

## The Indian Science Congress Association

### HYDERABAD MEETING

THE twenty-fourth annual meeting of the Indian Science Congress Association was held at Hyderabad on January 2-8, under the presidency of Rao Bahadur T. S. Venkatraman, of the Indian Agricultural Service, who was made C.I.E. in the New Year honour list. Summaries of the presidential address and of the addresses of presidents of the ten sections follow.

#### THE INDIAN VILLAGE

In his general presidential address, Rao Bahadur T. S. Venkatraman discussed "The Indian Village—its Past, Present and Future". The Indian village, which has remained in a quiescent and more or less petrified state for two thousand years, began as a result of Aryan group settlement in the north. This had produced two types of village, the *ryotwari* village, in which a group or family took up as much land as they thought they could cultivate; and the joint village, in which the founders were powerful families, or clans, who were not agriculturists, the cultivators of the soil owing obligation to these families, and being something in the nature of tenants. These villages were self-supporting, and governed by a council of elders, with a system of village industries, of which the practitioners received a portion of the agricultural produce for their service.

The old self-sufficing village system has now broken down by contact with the West, which has brought in competition and the commercialization of crops, now grown not merely for home consumption, but also for export. In the present-day village, notwithstanding the extension of irrigation, seven-eighths of the population are dependent on the monsoon, rendering agricultural income unsteady and uncertain. The village is out of touch with markets, hence a great part of the profit goes to the city which markets the commodities. The increase of population has grown beyond the capacity of the land, especially as the use of manure, animal and human, is banned by sentiment. Sub-division and fragmentation of land militate against efficiency in production and debar the introduction of capital. The attachment to the cow is now working detrimentally, as an enormous head of cattle is carried, which contributes nothing to profits, the only advantage being an abundance of milk. Labour is uneconomical and inefficient, as well as intermittently employed. The villagers are overwhelmed with debt owing to the fluctuation and uncertainty of their incomes, so that many are reduced to the position of serfs. The standard of village life is low, and compares unfavourably in interest with the life of the city. As a result, all the more intelligent are drawn to the towns.

How can the downward tendency be checked? Some provision has already been made by Government organizations for improvement in agriculture and for technical advance. Fragmentation and sub-division need restrictive legislation, education should be extended in village schools with a rural outlook, while intellectual alertness, business habits and a broader outlook on life should be cultivated in the villagers. The co-operative spirit of the villages of old should be fostered anew. Village industries should be encouraged and commercialized, while if

products were partly manufactured in the area of production, much of the present cost of transport could be saved. Town and village are complementary, each contributing something to the life of the other. The duty of India is clear, the president said in conclusion, namely "to improve the *Village*, the nucleus of our country life, and infect its Chief Agent the *Villager* with a chosen culture of the virus of modern age through *Education* and *Industrialization*."

#### ABSORPTION OF LIGHT BY ATOMS AND MOLECULES

Prof. S. Datta chose as the subject of his presidential address to the Section of Mathematics and Physics the "Absorption of Light by Atoms and Molecules", and in the course of it summarized the advances made during recent years, giving references to nearly eighty researches. Under atoms he explained the rule according to which the lines absorbed form only one group of those radiated, and showed that it is not rigidly obeyed. The energy levels of the theory of line spectra must be considered of finite thickness in keeping with the 'uncertainty principle'. The width of the absorption lines is due partly to this and partly to the thermal motion of the atoms of the gas. The intensity is best explained by Dirac's theories, but the thermal broadening and the Raman effect may require a sub-division of the quantum for their explanation. The complex motions which may take place in a molecule, even when only diatomic, account for their more complex spectra; but many of the phenomena of absorption are explained on the theory of both attractive and repulsive forces between the constituent atoms, while the continuous absorption bands may be ascribed to the absence of quantization for the normal vibrations.

#### CHEMISTRY OF ANTIMALARIALS

In his presidential address to the Section of Chemistry, Prof. J. N. Ray discoursed upon the chemistry of antimalarials, a subject of prime importance to India, since the prevalence of malaria is a most formidable obstacle to progress in that country. It is interesting to note that the cinchona bark, which was first used as a febrifuge in the fifteenth century, still furnishes the best specifics against malaria.

