

THE INDIAN STATISTICAL INSTITUTE

SEVENTH ANNUAL REPORT: 1938-39

The year under review has witnessed a great deal of extension of the activities of the Institute in various directions.

INDIAN STATISTICAL CONFERENCE.

The second session of the Indian Statistical Conference was held at Lahore from the 8th January, 1939 to the 24th January, 1939, in close co-operation with the Indian Science Congress. The Conference was opened by His Excellency Sir Henry Duffield Craig, K.C.S.I., Governor of the Punjab, and was presided over by Dr. T. E. Gregory, U.S.C., Economic Advisor to the Government of India. The Lahore session was largely attended and was considered highly successful in every way. A short report is given in the form of an appendix. A detailed report of the Conference with full Proceedings will be published shortly.

RESEARCH WORK.

It has always been the policy of the Statistical Laboratory and Institute to emphasize the fact that statistics is an applied science, and that its ultimate justification lies in the promotion of human welfare. We fully recognize the importance of fundamental research but our aim is to develop the mathematical theory in actual relation to practical problems. The work in Calcutta has been developed in conformity with this principle. Although grants are received from different sources (and in certain cases not directly in the name of the Institute) the research and technical work is organized on a unitary basis.

Improvement of the Jute Forecast. During the year under review extensive researches have been carried out in the field as well as in the Statistical Laboratory in connexion with the improvement of the Jute forecast. The economic importance of the question can scarcely be exaggerated as jute and cotton form the two chief items in the export account of India. The price of jute, more than any other single factor, controls the prosperity of agriculture, and hence of commerce and industry in Bengal. Existing methods for the preparation of the jute forecast are known to be thoroughly unreliable; and the need of improving the estimate has been recognized for a long time.

On an average more than seven million (or seventy lakhs) of individual plots are sown with jute each year. These plots, however, do not occur in compact blocks; but are scattered among about 120 million (or twelve crores) of other plots covering an area of over fifty-five thousand square miles. In this situation, a complete enumeration by direct inspection of each of these 120 million plots is out of the question. It would require an army of eight or ten thousand men and would cost at least twelve or fifteen lakhs of rupees, while the results would be thoroughly untrustworthy.

The Statistical Institute, therefore, suggested using the method of a sample survey in which only a very small fraction (of the order of one or two per cent of the plots) would be enumerated at random. The Government of Bengal and the Indian Central Jute Committee accepted the proposal and decided to explore the possibilities of the sample survey. An Experimental Crop Census was organized in 1937 and a larger field survey in 8 districts was conducted in 1938; model sampling experiments as well as detailed analysis of the data collected during the field survey were then carried out in the Statistical Laboratory. The results obtained were distinctly promising, and work has already started on a scheme for a random sample survey to be conducted in Bengal in 1939 at an estimated cost of about eighty thousand rupees.

Although the whole of the work in 1937 and 1938 was done in the Statistical Laboratory and the entire responsibility rested on us, the scheme was conducted in the name of the Jute Committee. From our point of view this arrangement was not satisfactory; and after a great deal of negotiations with the Jute Committee and the Government of Bengal it has been finally settled that the Statistical Institute should undertake the complete responsibility for the statistical portion of the work, and a block grant of Rs. 35,000 has been sanctioned for this purpose. The details of the present arrangement were considered and settled at a meeting of the Council held on the 9th February, 1939.

