

SUMMARIES OF ADDRESSES OF PRESIDENTS OF SECTIONS INDIAN SCIENCE CONGRESS, DELHI, 1947

POSSIBLE APPLICATIONS OF THE FUNCTIONAL CALCULUS*

STARTING with a single valued function $f(x)$ defined in the closed interval $(0, 1)$, the President outlines the construction of a vector-space of an enumerable infinity of dimensions. Introducing a general concept of integration over a permissible class of sets, the President dealt with the construction of sets of normal orthogonal functions $\phi_1, \phi_2, \dots, \phi_n, \dots$ and the expansion of a suitable function f as a linear combination $\sum a_n \phi_n$. The concept of distance in the function space is introduced in the form $D^2(f, g) =$

$$\int \int K(x, y) [f(x) - g(x)] [f(y) - g(y)],$$

where $K(x, y)$ is a kernel which may be symmetric or non-symmetric. Writing this right side as $\int (f - g) \times (f - g)$, where the operator Xf is defined as $\int K(x, y) f(y)$, integration being with respect to y , a few properties of this operator are set forth.

Some applications of these ideas to statistics, harmonic analysis, etc., are hinted, but we must wait to study in detail when the author publishes his theory in full, and works out the intended applications on a comprehensive scale.

The Indian Science Congress Session and its Proceedings have begun to attract scientists the world over, and it is not in the fitness of things that such Presidential Addresses are printed and got up in such a poor way as to make it an ordeal to read through it. The proofs were not corrected by the author, and a number of errors, printing and otherwise, have crept in.

C. N. S.

* Summary of Presidential Address delivered by Prof. D. D. Kosambi, to the Section of Mathematics, 34th Indian Science Congress, Delhi 1947.

DESIGN OF EXPERIMENTS*

"STATISTICS is a young science ... and its potentialities for the advancement of human knowledge and welfare are as yet largely unrealised and unexplored", said Mr. R. C. Bose in his Presidential Address to the Statistics Section. The address is a comprehensive survey of the subject "The Design of Experiment" as it stands to-day with all its theoretical developments, practical applications and unsolved problems necessitating the active interest and patient researches of mathematicians. At the very outset the important problems of theoretical statistics, viz., heterogeneity of the material, graduation of data, sampling from populations, distribution and estimation of parameters, and testing of hypothesis are vividly explained and work done so far in these fields are briefly indicated. After defining his subject design as "The problem of determin-

ing 'Optimum' allocation of the experimenter's resources in the collection of the observations", he explains the problem (of design) clearly and shows that the treatment effects to be studied or compared are only linear functions and so are problems in linear estimation; there follows a brief account of the theory of linear estimation from the point of view developed by himself and its connection with the analysis of variance and the well-known Student's t - and Fisher's z -distributions. Based on these ideas the general theory of the analysis of experimental design is developed. Further we have a complete review of the work done so far in the field of balanced incomplete block designs which have been developed in order to overcome "insensitiveness" and to meet economic considerations. Reference is also made to partially balanced incomplete block designs, Latin square, complete and partial Youden square designs. A short peep into the region of factorial designs and confounding forms the finishing touch to this brief picture. In conclusion, a moving appeal is made for establishing a "fruitful co-operation between the experimenter and the applied worker on one hand and the theoretical and mathematical statistician on the other".

M. C. SATYANARAYANA.

DISORDER IN ATOMIC ARCHITECTURE*

IN his Presidential Address, Prof. Banerjee dealt with the results of X-ray investigations of atomic derangements in crystals which have not been completely understood as yet. After giving a brief review of the experimental work carried out up to the present on the extra reflections in X-ray photographs as well as of the various theories proposed to explain them, the author describes the results obtained by him with crystals of phloroglucine dihydrate and benzil.

In the case of phloroglucine dihydrate the extra reflections are extremely sharp. The central parts of the spots are blank indicating thereby that the central part of the crystals do not show the effect, although the X-ray reflecting power is uniform throughout the entire portion of the specimen. The spots corresponding to $h = 0$ or $k = 0$ are absent. The observed features of the extra reflections in phloroglucine dihydrate cannot be explained satisfactorily on the basis of either the thermal theory or the theory of crystal defect. Prof. Banerjee gives a satisfactory explanation of the observed phenomena on the basis of the modified Raman theory. The extra reflections arise from the excitation of infra-red oscillations by the incident X-rays. The sharpness of the spots in this particular case indicates that the phase waves travel along the c -axis, while along directions normal to the c -axis the atoms should all vibrate in identical phases. This can happen only if one postulates that the

* Summary of Prof. R. C. Bose's Presidential Address to the Section of Statistics, Indian Science Congress, Delhi, 1947.