Although quinine has not yet been synthesized, its chemical structure is known, and the physiological action of its various groupings has been closely examined. Thus the superiority of quinine to cinchonine as an antimalarial has been traced to its greater solubility in the red blood cells, on account of the presence of the methoxyl group, which alone differentiates it from cinchonine. Again, while stereoisomerism around the secondary alcohol group, which links the quinoline to the quinuclidine ring, has no marked influence on its pharmacological properties, the latter are destroyed by substitution of hydroxyl by hydrogen, chlorine or acetoxyl. Oxidation of quinine and cinchonine to the corresponding ketones (quinone and cinchonone) is, however, not sufficient to affect their value, since reduction of the keto-group occurs in the body. The chief factor in antimalarial

action is probably the quinoline nucleus, but the alcohol group plays an auxiliary part. The vinyl group in the side-chain of the quinuclidine ring does not appear to be directly responsible for prophylactic properties, although hydrogenation increases and oxidation destroys the effect.

Among the numerous synthetic antimalarial drugs are *plasmoquine* and *atebrine*, which are derivatives of 6-methoxyquinoline and 2-chloracridine respectively, each containing the same complex alkylamino-side-chain. Neither plasmoquine nor atebrine, however, has true prophylactic action, for there is no specific action on the sporozites. Plasmoquine is most effective in conjunction with quinine. The combination has been tried on the large scale by the Bengal Government with encouraging results. Robinson and his colleagues have prepared several derivatives, the most promising being 8-( $\delta$ -aminobutyl-amino) 6-methoxyquinoline.

A synthetic drug has still to be found which will have curative value in recurrent infection. The alkaloids of opium appear to be of very little value, but the work of Gunn and Marshall on harmaline, which is effective in acute cases, shows that the search need not be confined to the quinoline series.

Prof. Ray appealed for further financial aid for research in pure chemistry.

#### INDIAN EARTHQUAKES

Mr. W. D. West discussed "Earthquakes in India" in his presidential address before the Section of Geology and Geography. He traced the beginning of their study to Dr. Thomas Oldham, the first director of the Geological Survey of India, who compiled a valuable catalogue of Indian earthquakes, and investigated the Cachar earthquake of 1869, and the advance to its present state mainly to his son, the late Mr. R. D. Oldham, who wrote the report on the Assam earthquake of 1897, a memoir that has been described as being "worthy of a great subject".

Mr. West divided the country into three great zones, one the belt of Tertiary folding to the south of the Himalayas, the second consisting of the frontal trough of alluvium, and the third the whole of peninsular India. The first zone is that in which all the great earthquakes originate, beginning with the peninsula of Cutch (marked by the earthquake of 1819), and bending round through Baluchistan (the Quetta earthquake of 1935 and others), Northern India (the Kangra earthquake of 1905 and the North Bihar earthquake of 1934), Assam (one of the greatest of all earthquakes, in 1897), and Burma (numerous earthquakes from 1839 onwards). Fault-displacements at the surface occurred with only three of these earthquakes, those of Cutch in 1819, Chaman in 1892, and Assam in 1897.

Mr. West also directed attention to two subjects of great importance, the provision of earthquake-proof buildings in the two northern zones, which coincide with the most populous districts of India, and the foundation of an earthquake research institute for the detailed study of Indian earthquakes.

#### INDIA'S CLIMAX VEGETATION

Mr. H. G. Champion's address before the Section of Botany directed attention to the neglect of the forest and the tree by the Indian botanical investigator, a neglect that is the more surprising in view of the fact that some twenty-five per cent of Indian

land is under forest, and that the natural climax vegetation for the greater part of the land surface is probably forest.

Mr. Champion pointed out that the direct application of transpiration data from European observations to Indian conditions without verification "is positively dangerous"; yet the comparison of forests with other types of soil cover and their study in relation to the water economy of the land surface represent problems of great importance to India.

