# THE INDIAN ACADEMY OF SCIENCES—THIRTY-FIRST ANNUAL MEETING

THE Thirty-first Annual Meeting of the Indian Academy of Sciences was held on 20, 21 and 22 December 1965, in Hyderabad, under the auspices of the Osmania University. The Conference was inaugurated by Mr. Pattom Thanu Pillai, Governor of Andhra Pradesh. Dr. D. S. Reddy, Vice-Chancellor of the University, welcomed the gathering.

Sir C. V. Raman, President of the Academy, in his Address on "The New Physiology of Vision" presented the results of his latest researches on the subject with particular reference to his new theory on defects in colour vision and "daltonism".

The next two days of the Conference were devoted to scientific meetings which were held in two sessions on each day. Presiding over the morning session on the 21st, Dr. M. S. Krishnan spoke on "The Earth's crust—its development and structure". This was followed by a lecture on "The present state of development of rocket and statellite meteorology" by Mr. C. Ramaswamy, and a paper on "The electron paramagnetic resonance in ferro-electric systems" presented by Dr. P. Venkateswarlu. In the afternoon session the Chairman Prof. T. S. Sadasivan spoke on "Phytotoxicity", and Prof. S. Ramaseshan on "The use of anomalous scattering of X-rays in crystal physics".

The second day's morning session was presided over by Dr. S. Bhagavantam who gave a talk on "Magnetic properties of crystals". Prof. S. Chandrasekhar spoke on "Liquid crystals" In the afternoon session Chairman Dr. T. R. Govindachari in his talk pointed out that the triterpenoid euphol acted as a biogenetic intermediate for the formation of a variety of complex substances. Dr. M. K. Vainu Bappu spoke on "Cometary spectra".

There were two evening lectures the first on the 21st, by Dr. M. S. Swaminathan on "Plant Genetics and food production" and the second on the 22nd by Prof. M. G. K. Menon on "Cosmic ray neutrino experiments".

The following are the summaries of some of the lectures delivered at the meeting :—

## Phytotoxicity

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Phytotoxicity as a fundamental problem has been recognized for over half a century, but its importance is gaining ground ever since the discovery of powerful chemotherapeutants and antibiotics. We are now entering into an age of systemic fungicides. Therefore, to keep pace with these newer developments a more critical study of life processes in plants like permeability, ion uptake, respiration, photosynthesis and the production of a group of interesting substances like phytoalexins seems essential. This is particularly so in a tropical country like India where application of proprietary fungicides without adequate knowledge of host physiology such as an accelerated basal metabolism under prevailing conditions could be ruinous. Fungicides have been applied in recent years both through the foliage and in soil and, indeed, the pathways have been elucidated through tracer techniques. Thus, the effects of the antibiotic chloramphenicol in inducing restraint in ion uptake and their active transfer across root membranes and the inhibition both in the uptake and subsequent incorporation of amino-acids into protein are now known. In our own work on cotton with fusaric acid (*n*-butyl pyridine dicarboxylic acid) we have shown ionic imbalance, altered oxido-reduction potential, reduced chlorophyll, changes in protein and soluble nitrogen. Working with various systemic fungicides on rice, susceptible and resistant to helminthosporioses, we have also noticed observable phytotoxicity and an altered pattern in the soluble nitrogen components. Various reports indicate that phytotoxic effects accrue even at the time of seedling germination.

Recently the effect of some fungicide sprays on the synthesis of chlorophylls, DNA and RNA in onion leaves has shown that the synthesis of both chlorophyll '*a*' and DNA was inhibited by cycloheximide, whereas content of RNA increased more than twofold in treated leaves. The fungicide dyrene seemed to favour synthesis of chlorophylls in developing leaves. All this indicates the vastness of this problem of phytotoxicity and underlines once again the need to understanding the physiology of a plant system under the stress of chemicals and antibiotics.

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## The Earth's Crust—Its Development and Structure

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Whatever origin is attributed to the Earth, it must have passed through a molten

state in the course of contraction. The age of the Earth is taken to be the same as that of the meteorites, about 4600 m.y. The greatest age got for rocks from the Pre-cambrian shields (from the White Sea coast in the Baltic shield, from Southern Rhodesia and Swaziland) is 3500 to 3600 m.y. This is very nearly the age of the first permanent crust, for the original crust must have been remelted while the crust was still hot. Life must have appeared at least 1000 m.y. later, but recognisable organic structures appear about 1600 to 1800 m.y. ago.

The original crust was of basaltic composition. It may have segregated around the poles or in the equatorial region. It was gradually differentiated, during the course of ages, by repeated igneous action and crustal movements involving fusion and by the addition of increasing quantities of sediments.

The Earth has been evolving as a density-stratified spheroid, with a metallic core and a mantle containing silicates, sulphides and other compounds. The Upper Mantle, down to perhaps 700 Km. or even 950 Km. depth, is non-uniform in composition and is the shell in which silicates and other compounds undergo phase changes due to change in density. Primary magma chambers occur at depths between 60 and 200 Km. though earthquake foci occur down to 700 Km, mainly by change of density in either direction. The Mohorovicic discontinuity, which occurs at depths between 20 and 85 Km. in continents (average around 33 Km.) and 5 to 10 Km. in ocean basins, is believed to mark the change of basalt to eclogite under the continents but may indicate only a density change under the oceans.