* Summary of Prof. K. Banerjee's Presidential Address to the Section of Physics, Indian Science Congress, Delhi, 1947.

infra-red oscillations excited by the incident X-rays induce same elastic waves travelling along the c-axis. The absence of the expected spots lying on the axial lines in the Laue photographs taken with the X-ray beam along the c-axis can also be satisfactorily explained by the modifications of the Raman theory suggested above.

In the Laue photographs of benzil taken with monochromatic X-ray beam along the trigonal axis of the crystal continuous lines appear where the layer lines would appear if the crystal were rotated about its three-fold symmetry axes. Similar continuous lines have also been observed in Laue photographs with the X-ray beam along the [1010] and [1120] directions. These results are suggestive of the existence of derangement waves lying along the planes normal to [1010] directions as well as along the basal plane though not so densely. The extreme sharpness of these lines indicates that the derangement waves lie strictly along these planes or have extensions in two dimensions. The continuous lines may, therefore, be considered as extra reflections due to two-dimensional derangement waves. Another feature observed in the case of benzil is the absence of the continuous lines corresponding to the zero layer lines. These facts are explained by Prof. Banerjee on the basis of the Raman theory with the same modification, viz., that the lattice oscillations that are generated inside the crystal due to absorption of X-rays generate elastic waves and the phases of the oscillations over different regions of the crystal are regulated by these elastic waves. It is necessary to suppose that in a crystal such an oscillation may be set up along certain discrete directions, and that elastic waves may be propagated along certain restricted directions.

SOME ASPECTS OF DHARWAR GEOLOGY WITH SPECIAL REFERENCE TO MYSORE STATE*

IN this address Prof. C. S. Pichamuthu has attempted to give a picture of the conditions which probably existed during the Dharwar Period. The Dharwars occur at the present time in isolated strips, remnants of a formation which must once have covered a large portion of Peninsular India. They exhibit variations in stratigraphic succession, dislocations on a gigantic scale, and differences in metamorphic grade, and so the problems presented by them are very complicated and difficult. A most intriguing question that arises whenever we deal with this ancient formation is, whether the Dharwar are the oldest, or whether they were laid down on some pre-Dharwar rock. Prof. Pichamuthu does not consider the Lower Dharwars as the earliest formed rocks. The existence of current bedded quartzites in the Lower Dharwars, and the pebbles of gneiss in the conglomerates of the Middle Dharwars indicate, according to him,

the existence of a Pre-Dharwar gneiss which formed the Dharwar basement.

He next traces the history of the development of the idea of the sedimentary origin of the constituents of the Dharwar Schists of Mysore, and suggests that in the Dharwars of Mysore, two distinct sedimentary cycles can be recognised. Each orogenic revolution is accompanied or followed by abyssal injection and volcanic action, and the Dharwars of Mysore illustrate this feature very well, for at the close of each sedimentary cycle there are instances of vulcanism. Leaving aside the probability of a Pre-Dharwar granitic intrusion, Prof. Pichamuthu is of the opinion that there were three separate granitic eruptive epochs, one at the closing stages of the Middle Dharwars, the other at the end of the Upper Dharwar period, and a third which was a very much later one, comprising the Cloppet granite and similar pink porphyritic granites.

The Dharwar period covers several million years and so variations in climate are to be expected. There are evidences of both warm climate and an intensely cold spell.

In referring to the life during the Dharwar Period, mention is made of the occurrence of blue green algae in some cherts.

The discovery of current bedding and graded bedding in the Dharwars of Mysore has opened out new possibilities of working out the complicated tectonics of these rocks.

The topography of Mysore is dependent on the geology of the State and the Dharwar rocks have had a great influence in developing the major landscape features. The ferruginous quartzite which is one of the constituent rocks of the Dharwars is very resistant to weathering, and this explains why the Dharwar Schist region which occupies only one-sixth of the area of the State contains many of the biggest hill ranges in contrast to the Peninsular gneiss region which has reached the stage of peneplanation with only occasional monadnocks. The trend of the Dharwar Schists has also greatly influenced the drainage pattern of Mysore State.

Adequate stress has not so far been laid in Mysore on the stratigraphical and structural aspects of the Dharwars. Textural and structural features such as current bedding, ripple marks, graded bedding, intraformational folds and drag folds will doubtless shed light on stubborn tectonic problems, and help in the correlation of rocks composing the widely scattered outcrops belonging to the Dharwar System. Petrofabric analysis is a technique which is bound to be very useful in this study.

The question of the ages of the different igneous intrusions in the Dharwar period is another important problem which has not as yet been investigated. Radioactivity data and principles afford a mode of attack. Heavy mineral analysis is also a valuable aid for correlating rocks of the same period of intrusion, and for separating suites of rocks of different ages.

