shrouded in mystery in spite of the numerous theories that have been formulated by the various anthropologists and the ancient Hindu rishies.

The President gives some parallelism between the early developed culture in Northern India and Polynesia. Further the stratic graphic study of culture in the line of the German school and mapping out of culture areas are recommended. Definite distribution of traits of a culture complex is far more yielding of results in the fields of material culture. The study of material culture traits common to India, Africa and the Pacific might lead to produce types which are likely to have originated in a central home before dispersal.

The recent studies of Dr. Broom in South Africa reveal the probable existence of a South African Australoid race who have left similar physical traits. In the opinion of the President, India can be studied in comparison with the data from Africa on the one hand and the Pacific on the other. The implements in South India and Tasmania are said to be similar. As probable survival of the early stone age culture complex, boomerang plays a prominent part. Griebner in his classic study of the Milanesian bow culture has shown five stratifications of which the old Australian culture with boomerang was the earliest, and this was followed by totemic culture, and then a matriarchal dual organization after which came the boomerang bow culture complex and still later the Polynesian culture. The boomerang, says the President, is common to Africa, India and to Australia, as may be seen from the specimens exhibited in the Pitt-Rivers Museum of Oxford. Similarly the study of the bow will also yield valuable results.

The study of the problem relating to the dispersal of taro and banana and of domesticated animals, study of culture of intercontinental regions will reveal important role of India as primary or secondary centre of diffusion of cultures in several stages of her culture complex in the march of time. The study of the origin and development of plough yields important results. Finally India has to take inspiration from her cultural patterns so as to be able to combine with the cultural traits of the West and break into new paths. Finally he concludes his address by referring to some super anthropological problems.

L. K. A.

BOTANY:

THE study of algæ did not receive for a long time the attention due to it from Indian botanists. One main reason for its neglect is the general impression that a study of this group of plants can hardly be of any economic value. So, while Mycology, Plant-Breeding and Plant-Physiology are drawing most of our men, subjects like Algæ which are supposed to be of academic interest only fail to attract any of them. It is gratifying to see, however, that of recent years more people are taking to the study of algæ. An attempt is made in this address to show among other things how a study of algæ, besides throwing valuable light on fundamental biological problems, can also be of value economically.

It is generally believed that life first originated in water and that the first living organism must have been of an algal type. And a detailed study of these plants will throw light on the problem of the origin of life, the solution of which is the ultimate goal of all biologists. Again a study of this group will enable us to understand many biological principles such as division of labour, parallelism in evolution, the phenomena of differentiation of somatic and reproductive cells, origin of sex, alternation of generations, adaptation to land life, etc. And the structure, function and origin of cellular bodies like the nucleus, plastids, pyrenoids, blepharoplasts, chondriosomes and golgi bodies are more likely to be understood by a careful study of this group of plants than of any other.

The different systems of classification of algæ are briefly dealt with, particular emphasis being laid on the flagellate origin of algæ, the main differences between the *Isokontæ* and the *Heterokontæ*, the parallel evolution seen in both these two groups and the existence of "flagellate" and "algal" forms in all the main algal groups. Reference is made to the works of several algologists on these simplest types of algæ and the desirability of work being done in India on similar lines is emphasized.

The work done on the ecology of algæ by several workers like West and Pearsall, Naumann, Fritsch, Donat and others is briefly described. Among other points, the ecology of freshwater lakes as described by these authors is explained in some detail. The classification of lakes as under Oligotrophic, Eutrophic and Dystrophic ones is explained and the effects of various factors such as the depth and form of the lake, the sediment, the hydrogen-ion concentration, the surroundings of the lake, etc., on the nature and composition of the algal population are described.

The ecology of subærial algæ is next described and an account is given of the important role these algæ play in colonising new and inhospitable strata, which are thereby rendered more habitable for higher plants. The need for research work on the ecology of algæ in India is pointed out.

The possible lines of work on the cytology of algæ in India are referred to, particular emphasis being laid on the possible presence of structures similar to Golgi bodies and mitochondria in algal cells.

Lastly, the economical aspects of the study of algæ are dealt with in some detail. The value of algæ on the growth of fishes is briefly explained. The algæ form the food of minute animals, which in their turn form the food of larger animals, which in their turn again serve as food for fishes, so that possibility of fish-life in any area is ultimately dependent on the presence of these minute lowly plant organisms. Investigations on the algal population and the various physical and chemical features which control their growth will help to control the nature and extent of the fish-population in any area.

The need for the establishment of freshwater biological stations for investigating hydrobiological problems in India as has been done in other countries is pointed out.

The study of algæ in relation to agriculture is next dealt with and the importance of determining whether the algæ growing on cultivated soils are beneficial or harmful to the crops is pointed out.

Many scientists have adduced evidence to suggest that the algæ are able to fix the free atmospheric nitrogen. If this should prove to be true, the growth of the algæ must be encouraged on the fields.

The study of algæ is necessary in connection with town water supplies. In the reservoirs there is usually a fair amount of algal growth. The physical and chemical conditions of the water in the tanks and the nature of the algal population should be studied, and, when necessary, measures should be taken to check or altogether eliminate the growth of the algæ in order to ensure a pure water supply.