Flood Problems in Orissa. The Hon. Secretary had submitted some time ago a comprehensive report on rainfall and floods in Orissa; and the Government of Orissa have been taking a good deal

INDIAN STATISTICAL INSTITUTE

of interest in this work since 1937. During the year under review the Hon'ble Mr. Kanango, Minister-in-Charge of the Irrigation Department, Mr. A. Vipan, Chief Engineer and Mr. J. Shaw, Special Flood Officer, Orissa came to the Statistical Laboratory and discussed various questions in the present connection with the Hon'y. Secretary; and Mr. Lingaraj Das, Assistant Engineer, was sent on deputation to the Statistical Laboratory in March, 1939, to study some of the technical problems. The Government of Orissa have also expressed their appreciation of the work done in this connection in the form of a resolution from which an extract is given below:—

"Professor F. C. Mahalanobis, Calcutta, at the request of the Government of Bihar and Orissa, undertook the preparation of a report on the complete study of rainfall and floods in Orissa and the report is now in the hands of the printers. * * * * * Professor Mahalanobis has completed this monumental work covering about 535 pages and about 180 maps and diagrams which the Government of Orissa think will be a classic of such work in India. * * * * * The Government of Orissa are indebted to Professor Mahalanobis who has done this work free of charge on his part. The preparation of a report on Orissa Floods in his spare time, has of necessity taken some years and it will be some months yet before the report is finally published; but the Government of Orissa wish to take this opportunity of thanking Professor Mahalanobis and expressing their high appreciation for his great work, study and self-sacrifice in producing the report, which it is believed, will be of great value to the Orissa Province and also to India as a whole.

River Problems in Bengal. The Hon'y. Secretary was appointed a member of the Conference on River Problems convened by the Government of Bengal in Calcutta in July 1938. Among other recommendations the Conference unanimously supported the proposal that necessary arrangements should be made for the systematic statistical analysis of data relating to rainfall, irrigation, flood and drainage.

Economic Statistics. At the request of the Government of H. H. the Maharaja Holkar of Indore, a detailed scheme has been prepared for an enquiry on a random sample basis into the family budgets of textile workers in Indore with a view to the construction of a cost of living index.

During the year under review a good deal of help was also given to the recently started Bureau of Economic Intelligence of the United Provinces, especially in connection with an enquiry into the family budget and housing conditions of working men in Cawnpore and certain enquiries into the standard of living of cultivators in villages. At the request of the Government of the United Provinces the Hon'y. Secretary went to Lucknow for three days in January, 1939 to discuss various problems in connection with the statistical work of the province; and attended a special conference of Government officers which was convened in Lucknow for this purpose. As a result of these discussions several schemes have been already prepared and are under consideration by the U. P. Government.

The Hon. Secretary has been re-appointed a member of the Bengal Board of Economic Enquiry; and the question of taking up an enquiry into the family budget of textile workers in Bengal with the active co-operation of the Institute is under consideration.

Work has been continued under the guidance of Dr. H. Simha on various economic questions such as the exchange ratio and the Indian foreign trade.

Agricultural Statistics and Design of Experiments. Systematic studies in the design of experiments have been conducted in various directions. A new mathematical method of constructing Hyper-Graeco Latin Squares has been worked out, and the method of constructing symmetrical incomplete block arrangements have been completely systematized, leading to the solution of further new designs. Generalized types of designs which include as special cases Yates's incomplete balanced block designs and quasi-factorial designs with equal or unequal block sizes, are being investigated; and the concept of generalized interaction in the case of the 2^s design has been extended to include all symmetrical designs of the type S^s , where S is a prime or a power of a prime. A new method of estimating mixed-up yields in a field experiment and performing exact tests of significance for the treatment effects has also been worked out.

A large amount of work was done on the analysis and interpretation of field experiments. A number of schemes and sampling programmes were as usual prepared for various purposes such as crop-cutting experiments, survey of sugarcane pests and borers etc. Complex experiments and quasi-factorial designs on various crops were also analysed and interpreted. The Hon'y. Secretary attended the meeting of the Advisory Board of the Imperial Council of Agricultural Research in November, 1938 and served on various committees.

ANNUAL REPORT FOR 1938-39

Anti-malarial Work. A detailed report was prepared on the basis of field data collected in course of anti-mosquito experiments organized by the Bengal Department of Public Health with a view to ascertain the usefulness of certain special apparatus for the control of malaria.