The earth shows folded mountains thrust over the edge of the Pacific Ocean while the Atlantic and Indian oceans are surrounded by faulted coasts. These features have been produced by the drift of continents which began in the Upper Mesozoic and have been completed in the Pleistocene. The final adjustments are still taking place. Other connected features are the Rift Valleys and major grabens like the Rhine Valley, White Sea-Caspian depression, the Ob-Aral Sea depression, etc. The present active features are the Mid-Ocean ridges and the Island Arcs. The Mid-Ocean ridges are bringing up basaltic lavas and building up a huge sub-oceanic mountain system in all the major oceans. The Island Arcs around the Pacific coasts mark major 'fault planes' dipping under the continents and they contain the foci of greater majority of earthquakes occurring at present. Along these arcs also rise basaltic and andesitic lavas and ashes. Both these features are now actively contributing to the addition of crustal material. There is thus an equilibrium between the wearing down of continents and addition to their material. The continents are however believed to be growing in extent gradually.

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## Plant Genetics and Food Production

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India has over 20,000 species of flowering plants in the country, a number far surpassing that found in countries of a much larger land area such as the U.S.S.R. and U.S.A. The primary natural endowments necessary for successful plant growth are abundant sunlight and adequate moisture. The laws of heredity discovered by Gregor Mendel in 1865 have made it possible for us to synthesise plant varieties which can utilise more efficiently solar energy as well as chemical energy applied in the form of organic and inorganic manures. Genes or the factors determining hereditary characteristics are located on rod-like bodies called chromosomes, whose number is constant in every species. While the history of the earth is written in its layers, the history of all living organisms is inscribed in their chromosomes.

Through a process of genetic and chromosome engineering, very high yielding varieties of Rice and Wheat and hybrids of Maize, Jowar and Bajra (Cumbu) have been developed during the past 4 years. These varieties and hybrids if grown with adequate quantities of fertilizer and water can yield 4 to 6 tons of grain per hectare. Since a minimum of 2 crops can be grown in our irrigated lands, the yield potential of our lands can be as high as 10 to 12 tons of grain per hectare. In fact, at the Division of Botany, Indian Agricultural Research Institute, New Delhi, 5·8 tons of maize were harvested in October, 1965 in the same hectare of land in which 6·3 tons of wheat had been harvested in April, 1965. Such a favourable situation for high production does not exist in the temperate areas of the globe. Plant Genetics has ushered in a hopeful era in Indian agriculture by opening up new vistas in crop yields. The 9 million tons of *Jowar* currently being produced in India from 43

million acres can easily be produced in a maximum of 9 million acres, since 1 ton per acre can be obtained with the hybrid *Jowar* varieties even by poor farmers. Thus, altogether new land use patterns can be envisaged. The varieties or hybrids recently produced by our geneticists are all maturity-oriented and can be grown in any season, provided there is water and the temperature is not too unsuitable. Hybrid *Jowar* can be grown in the paddy fallows of Andhra Pradesh and Madras and in this way, the traditional *Jowar* lands can be utilised for other purposes.

We in India are only at the beginning of the scientific age with reference to agriculture. The new genetic tools have conferred upon man the powers to create new varieties. The branched wheats evolved at the Indian Agricultural Research Institute through the use of atomic radiations will open up a new dimension in wheat yields. The production of amber-coloured grains from Mexican wheat varieties with red grains within 2 seasons is an example of the rapid progress possible.

Genetic manipulation of quality has just begun and already wheat varieties with over 14% protein content have been selected. The discovery made at the Nutritional Research Laboratories, Hyderabad, that excess of the amino-acid leucine in the *Jowar* grain is responsible for the occurrence of pellagra in populations mainly subsisting on *Jowar* has paved the way for breeding *Jowar* varieties low in leucine content.

The rapid increase in the demand for fertilizers during the last few years is due to the striking response shown by the new varieties and hybrids to fertilizer application. During the spread of intensive agricultural practices, new problems such as new diseases and pests will crop up and it is essential that genetic research in the country is developed to the extent necessary for anticipating some of these problems and solving them quickly.

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## BEHAVIOUR OF NONHUMAN PRIMATES *

THIS is a work which surveys modern laboratory and field research on the behaviour of monkeys and apes; its publication should be welcomed by students of behaviour who have felt the need for a convenient source of information about the behaviour of the animals most closely related to man.

Among the topics covered are learning, behaviour development, aging, social behaviour, and effects of ionizing radiations. The material is directed towards research workers who are unfamiliar with the techniques, problems, and findings of primate research as well as specialists in the field. It should also be useful to advanced undergraduate and graduate students in psychology and to researchers in related fields such as anthropology, neurophysiology, sociology, and zoology.

Volume I contains the following articles: Discrete-Trial Training Techniques and Stimulus Variables, by Donald R. Meyer, F. Robert Treichler, and Patricia M. Meyer; Discrimination-Learning Sets, by Raymond C. Miles; Hypothesis Behaviour, by Marvin Levine; The Delayed-Response Problem, by Harold J. Fletcher; Associative Problems, by Gilbert M. French; Operant Conditioning, by Roger T. Kelleeher; Primate Learning in Comparative Perspective, by J. M. Warren.

Volume II contains the following articles: The Affectional Systems, by Harry F. Harlow and Margaret K. Harlow; Determinants of Social Behaviour in Young Chimpanzees, by William A. Mason; Ontogeny of Perception, by Robert L. Fantz; Ontogeny of Learning, by Robert R. Zimmermann and Charles C. Torrey; Age Changes in Chimpanzees, by A. J. Riopelle and C. M. Rogers; Investigative Behaviour, by Robert A. Butler; The Radiation Syndrome, by Roger T. Davis; Field Studies, by Phyllis Jay.

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* *Behaviour of Nonhuman Primates: Modern Research Trends*, Volumes 1 and 2. Edited by Allan M. Schrier, Harry F. Harlow and Fred Stollnitz. (Academic Press, New York and London), 1965.
Volume I: Pp. xv+285+33. Price $ 9·00.
Volume II: Pp. xv+309+33. Price $ 9·50.