee. *Phil. Trans. Roy. Soc., A*, **231**, 235, 1933.]

IN this paper the authors report an extensive investigation on the magnetic anisotropy exhibited by single crystals. The object of the research is to obtain information on the orientation of the molecules in the unit cell by means of magnetic measurements. This is made possible by the fact that the differences of susceptibility in different directions depend upon the orientation of the molecules and not on their position. The difference in susceptibility is directly measured by suspending the crystal in the uniform field of a large electromagnet with plane pole pieces. The crystal is attached to a moderately thin glass fibre of 7 to 8 mm. length, and the fine suspension fibre of quartz is attached at one end to the glass fibre and at the other end to a torsion head. The latter is so rotated that there is no torsion in the fibre when the direction of maximum susceptibility in the plane of oscillation is parallel to the field. The periods of oscillation, T and T' , with and without the field being determined, the difference of susceptibility is calculated by the formula

$$X_1 - X_2 = \frac{T'^2 - T^2}{T^2} \cdot \frac{C}{H^2} \cdot \frac{M}{m},$$

where X_1 and X_2 are the maximum and minimum values of the gram molecular susceptibility of the crystal in the plane of oscillation, C is the torsion constant of the fibre, m the mass of the crystal and M its molecular weight.

The results of measurements made on a large number of crystals are given in the paper. The striking fact revealed by these data is the large magnetic anisotropy of the nitrates, carbonates and the chlorate, while the sulphates are more or less completely isotropic. The behaviour of the nitrates and carbonates is explained by the

intrinsic anisotropy of the NO_3^- and CO_3^{--} ions and the parallel orientations of all the ions in the crystal. The contribution of the metallic ions to the susceptibility seems to be isotropic. The anisotropy of the NO_3^- and CO_3^{--} ions is stated to be probably connected with their plane structure: the fact that strong magnetic anisotropy is usually associated with optical anisotropy is thus explained. The isotropy of the SO_4^{--} ion is also shown to be in agreement with the results of X-ray investigations. From the behaviour of the ClO_3^- ion it is concluded that the structure of this ion is probably pyramidal with Cl at the apex.

Measurements have also been made on a number of organic crystals, while their absolute susceptibilities have been determined so as to fill the gap in the existing data. A null method of the type used by Rabi (*Phys. Rev.*, **29**, 174, 1927) has been employed for the purpose. The susceptibilities of the fused crystals have also been determined by the modified Quinke method used by Ranganadham. It has been found that there is no change in susceptibility on fusion in the case of naphthalene, while benzophenone showed a change of about 2.5%. Further experiments are promised with a view to discover if this difference in behaviour is connected with the dipole moments of the substances. Detailed discussions of the molecular orientation are given in the case of naphthalene, anthracene, biphenyl, dibenzyl, azobenzene, stilbene, β -naphthol and acenaphthene. It is concluded that magnetic measurements can yield the entire molecular orientations in the unit cell in favourable cases like biphenyl and dibenzyl, while in less favourable cases, some of the angular parameters that determine the orientations can be derived as in naphthalene and anthracene. Finally, the authors conclude that any structure proposed on X-ray or other considerations can be acceptable only when it is in agreement with the results of magnetic measurements.

Preliminary Observations on some Polychæte Larvæ of the Madras Coast and a Note on the Occurrence in Townet Water of the Larvæ of Chætogordius ? Moore.

PROF. R. GOPALA IYER deals with a collection of Polychæte larvæ (*Journ. Madras Univ.*, Vol. V, No. 1) obtained in townet water from the Madras coast. A general idea of the seasonal occurrence of the various larvæ is given and observations on the larval development of some of the common genera are also made. It is pointed out that *Mitraria* larvæ stand out first in point of numbers and they attain maximum number in August. *Spionids* come next and are characteristic of the plankton during the months of November and December and to a lesser extent in January. *Terrellids*, represented by the post larval stages of *Loimia medusa*, have been observed to turn up with singular regularity about the middle of June and November. *Nephtyds* and *Phyllodoceids* occur in fairly large numbers during the months of December and January while *Eunicids* and *Polynoids* have March and April as their favourite months. *Nereids*, never very numerous, could be picked up during February and March. *Chaetosphærids* and *Chætopterids* occur in small numbers in November and March while *Magelonoids*, represented by the post larval stages of *Magelona papillicornis*, occur in November and January.