Diet Survey in Calcutta. With the help of a special grant a diet survey on a random sample basis covering about 1400 families in Calcutta was completed during the year under review. It is hoped that the survey would yield results of considerable practical usefulness.

Theoretical Statistics. Work on the D^2 -Statistic has been continued, and a simple elegant method of obtaining the distribution of the Studentized form of the statistic has been obtained. The importance of our previous work has been recognised in generous terms by Prof. R. A. Fisher in an authoritative article in a recent issue of the *Annals of Eugenics* (VIII, 1938, 276-286) in which he has linked up our work on the generalized distance with his own work on the discriminant function. Tables for the Studentized form of the statistic are proposed to be constructed, for which a scheme has been submitted to the Imperial Council of Agricultural Research. A list of papers published or completed during the year is given in Appendix I.

GRANT FROM THE GOVERNMENT OF INDIA

The Government of India had made provision for an increased grant to the Institute in the budget for 1938-39; owing however to the sudden deterioration in the financial situation the proposed increment was kept in abeyance. The Hon. Secretary made personal representations in this matter to a number of high officials of the Government of India; and we are glad to report that the Government of India have been pleased to restore the grant from the current year. The conditions of the grant remain practically identical; but the Government of India have expressed a desire to nominate two members instead of one member of the Standing Committee for Research. This proposal has been already accepted by the Council.

During the year under review some of the research workers of the Institute were engaged in the Jute Census scheme and were paid out of the funds provided for this purpose. The expenditure on the research staff paid directly out of the general fund of the Institute has therefore been comparatively small this year.

The Standing Committee for Research consisted of the following members during the year under review.

Dr. G. S. Bose, *Professor of Psychology, Calcutta University*; Prof. S. N. Bose, *Professor of Physics, Dacca University*; Mr. P. H. Carpenter, *Chief Scientific Officer, Tocklai Tea Experimental Station, Assam*; Col. A. C. Chatterjee, I.M.S., *Director of Public Health, Bengal*; Prof. K. B. Mahava, *Professor of Statistics, Mysore University*; Dr. John Mathai, *Director General of Commercial Intelligence and Statistics, Delhi-Simla*; Dr. C. W. B. Normand, *Director General of Observations, Poona*; Mr. T. J. Y. Roxburgh, I.C.S., *Judicial Secretary, Bengal*; Col. A. J. H. Russell, *Public Health Commissioner with the Government of India* (nominated by the Government of India); Prof. N. R. Sen, *Ghosh Professor of Mathematics, Calcutta University*; Dr. H. Sinha, *Calcutta University* with Prof. P. C. Mahalanobis as Secretary of the Committee.

STATISTICAL ESQUIMES.

As in the previous years, a large number of inquiries from all parts of India were attended to during the year under review. The distribution by subjects and by provinces is given below:—

By Subjects—Agriculture 75; Anthropology 2; Economics 18; Irrigation 7; Mathematical Statistics 3; Medical 22; Psychology 6; Miscellaneous 6; Total 136.

By Provinces—Assam 4; Bengal 96; Bihar 2; Bombay 1; Madras 2; Orissa 2; Punjab 5; United Provinces 20; Sind 1; others 6; Total 136.

ADVANCED WORKERS.

The year under review has been particularly notable for a rapid increase in the number of officers and advanced workers from different parts of India coming on deputation to the Statistical Laboratory for training. A complete list is given in Appendix 2. The total number of workers for whom accommodation could be provided was 27; and the total amount of tuition given was 163 man-months, so that the average attendance was about 9 men per month on an average. A large number of applications had to be refused, however, owing to lack of accommodation and other facilities for training.

INDIAN STATISTICAL INSTITUTE

DR. SIR BRAJENDRA NATH SEAL, 1864—1938.