Similarly the lac industry, the supplies of valuable gums, dammars, resins, etc., could benefit by studies of tree physiology, while Mr. Champion's own studies upon the 'spiral grain' of the Chir pine have given an indication of the significance that genetic studies may yet have for Indian forestry.

#### INDIAN CONTRIBUTIONS TO HELMINTHOLOGY

The presidential address to the Section of Zoology was delivered by Dr. Gobind Singh Thapar. The subject chosen was that of helminthological research in India. Beyond doubt, the subject offers great possibilities in that country, where, apart from valuable work on its medical and to a less extent on its veterinary aspects, comparatively little has been done until recently, when new lines have been opened up and schemes of co-operation set in being. Certain references to helminths in ancient writings, among which possibly *Enterobius vermicularis*, microfilariae and tapeworms can be recognized, were cited, and the present position of the science outlined. It was pointed out that difficulties arise from the fact that an obsolete terminology is still employed in many general text-books of zoology and there are even errors, sometimes serious ones, in the accounts of the life-histories of common forms.

The helminth fauna of India other than those members of it responsible for human helminthiasis is largely unexplored. Details of the morphology of some helminths, *Ascaris*, *Enterobius* and *Labidurus* were given to illustrate how they may play their part in solving problems of classification and relationship. Attention was directed to the discovery of an *Echinococcus* cyst that simulates a *Cœnurus* cyst in that it lacks the typical brood capsules. Brief notice was taken of plant nematodes, host specificity, anthelmintics, pearl formation, etc.

The address concluded with an appeal for a wider appreciation of the importance of helminthological study in India, and for further co-operation among the various workers. Some aspects of this address have been more fully elaborated by the author elsewhere (Lucknow University Studies, 3).

#### ETHNOLOGY OF THE COORGS

In his presidential address to the Section of Anthropology, Dr. Dewan Bahadur L. K. Ananthakrishna Iyer presented "An Ethnographical Study of the Coorgs". Inscriptions throw little light on the early history of the Coorgs, but from historical evidence it is conjectured that they were not without racial admixture from a remote period. There has been also a great deal of culture contact between the Coorgs and the people of Malabar, Canara and the Tamil districts. Their language is a mixture of Dravidian languages. In physical traits their mountain habitat has differentiated them from the people of the plains. In their economic life they are first hunters and fishermen, and then agriculturists.

Agriculture, which is of the rudest kind, is similar to that carried on in other parts of India. It has been transmitted unchanged for ages. The industry of the people of the highlands is confined exclusively to the cultivation of rice. Though agricultural implements are few and rude, enough has been produced from ancient times to meet home consumption and to export to Malabar. Where possible the valleys have been formed into flat terraces for cultivation.

The agricultural year opens about the middle of April, when ploughing begins with the first shower. This is a ceremonial observance, in the course of which the ancestors, the river deity and the presiding deity of the division of the district are invoked, and prayers are offered to Siva. Before the completion of the transplanting of the largest field, an open space ten feet wide is left the whole length to provide the race ground for the Coorg sport.

Food supply is plentiful. The Coorgs rear sheep and goats, and the chief article of their diet is rice. Hospitality is proverbial. The houses are situated close to the paddy fields, and resembles the Nayar house. The approaches to the old Coorg house mark the design of fortification, pointing back to the old days of general feuds. Their dress and ornaments are peculiar. Their marriage customs are a medley of old and new. Formerly marriage festivities had a communal character. The Coorg family is joint and patriarchal, and no family affair of any importance may be undertaken without the knowledge of the senior member. The senior female member is the queen of the household. Public morality is controlled by a council of elders. The Coorgs are animists, having ancestor and demon worship; but they show evidence of the influence of outside beliefs. Of late they have begun to worship the Hindu deities.

#### AGRICULTURE IN INDIA

For the presidential address to the Section of Agriculture, Rao Bahadur B. Viswa Nath took as his subject, "Science and Practice of Agriculture". Indian soils and agricultural practices, he said, were several centuries old and research should, and was, concerning itself more with details of existing practices than with the evolution of wholly new methods, the aim being to build up on the existing system a state of agriculture suited to the conditions of the soil and the resources of the cultivator.