Observations on some of the developmental stages of *Phyllogoce*, *Nephtys*, *Eunice*, *Glycera*, *Eone*, *Chaetosphæra*, *Chætopterus*, *Telepsavus*, *Magelona*, *Loimia*, *Capitella* and *Sabellaria* are given. Unfortunately in most of the above mentioned cases specific identification of the larvæ was not found possible. A fairly connected account of the larval development of what is probably a species of *Chætogordius* is also given.

Microscopical Study of some Indian Coals.

MICROSCOPIC examination of coal has been for some years an established branch of study in Europe and America and is being recognized as an useful adjunct to the study of coal seams. Mr. A. K. Banerji has published in the last issue of the *Records of the Geological Survey of India* (Vol. LXVI, p. 333) some highly interesting results derived by the microscopic study of some samples of Indian Gondwana and Tertiary coals, in which he employed the modern

technique of coal petrography. Examination of two samples of gondwana coal has shown that woody stems contributed to some extent to the formation of the coals; they may, therefore, be said to have originated from tree-like plants. The presence of Araucarian pitting has been definitely established, while no scalariform tracheids characteristic of the *Filicales* has been observed. This seems to indicate a gymnospermous affinity of a portion at least of the flora, especially as megaspores are completely absent. One of the most striking features of the Indian tertiary coals is the relatively frequent occurrence of sclerotium bodies of certain fungi, partly differentiated into several cells and partly simple. It will be important to observe whether these bodies occur with the same frequency in the brown coals or lignites from other parts of the world.

The Relative Numbers of Immature Erythrocytes in the Circulating Blood of Several Species of Marine Fishes.

DAWSON, B. ALDEN, has made a comprehensive study of the blood of general circulation of twenty species of marine fishes (*Biol. Bull.*, 64, 1, 1933), and has noticed that the number of immature erythrocytes varies widely. The differential erythrocyte counts were based largely on supravital preparations stained with brilliant cresyl blue. The twenty species were divided into four groups and each group presented a varying count of immature erythrocytes. The variations were according to their mode of adaptations such as their type of external respiratory mechanism, the efficiency of their oxygen transporting system, their oxygen requirements and the oxygen tensions of their environments.

The Vellalas of Travancore.

THE article on Vellalas of Travancore by Mr. L. A. Krishna Iyer (*Journal of the Madras University*, Vol. V, No. 1, Jan. 1933) is an interesting contribution to South Indian Ethnology. They are an isolated group of early Dravidians retaining and practising some of the primitive social customs, eking out a scanty livelihood from agricultural pursuits. They are a poor community diminishing in numbers; the inhospitable areas which they inhabit smite

them with disease and cripple their energy. In personal appearance they have a dark complexion with an inclination to dolichocephaly head and a broad nose. Having lived in contact with the civilised Hindus, they have adopted their Gods for worship, their rules of inheritance, the panchayat system for settlement of disputes, funeral ceremonies and instincts of personal gold and silver ornaments. These are recent acquisitions. The physical anthropology of the primitive tribes of India is a field of study which is likely to yield fruitful results and before these interesting groups disappear, a comprehensive investigation should be undertaken. Ethnological investigations have revealed that social customs and habits, the superstitious faiths and religious practices, the code of morality and sex relations have had a parallel evolution among the primitive tribes and a comparative study of physical anthropology of the Indian primitive communities may throw light upon their origin, places of settlement, their lines of migration and the factors of differentiation.

On the Singularities of Laplace-Abel Integral.

IN the course of a lengthy memoir published in the *Math. Zeitschrift*. Band 29 (1929), Polya has discussed the properties of the

integral $\int_0^\infty F(Z)e^{-zZ}dZ$ where $F(Z)$ is an integral function of what he calls "the exponential type" i.e. $|F(Z)| < Ae^{a|Z|}$. The paper published by P. L. Srivastava and S. P. Jain in the *Bulletin of the Academy of Sciences*, U.P., Vol. II, No. 2, Decr. 1932, considers instead of an integral function, an analytic function $\phi(Z)$ again of the exponential type, analytic in the region $|\operatorname{amp} Z| < a (>0)$, and discusses what analogous results can be established for the integral $\int \phi(Z)e^{-zZ}dZ$. The introduction of a function $\lim_{P \rightarrow \infty} \frac{\log |\phi(Pe^{i\phi})|}{P}$ exactly

analogous to what Polya calls the *indicator* leads to the required results.

