

**SEVENTYTHIRD INDIAN SCIENCE CONGRESS HELD AT DELHI—1986
SUMMARIES OF LECTURES DELIVERED**

Mathematics

The Present Trends and Future Directions of Statistics in India by G. Sankaranarayana, Department of Mathematics, Annamalai University, Annamalainagar 608 002.

In his presidential address Professor G. Sankaranarayanan traced the exciting refinements and generalisations in the Statistical Methodology. He stated that Modern Statistics is a combination of descriptive statistics dealing with the collection of data and the analytic statistics associated with the concepts of chance and probability. He stated that, although descriptive statistics is an important branch of Statistics and continues to be widely used, since statistical information arises from samples, in recent years there is a shift in emphasis from descriptive statistics to statistical inference. Since statistics is a hand maid of physical, biological and social sciences, he emphasised the need for evolving a comprehensive teaching programme in statistics for the benefit of scientists, engineers and physicians. He then continued to remind the audience about the use of Statistical Theory in the development of Kinetic Theory of gases, Statistical Mechanics and Quantum Mechanics. He further mentioned its uses in the study of Population Dynamics, Actuarial Work, Bird Navigation etc. He went on to add that the Calculus of Probability is as abstract as pure mathematics with a difference that concepts are couched in terms of real life objects. In the course of his address he mentioned the impact of Neymann-Pearson Theory on the problem of Automisation of Signal detection. He added that considering the enormous amount of work transacted already in Statistics, many Scientists are still working on problems for which solutions already exist in statistical literature.

While discussing the statistical back-ground and environment of our country, he mentioned the great contribution of the University Grants Commission in maintaining the standards of Statistical Education. He pleaded for starting more Journals in Statistics for the benefit of young and dynamic research workers. He stated that research worker in Statistics should contribute on problems of importance for the Socio-Economic development of the country and added that the significance of the researcher's contribution depends upon its usefulness to as many scientific en-

deavours as possible. He also emphasised the need for having a second look at the work that has already been carried out in the context of newly emerging interdisciplinary areas such as Pollution control, Environmental management, Hydrology, Ecology and so on. He was of the opinion that this will help the specialists to solve many problems which they are facing. He also touched on the problem of computer oriented education and warned that this should not over shadow the importance of a good statistical teaching programme.

He then proceeded to discuss a few problems connected with the focal theme which includes Census data, Evolutionary process, Biological study dealing with mutation rates, Rate of decay of Evolutionary units, Epidemic models, Use of Antibiotics, Microbiology etc. He also touched upon some Environmental models dealing with Man power planning, Plantation models, Ocean temperature dynamics and its relation to acoustic signal propagation, Earthquakes etc. He concluded the address by appealing to the Government and the Statistical Community to instil the spirit of enquiry, motivation, independent thinking, originality and above all self-confidence in the newly emerging and highly dynamic community of young men and women.

Perspectives in Applied Mathematical Modelling with spectral reference to Atmospheric, Oceanic and Physiological Sciences by M. P. Singh, Centre for Advanced Studies in Atmospheric and Fluids Sciences, Indian Institute of Technology, Hauz Khas, New Delhi 110 016.

In this address an attempt has been made to highlight the possibility of application of mathematics to areas of National Priority and Frontline Research. Stress has been made for the orientation of research interests of the faculty and researchers of various Universities and Institutions towards computer oriented mathematical modelling in Atmospheric Sciences, Oceanic Sciences, Environmental Sciences, Social Sciences, other branches of fluid dynamics like Magnetohydrodynamics, Astrophysics, etc.

In this context, the work being done at the Centre For Advanced Studies in Atmospheric and Fluids

Sciences, Indian Institute of Technology, New Delhi have specifically been mentioned. This Centre has been recently set up in response to the directive from the Planning Commission and the Ministry of Education for the creation of infrastructure in areas of emerging technology during the Sixth Five Year Plan. This Centre is giving special emphasis on Mathematical modelling in Meteorology, Oceanography and related areas in Fluid Dynamics. Some of the achievements of the Centre are as follows.

The general circulation modelling of the atmospheric flows with special emphasis on the Indian Summer Monsoon motivated the scientists of the Centre to develop a global model. The model is named as the Monsoon General Circulation Model (MGCM) and is installed on the CYBER system of the National Informatics Centre, New Delhi. The model can eventually, be used both for climate simulation studies and the medium range weather prediction purposes. Very recently the model has been run successfully on real time basis during the 1985 monsoon onset period. This real time experiment was performed with the help of operational scientists of the India Meteorological Department.

A numerical model has been developed for the prediction of storm surges associated with severe cyclones in the Bay of Bengal and Arabian Sea. The model is presently being used on real time trial basis to examine its feasibility in operational forecasting.

A static model (the so-called Gaussian plume model) has successfully been used to determine the concentration of SO_2 in the city of Agra and Delhi due to domestic sources. The model has also been used for determining the concentration of carbonmonoxide due to varying traffic pattern in Delhi. A mathematical model has also been developed and used successfully in computing the concentration of MIC which leaked out of the Union Carbide Plant in Bhopal.

The research in cardiovascular Fluid Dynamics is motivated by the desire to understand the origin and propagation of the arterial disease – atherosclerosis. The mathematical modelling study suggests that fluid dynamics of the blood flow is responsible for the deposition of fatty particles at some preferred sites on the arterial wall.

Models based on the physical laws for the combination of physiological gases with blood have also been developed for determining the amount of O_2 and CO_2 carried out by haemoglobin.

Chemistry

Aspects of Bio-inorganic and Bio-organic Chemistry related to Environmental Pollution by M. M. Taqui Khan, Central Salt and Marine Chemicals Research Institute, Bhavnagar 364 002

The industrial progress of man in the present century has brought him enormous dividends in terms of comforts of life and other amenities. Thus humanity has seen a spectacular increase in food production, exploitation of various resources on the earth crust and the sea and larger and quicker methods of transportation. The negative implications of industrial growth however has been two factors that have affected the society and the environment. The first factor is the very nature of an industrial product which may be hazardous in nature; like radioactive substances, chlorine or more recently the MIC gas in the Bhopal disaster. Secondly, any major industrial operation is associated with the waste material that has to be disposed off. If this is done without a thought to the capacity of the environment to absorb and disperse safely this material, the result is an ecological disaster and impairment of the quality of life of the community. Uncontrolled disposal of waste has polluted many rivers and destroyed the marine life. The gaseous discharge from large factory complexes pollute the atmosphere and seriously effect the flora, fauna and the health of the inhabitants.

The chemical aspects of environmental pollution mostly deal with the build up of the concentration of toxic compounds in the environment. This causes disturbance in the echo system in terms of an increase in the concentration of toxic metal ions and organic compounds beyond their natural levels in plant and animal life as well as air, water, soil and sediments. There are three general routes by which man has disturbed the natural balance through pollution.

1. The introduction of abnormal amounts of metal ion and metal complexes of toxic elements like mercury, lead and cadmium in one or more parts of the ecosystem referred to as the bio-inorganic aspects of pollution.
2. The introduction of synthetic compounds like pesticides, toxic effluents or abnormal level of natural organic compounds in the system, referred to, as the bio-organic aspects of pollution.
3. The introduction of toxic gases like carbon dioxide, oxides of sulfur and nitrogen in the atmosphere, depletion in the level of ozone and hazardous radio-chemical and photochemical changes in the atmosphere.