The address concludes with the note that while a great deal of work has been done on the Dharwars, much remains yet to be accomplished, for problems which appeared to be

* Summary of Dr. C. S. Pichamuthu's Presidential Address to the Section of Geology and Geography, Indian Science Congress, Delhi, 1947.

relatively simple, gather greater complexity as knowledge progresses.

MORPHOLOGY OF THE GYNÆCIUM*

ADDRESSING the Section of Botany, Professor Joshi has covered the welter of controversy in which the morphology of the gynæcium is shrouded. The approach to the problem has lain along varied paths and the number of theories is legion. It is significant that among these, the concept of the Poet-Philosopher Goethe has weathered the storm of controversy and stands to-day with the widest measure of support. Known to botanists as the "Classical Theory" Goethe's doctrine would have the leaf as a morphological constant from which all the other appendages of the stem have arisen. The carpel is equivalent to a leaf folded upwards along its mid-rib and bearing ovules on its incurved margins which unite to form the ventral suture. Evidence for this has come from carpels of several plants and Professor Joshi's observations lead him to believe that the fusion of the carpellary margins can be noticed in the early stages in nearly all carpels, while in *Boerhaavia*, it persists to the fruiting stage. Thomas' suggestion that one should look for the progenitors of the modern carpel in the reproductive organs of the Caytoniales, and the theory of Carpel Polymorphism have both come in for withering criticism. The inferior ovary is now believed to be of an appendicular nature having arisen by a concrescence of the basal portions of the calyx, corolla, stamens, and the ovary and Professor Joshi working on the *Amaryllidæ* has made notable contributions in this field. In a reference to the different form of ovules in the Angiosperms, Professor Joshi visualises that mechanical pressures exerted during development along with mutations have together determined the varied types.

K. V. SRINATH.

* Summary of Prof. A. C. Joshi's Presidential Address, to the Section of Botany, Indian Science Congress, Delhi, 1947.

SOME PROBLEMS OF INDIAN ANTHROPOLOGY*

"ONE conviction", says Dr. Karve, "which is forced on every worker in India is that nothing whatsoever is lost either physically or culturally in the peculiar way in which Indian culture is shaped. The primitive lives check by jowl with the latest and the most sophisticated. The unbounded tolerance for other customs, other dresses, other faces and other gods, has resulted in a culture which adds to its repertory of cultural and physical features and never destroys anything deliberately. The process of elimination of the old and the adoption of the new goes on very slowly and never hits the whole population simultaneously. We

have the curious phenomenon of castes and tribes following their age-long customs in the midst of the modern world, not because they have no knowledge of the new, but because they think that their way of life is as good as any other. They represent, thus, petrified history and give clues about the time and origin of their migration as about their physical affinities. As social reformers, too eager to impose our standards of life and morals on unlettered communities, we may deplore this vast and varied panorama of social life, but as ethnologists and anthropologists we must make the most of this unique opportunity to record all customs, speech, songs and physical types. An accurate record of this type will help to unravel human history. It will also help a nation which is eager to govern itself, by giving an idea of the mechanism of cultural transformations, about the relativity of moral ideas, about the whole social process it may wish to influence or change."

With very few exceptions, Indian ethnic history has been one of receiving peoples; India has not been a corridor of migration but a blind alley. The main routes of folk and culture migrations were well defined even during the Puranic and historic times. The middle Indian highlands are not so much to be regarded as culture barriers, but as regions of culture contact between the northern and southern cultural areas. Along with several common elements of culture, these two regions have significant differences, particularly in the matter of kinship usages. Light is thrown on the problems of culture contact by the study of migrations and movements of the various beginning with the Brahmins. This leads on to the crucial question whether and how far the bearer of the different caste names are ethnically different as most of them seem to be. The answer to this big question demands more of intensive work both in physical and social anthropology. As a result of the regional surveys of blood groups made so far it has been found, broadly speaking, that there are regions and communities where groups O, A and B are concentrated. A thorough survey of the castes and sub-castes in the Gangetic region "may lead to the pinning down of the B blood group to its proper racial element and to its proper region." The Indian caste system, which is an unmitigated evil socially, provides opportunities for intense research to anthropologists and geneticists. Each caste claims blood relationship of all its members and in the case of the smaller castes the blood tie is no doubt true. The feeling of belonging together is sometimes the result of a caste profession or of common traditions. Different castes may have originated from a common stock or they may have sprung from different stocks altogether. Genetical investigations will, therefore, have to be checked and verified in the light of cultural and historical background. Hence the need for anthropologists taking up this line of investigation. The vast and urgent task awaiting the anthropologists in this country require far greater resources both in men and money.

A. AIYAPPAN.

* Summary of Mrs. I. Karve's Presidential Address to the Section of Anthropology and Archaeology, Indian Science Congress, Delhi, 1947.