Work on soil had originally been confined to a study of fertility, but other aspects were now known to be important, and it had been found that characteristics and reactions of different soils were determined by climatic factors rather than by their geological origin. As regards manuring, the importance of organic manures for Indian soils was stressed. Intensive cultivation and continued use of artificial fertilizers were liable to lead to evil consequences if they were not accompanied by the addition of adequate organic matter; in fact, the utilization of the increased knowledge of the soil obtained by research would be in proportion to the building up of the reserves of organic matter in the soil. Further, the nutritive value of a crop was enhanced by the use of organic manure. With the view of meeting this need, much attention had been paid to the utilization of animal and vegetable waste products. Composting had achieved considerable success, but a simpler and cheaper method was still required if

it was to be more generally adopted by Indian agriculturists.

In conclusion, the president showed that there was considerable scope for increased production, as the present yield of food crops was sufficient for the proper feeding of only two-thirds of the Indian population.

#### ANIMAL NUTRITION AND PUBLIC HEALTH

"The Relation of Animal Nutrition to Public Health in India" was the title of the presidential address to the Section of Medical and Veterinary Research, delivered by Colonel A. Olver. He pointed out the causative role of faulty nutrition in relation to many diseases from which livestock suffer in various countries. Thus, 'bush-sickness' in New Zealand and elsewhere is due to iron deficiency, and calves in India develop a form of blindness caused by vitamin A deficiency in the fodder; well-fed meat and milk of good quality are of higher biological value than similar material of lower quality. In India every year there is a period when natural growth of succulent fodder is almost at a standstill, and when the foodstuffs available for stock are mostly dry, over-ripe crop residues lacking in mineral, vitamin, and other essential constituents. This reacts upon the population, who cannot thrive when the meat is poor and the milk is deficient in quantity and quality.

Colonel Olver therefore urged that more attention and research should be bestowed upon the production of fodder crops of good quality. The production of suitable fodder crops economically in a system of agriculture that is largely governed by the limited capital resources of Indian cultivators is, however, one of the most difficult of the problems with which the better nourishment of the people of India is unfortunately confronted.

#### INDIAN PHYSIOLOGY

Lieut.-Colonel S. L. Bhatia commented, in his presidential address before the Section of Physiology, on the melancholy fact that in spite of the great importance of a knowledge of physiology among those who are responsible for the well-being of the people, this subject has been little studied in India, in comparison with physics and chemistry. The Section of Physiology of the Association, which celebrates this year its first anniversary, looks forward to a period of vigorous growth, in which professors of physiology now established all over India in full-time chairs with well-equipped laboratories, will direct their energies particularly towards problems of special importance to India—problems of nutrition, of adaptation to tropical climates, and of the application in India of methods which have already been applied in the West.

Colonel Bhatia emphasized the practical importance of physiology by reviewing the growth in Europe of this offspring of medicine, which has had so much influence on its parent, and which has never been so abstract and impractical as some of its critics believe. The decision of the Royal College of Surgeons of England to hold a primary F.R.C.S. examination each year in India will give a great impetus to the study of physiology in all the medical colleges.

The president read quotations from some of the letters of greeting and encouragement which the

Section had received from leading British physiologists. Prof. A. V. Hill spoke of the international character of physiology and of its status as an independent science. If physiology had been content to be merely the handmaid of medicine and to give important positions only to medical men, it would have missed many of its ablest exponents—Pasteur, Langley, Barcroft, Cannon, Bayliss, Lucas, Krogh, Lapicque, and many others, including, we may add, A. V. Hill himself.

#### SOCIAL MIND OF THE INDIVIDUAL

K. C. Mukherji took, for the subject of his presidential address to the Section of Psychology, the "Social Mind of the Individual". He regretted that there should be any controversy about the importance of social compared with individual psychology, since it is a matter of observation that individual psychology depends as much upon the psychology of society as the psychology of society upon it.