Among some of the striking results are the following:

(1) If $f_1(s) = \int_0^\infty \phi(a+Z)e^{-sZ}dZ$, and

$$f_2(s) = \int_0^\infty \phi(b+Z)e^{-sZ}dZ,$$

where a and b are points inside the region wherein $\phi(Z)$ is analytic, then $f_1(s)$ and $f_2(s)$ have the same line of absolute convergence and the same singularities.

(2) A similar result for the series $f_1(s) = \sum_0^\infty \phi(a+n)e^{-sn}$ and $f_2(s) = \sum_0^\infty \phi(b+n)e^{-sn}$.

As a corollary, the singularities of the Dirichlet series $\sum_1^\infty \phi(\log n)n^{-s+1}$ and of the

integral $\int_0^\infty \phi(Z)e^{-sZ}dZ$ are identical.

The authors' abstract of their paper has been published in the *Comptes Rendus*, Tome. 194, pp. 2111-2113. The authors call

the integral $\int_0^\infty \phi(Z)e^{-sZ}dZ$ the Laplace-

Abel integral. Is there a slip, Abel replacing Borel? The analogy of the integral to Dirichlet's series would justify the association of the name of Dirichlet as well.

Mitosis in Hydra. Mitosis in the Ectodermal-Epithelio Muscular Cells of Hydra.

CARL H. MCCONNELL describes the mitotic phenomenon in the ecto-epithelio-muscular cells of Hydra and the appearance of this kind of activity is exceptional (*Biol. Bull.*, 64, 86, 1933). Interstitial cells divide mitotically and endoderm cells propagate themselves by amitotic divisions. The author has demonstrated nevertheless mitotic divisions in the ecto-epithelio-muscular cells. He has observed different stages of mitosis from prophase to telophase in about 205 preparations he has studied and thus establishes beyond doubt that mitosis is the rule rather than an exception. Mitotic figures are found in all parts of the body except the epithelio-muscular cells of the tentacles and are generally restricted to, or at least more numerous in, the upper two-thirds of the body. The centrioles and asters are present and the chromosome number is 12. It is further observed that mitotic phenomenon in Hydra occurs under all conditions.

According to previous observers the absence of mitotic division in the epithelio-muscular cells rendered their replacement by cells elaborated from the indifferent cells. The suggestion that an activity in the ecto- and endo-indifferent cells leading ultimately to cells which replace ecto- and endo-epithelio-muscular cells is denied on the basis of accurate observation. It is therefore suggested that the endo- and ecto-epithelio-muscular cells are self-propagating by a process of mitosis while the ecto- and endo-epithelial cells are concerned in the formation of sperm, egg and nematocysts among other functions.

The Nattukottai Chettiars.

DR. P. J. THOMAS has written an illuminating article on this community of indigenous bankers in the *Journal of the Madras University*, Vol. V, No. 1, January 1933. The Chettiars form a strong ethnic race of the Dravidian stock, distinguished for their extreme frugality and simplicity of habits, their strong individualism and spirit of enterprise, no less than their charitable disposition, religious endowments and munificent bequests to learning. The Indian Banking Communities, in addition to being money-lenders, are also merchants, commercial agents, landowners and managers of mills and factories; but the Chettiars as a rule avoid trade and other business concerns and if in recent years they have come to deal in gold or to occupy lands and plantations, they have been forced on them as unredeemed pledges. Though extremely thrifty in their personal comforts, they possess the primitive instincts of extravagant display of wealth as is evidenced by the total investment in houses and jewels amounting to about fourteen crores of rupees. It is estimated that the total capital employed by the Nattukottai community in their banking concerns is about rupees 120 crores, spread over Burma, Malay Peninsula, Straits Settlements, Ceylon, Cochin, China and Madras Presidency. The greater part of this working capital is derived from the proprietors and a small fraction of it is composed of deposits and advances and overdrafts from Joint-Stock Banks. The success of this community is due to their avoidance of all speculations and their interlocking of business interests which guarantees each other generous assistance in times of need. The custom of setting up a young married man in business either as a partner