PSYCHOLOGY AND THE REHABILITATION OF HUMAN SOCIETY*

PROFESSOR NAIDU'S address begins with the observation that the present is the most critical period in the history of human race and compared with the magnitude of the disaster which is threatening the world to-day, the crises in the past history of man pale into insignificance. He is of the view that the phenomenon of war as such is not disquieting, but the regularity and the frequency with which humanity is seized with it, that is really most disquieting. The advance of civilization has helped only to retain the methods by which nations seek the blood of brother nations. At the slightest pretext one nation flings itself at the throat of the other in a fratricidal war; and we are led to ask the question, "What is the remedy?"—if there is any remedy at all for all these ills. The answer is, "There is hope for man yet; and that hope comes from psychology."

The professor is of the view that in days gone by people had intuitive or mystical knowledge and that was enough to keep man free from mischief; but science, which came later, in fullness of time, destroyed spirituality and mysticism and failed to put anything in their stead. To quote the professor, "The rudder has been broken, the ballast thrown overboard, while the winds on the sails are being blown into ferocious violence. The vessel is heading towards the rock and something must be done and done at once to save man from disaster."

There is an encouraging sign, however, and that is, scientists are steadily realising the need for a reorientation of the values of science. The tendency on their part to speak of the social functions of science and to assess scientific achievement in terms of human values is growing steadily. It is being realised both by scientists and political thinkers alike that there is a lag between the achievements of man's brain and the deeper promptings of his heart. There is, no doubt, a feeling among scientists that by reshuffling the environment, human nature may, somehow, be improved; but it is not realised that without understanding the psychological forces, governing human behaviour, it will be impossible to plan for the improvement of human society. It is, therefore, recommended that in all plans for the future ordering of human society, the findings of applied, experimental and depth sections of psychology should be accorded the place of prime importance. That is, the science of man should be accorded the place that is due to it.

It is stated that the science of psychology prescribes the three grades of Efficiency, Happiness and Self-realisation as worthy of pursuit by man. "Efficiency relates to the body and the spiritual levels of mind, happiness to the deeper mental levels, and self-realisation to the total personality and to the whole being of man." In general, psychology suggests the methods by which human society can be rehabilitated. Applied and experimental psychology will help man to attain efficiency, depth psychology, the attainment of happiness and the

spiritual psychology, the realisation of the highest goal of self-realisation.

A plan is then suggested for achieving the efficiency in our National life. An extensive nation-wide survey of the abilities of the boys and girls of all ages and grades, who are now at school, should be undertaken. Along with the medical inspection of children, the listing of intelligence also must be carried out. In the medical inspection charts the results of mental test should be recorded. To prepare the test-material in the various Indian languages, there should be a central Psychological Research Organisation set up. For discovering the innate capacities of children of school-going age tests of special ability should be prepared and applied. By annual re-testing an anxious watch should be kept on the way his ability unfolds itself. In the High School or Polytechnic stage, steps should be taken to train and develop the latent capacity according to strict psychological methods. The data gathered from the psychological tests of intelligence, abilities and temperaments should be subjected to the most up-to-date statistical treatment and the profile drawn for the individual. Job profiles, also, should be carefully prepared. Then remains the task to fit the individual to the job best suited to him. This will account for the attainment of the goal of efficiency. There is, then, need for bringing into being an Indian Institute of Industrial and Applied Psychology. This body will frame and standardise tests and will be charged with the task of organising a Psychological Survey of India. In fact, it will conduct field work on human engineering. Finally, a National Council of Psychology should be entrusted with the task of eliminating avoidable wastage, pain and misery in human society.

Sentiment-building is the process by which culture—individual or racial—comes into existence, and it is here that we must look for happiness. By a process of reasoning, the professor concludes, that no one can hope to plan for happiness by reshuffling the economic structure of society, if he does not have a firm grasp of the psychological forces, which control the economic life of man. He pleads for a psychological orientation of all plans for economic and industrial reorganisation for the reform of society and for educational re-orientation and above all for banishing war. To achieve this it is suggested that a National Psycho-Analytic-Psychiatric Service should be brought into being. Extension Lectures and training in depth psychology should be organised. In fact, the utility of preventive psychotherapy in the daily life of the civilised citizen should be realised.

Finally, for the attainment of self-realisation, which is the final goal of human life, the steps to be followed are also suggested. They are faith in divinity, then the company of holy men and then concentration, meditation and prayer, then taste for spiritual enjoyment, then attachment for the Lord followed by divine love, the final realisation.

Thus the address was a passionate plea for the study of psychology and application of its results and methods as a remedy for the various ills man is subjected to in the present day and for the proper rehabilitation of human society on sound lines.

* Summary of Prof. P. S. Naidu's Presidential Address to the Section of Psychology and Educational Science, Indian Science Congress, Delhi, 1947.