While admitting the importance of the institution of the family life for the welfare of the State in its material aspects, he emphasized that the mental effects of the family life in relation to the foundations

of national sentiment are equally important. Although the effects of family life on one hand may be a barrier to the development of wider social interests, it is, however, the necessary preparation for the foundation of the social sentiments. The views of various writers on the ultimate elements of social interests were critically considered.

Mr. Mukherji thinks that life in the first instance is a social life which grows unconsciously, but, when with advancing individual development the critical spirit arises, the unconscious acceptance of the social group becomes modified by conscious effort; thus the social life may be said to be individualized.

The relation of the individual to the group led him to consider the relationship between minor groups under the political, economic, or cultural dominance of a major group. If the minor group accepts the dominance of the major group, there is no trouble; if the minor group assumes an attitude of equality or superiority in some field, it threatens the prestige of the major group, and fear of that loss tempts to aggression. He thinks that this represents the problem of the Jews in Germany, and the Hindu-Muslim tension. The address raised some very interesting problems in a clear form.

## X-Ray Studies of Proteins

AT the thirty-seventh lecture of the Bedson Club at Armstrong College, Newcastle-on-Tyne, on March 5, Dr. W. T. Astbury gave an account of his work on the "X-Ray Interpretation of Protein Structure".

Proteins can be divided into two classes, fibrous and globular, and they all contain  $\alpha$ -amino acids condensed, primarily, as polypeptide chains. This classical theory of Emil Fischer does not fully characterize the proteins, and research has shown that these long polypeptide chains are folded and further cross-linked by the reactive centres of the side chains. In dealing with the proteins, it is necessary to ask three questions: What are the side chains? How are they distributed? And what is their stereochemical aspect? Dr. Astbury dealt with the last topic.

The fibrous proteins are mainly stable, the simplest being fibroin (silk protein) which consists largely of glycine and alanine residues. Its X-ray photograph agrees with the view of a fully extended polypeptide chain, and this is confirmed by the fact that silk fibres cannot be reversibly stretched. Any stretching that does occur is permanent and due to the crystallites sliding over one another. The stretching of wool, hair, etc., is about a hundred per cent and reversible, and the usual X-ray photograph is not the same as that of fibroin; but on stretching, a similar photograph has been obtained, indicating that keratin (the protein of hair) is a fully extended polypeptide chain system only in the stretched state ( $\beta$ -keratin); the unstretched condition is known as  $\alpha$ -keratin. It seems, therefore, that in the  $\beta$ -keratin form the proteins consist of parallel polypeptide chains linked by cross-linkings, while in the normal or  $\alpha$ -form these chains are folded. If keratin is stretched and steam applied, the cross-links are hydrolysed and

the extension then becomes permanent by the formation of new cross-links. Keratin fibres can also be contracted by nearly fifty per cent (supercontraction) due to further folding of the main-chain. This supercontraction of hair has been found to be very similar to the contraction of muscle. The extension and contraction of many fibrous proteins can take place by free rotation around the single valency links, and therefore unreasonable straining of the valency bonds does not occur.

The globular proteins are only stable within narrow limits. Some of them have been obtained in a crystalline state, and in this condition X-ray investigation has been possible. Svedberg, by means of the ultracentrifuge, has indicated that the molecular weight is a simple multiple of 35,000 (approx.). The characteristics of this class are rapidly lost on denaturation, and the stretched state of the denatured protein gives X-ray photographs very like those of  $\beta$ -keratin and the stretched fibres in general, thus showing that all proteins, whatever they are in the natural state, can be brought to a condition approximating to long polypeptide chains with cross-links.

The folding of these chains must be specific, and Dr. Astbury discussed possible methods by which this could take place, and indicated how supercontraction was brought about. The specificity argues some controlling factor, and it was suggested that this is a property of the side chains.

In conclusion, Dr. Astbury dealt with the feather protein and the virus which causes 'mosaic' disease in tobacco plants. The former falls between the fibrous and globular, while the latter, analogous in several ways to feather protein, appears to be no other than a crystallizable protein bridging the supposed gap between living and non-living matter.