in old established concerns or independently has tended to promote independence and self-reliance among the members and the training in conservative business methods which a young apprentice receives fosters the traditional spirit of caution and shrewdness. Within recent years, the prominent members of this community like Sir Annamalai Chettiar, Rajkumar Muthia Chettiar have entered public life and have made notable contributions, and to the munificence of the former, one of the flourishing South Indian Universities owes its origin. Like the Jews of old, money-lenders have always suffered and in Indo-China where the Chettiars have extensive banking interests, the decree-holders are threatened with expulsion from the French territory if they dared to execute the decrees against the offending debtors and an order of this nature on the part of the French Government in Saigon is likely to affect seriously the flow of trade and the availability of liquid money for the promotion of commerce. Dr. Thomas has made an important suggestion in regard to the future business of this important community. He has pointed out that private money-lending may not prove a profitable concern when the country is being rapidly industrialised and industrial investment is likely to prove of great benefit to their own interests and those of the country. This is especially so when it is remembered that an efficient system of large-scale industry is of prime importance for the prosperity of India and none can finance it with greater success than the shrewd and businesslike Nagarthars.

The Mechanism of Adaptation to varying Salinity in the Common Eel and the General Problem of Osmotic Regulation in Fishes.

(P.R.S., Ser. B., 112, 576, 1933.)

It is of common knowledge that teleost fishes could live in fresh water and salt water as well. Ancel Keys in a very interesting article describes the various experiments conducted and the results. It is pointed out that the eel behaves as a fresh-water fish in a medium of fresh water and as a marine fish in sea water. Further the blood of the euryhaline species in sea water is practically indistinguishable in osmotic concentration from the blood of the stenohaline marine forms. Both types are capable of extracting water from

sea water and in the euryhaline fishes and fresh water teleosts the kidney assists in filtration. This point has been experimentally determined.

The Growth of the Nucleus in the Developing Egg of *Chlorohydra viridissima*.

CONCERNING the development of the egg of *Hydra*, there have been various theories advanced by different schools of thought. It has been maintained by some authors that the eggs are differentiated from a few of the not too specialised interstitial cells, a majority of the latter being used as food for the developing egg. Only one egg ultimately reaches maturity. Carl H. McConnell makes the suggestion (*Biol. Bull.*, 64, 103, 1933) that several functional eggs develop in the ovary simultaneously. The interstitial cells destined to develop into eggs are easily distinguishable from others by the size of the cell, the peculiar nucleus and the cytoplasmic contents. The fate of the nucleus of the developing egg has been studied and it apparently maintains a ratio of 1:9.66 to the cytoplasm. The cytoplasm ceases increasing in volume after the nucleus reaches a certain size. The nucleoli increase in number in relation to the size of the nucleus. The maturation process is heralded by the vacuolisation of the nuclear membrane and during the process of maturation the volume of the nucleus is an eighth of its volume prior to maturation.

Some Relict Races of *Cottus quadricornis* from Finland.

FROM a geological point of view Finland is very interesting and its numerous lakes, till very recently, formed part of the sea. Relict races of different forms of animals have been described from these lakes and not the least important are those of *Cottus quadricornis* examined by E. Lonneberg (*Ark. for Zool.*, Band 24, Haft 3, 1933). He finds certain differences between typical marine forms of *C. quadricornis* and the relict races from the different lakes of Finland, associating the absence of spinous scales and other secondary sexual characters to the lack of calcium salts in the waters of the lakes in which these fishes are obliged to live.

On the Respiratory Function of the Blood of the Porpoise.

GREEN, Arda A., and Alfred C. Redfield have set forth (*Biol. Bull.*, 64, 44, 1933) experimental data obtained as a result of an examination of the physico-chemical properties of the respiratory fluids of these aquatic mammals. The properties of blood are very similar to those of the terrestrial mammals. The only clear-cut aquatic adaptation recognizable in the corpuscles of the cetacean and the sea-lion is the increased concentration of haemoglobin in the corpuscles. Aquatic life though it brings about morphological adaptive modifications does not significantly affect the physico-chemical properties of blood.