Many mosquito larvæ depend on algæ for their food and hence there is a possibility of checking the growth of the larvæ by controlling the growth of the algæ. It is reported that mosquito larvæ do not flourish in waters in which *Characeæ* are growing. If this should prove to be correct, then we have another method of getting rid of the larvæ.

Algæ are used as manure in Rajaputana, as they are very rich in nitrogenous material. It is not known whether they are used for a similar purpose in other parts of India. Characeous deposits are used as manure in Switzerland. Moreover, the peculiar odour emitted by them is said to help in keeping the soil free from insects.

M. O. P.

CHEMISTRY :

IN the first part of his address Prof. Neogi draws attention to an analysis of the causes which have led to the remarkable increase in the output of original work in chemistry throughout India during the last 20 years. Sir P. C. Ray along with Sir Alexander Pedlar and Dr. Richardson shares the glory of being among the pioneers of chemical research in India. Every paper of Sir P. C. Ray was commented upon by newspapers of the country, thirty years ago, as proof of the capacity of Indians for original work in chemistry but at the present day, only the most outstanding discoveries like Raman Rays attract the attention of the Indian public. The principal causes which have contributed to this change are: (1) the establishment of post-graduate departments in most Indian Universities; (2) expansion and consolidation of purely research institutions like the Indian Institute of Science at Bangalore and technological departments in some Universities; (3) establishment of industrial and scientific departments by provinces and native states; (4) institution of the M.Sc. and D.Sc. degrees with fellowships and scholarships for research in many Indian Universities. But as important as any is the formation of the Indian Science Congress through the efforts of Professors J. L. Simonsen and P. S. MacMahon whereby different workers throughout the country were brought into touch with one another more closely and inspired the youth to emulate the work of the elders. Research has kept pace with the growth in opportunities for work, these thirty years. Dr. Neogi suggests the institution in Indian Universities of the Ph.D. degree for original work after M.Sc. stage, though still assisted by the teacher and pleads for greater help to the research student by a larger number of liberal research scholarships in Indian Universities, similar to those prevailing in the Indian Institute of Science at Bangalore.

The next portion of the address gives an account of optical isomerism as applicable to co-ordinated inorganic compounds. Optical isomerism was, as is well-known, explained by Le Bel and Van't Hoff in 1874 by the tetrahedral space arrangement of carbon linkages. In the next few decades, numerous classes of optically active compounds of elements other than carbon, such as N, S, P, As, B, Sn, Pb, Si and inorganic co-ordinated compounds of Co, Cr, Be, Pt, Ru, Rd, Ir and Pd were discovered and their isomerism explained by the newer conception of the arrangement of atoms in space. Werner was the pioneer in extending the conception of space representation to co-ordinated inorganic compounds. He and his co-workers soon discovered that (1) a co-ordination complex usually contains six monovalent groups round the central metal atom; (2) compounds containing complex of the type $[MA_6]$ or $[MA_5B]$ do not exist as isomers; (3) cis- and trans-isomerism exists in compounds containing complex of the type $[MA_4B_2]$ or $[MA_4BC]$; (4) In such cis-compounds if A_4 be substituted by two radicals, like oxalato or ethylenediamine, each occupying two co-ordinate positions in the complex, the compound will exhibit optical isomerism. In a complex of the type $[MA_6]$, A_6 be substituted by three radicals like oxalato or ethylenediamine, each occupying a double co-ordinate position, such complex will also exhibit optical isomerism.

The repeated occurrence of co-ordination number six among the complex salts led Werner to suppose that the substituents were placed at the corners of a regular octahedron having the central metal atom at the centre. He was able to prepare all the ten theoretically possible cobaltic-dinitro-ethylenediamine-propylenediamine compounds and all the twelve trispropylenediamine compounds in agreement with the octahedral structure. Varied and extensive experience and X-ray examination has overwhelmingly confirmed this view. The first optical isomers were isolated by Werner and Kling in 1911 and thus this branch of chemistry is only of 20 years' growth.

The first active co-ordinated inorganic compound contained cobalt as the central element. Soon Werner was able to isolate active complex compounds containing other elements of groups VI and VIII Cr, Fe, Ni, Ru, Rd, Pd, Ir and Pt. Recent work of Mills, Lowry, Wohl and others proves that elements of other groups, Cu, Be, Zn, B, Al and As also yield co-ordinated compounds. The resolution of hexol-dodecammine-tetracobaltic bromide $\{CO[CO(NH_3)_4(OH)_2]_3\}Br_6$ by Werner (1914) into *d* and *l* forms gave a blow to the belief that organic radicals are essential for optical activity in co-ordination compounds.

Both Le Bel and Van't Hoff postulated in the case of carbon compounds that, for optical activity to occur in a molecule, it must have at least one carbon atom attached to four different radicals. Later work as that of Pope, Perkin and Wallach (1909) on 1-methyl cyclohexylidene-4 acetic acid showed that the doctrine of the asymmetric atom is no longer a fundamental concept but is only a part of a wider truth. The successful resolution of cis- or tris-ethylenediamine or similar compounds which do not have any asymmetric atom, brought out