There were two heavy losses by death during the year under review. Sir Brajendra Nath Seal, who was Honorary Member of the Institute since his inscription in 1931, died in Calcutta on the 3rd December, 1938. He was born in Calcutta on the 3rd September, 1864, and very early acquired a unique reputation as a most versatile and erudite scholar and philosopher. He had a deep knowledge of the mathematical theory of probability and statistics which he considered to be the foundation of inductive inference in science. He initiated statistical researches on modern lines in Calcutta in 1916 when he was holding the chair of philosophy in the Calcutta University. This served to create a small nucleus for statistical work which later developed into the Statistical Laboratory and Institute. When he became the Vice-Chancellor of the Mysore University he created a special chair for Mathematical Economics and Statistics, the first and up till now the only chair of its kind in India. In spite of failing health he continued to take an active interest in the work of the Institute as long as he was alive. An obituary article will be published shortly in *Sankhyā*.

SUBHENDU SEKHAR BOSE, 1906—1938.

Subhendu Sekhar Bose, a member of the Council of the Institute, was born in 1906 in a village near Calcutta. After a brilliant academic career he took up the study of Statistics seriously in 1930, and joined the Statistical Laboratory as a scientific assistant in 1931, and was its most active worker up to the time of his sudden death after an emergency operation on 2nd November, 1938. He published about 25 papers on theoretical and applied statistics and in 1935 was awarded the Fremchland Roychand Studentship of the Calcutta University for statistical researches. In one sense even more important was his contribution to the organisational side. In recent years he was in effective charge of the training section, and thus came into personal contact with most of the statistical workers of his generation in India. He was a pioneer in the statistical movement in India, and without his help the Statistical Laboratory and Institute could never have attained its present position.

A memorial meeting was held in the Statistical Laboratory on the 7th November, 1938. A memorial fund was opened at the same time to which about Rs. 1,500/- have been contributed so far. A sub-committee has been appointed by the Council to prepare a scheme. A special memorial article will be published in the next issue of *Sankhyā*.

VISITORS.

As in the previous years a large number of distinguished visitors came to see the work of the Institute, among whom may be mentioned:—

Mr. S. Basu, I.C.S. (Secretary, Imperial Council of Agricultural Research, New Delhi); Sir Edward Bentall, Kt.; Mr. J. R. Blair, I.C.S. (Secretary, Communication and Works Department, Bengal); Mr. M. O. Carter, I.C.S. (Director of Land Records, Bengal); Col. A. C. Chatterjee, I.M.S. (Director of Public Health, Bengal); Dr. Arthur Geddes (University of Edinburgh, Scotland); Dr. F. C. Ghose; Mr. H. Graham, I.C.S. (Secretary, Agriculture and Industries Department, Bengal); Mr. P. J. Griffiths, I.C.S. (Retd.), (Vice-Chairman, Indian Tea Market Expansion Board); Mr. A. Hughes, I.C.S. (Joint Secretary to the Government of Bengal, Department of Commerce and Labour); Mr. C. C. Inglis (Director, Central Irrigation Research Laboratory, Poona); Mr. H. V. Kaneth, I.C.S. (Retd.), (Co-ordination Officer of the Indian Nations' Congress); The Hon'ble Mr. Nityamanda Kansugo (Minister, Government of Orissa); The Hon'ble Mr. Tanviruddin Khan (Minister, Government of Bengal); Mr. D. MacPherson (Secretary, Communication and Works Department, Government of Bengal); Mr. S. C. Majumdar (Chief Engineer, Irrigation Department, Bengal); The Hon'ble Maharsia Sris Chandra Nandy (Minister, Government of Bengal); Mr. S. N. Roy, I.C.S. (Deputy Secretary to the Government of Bengal, Finance Department); Mr. Jola Sargent (Educational Commissioner with the Government of India, New Delhi); Mr. J. Shaw (Executive Engineer, Orissa); Mr. P. G. Shaw (Chief Auditor, East Indian Railway); Mr. H. R. Stewart, I.A.S. (Officiating Agricultural Expert, Imperial Council of Agricultural Research, New Delhi); Mr. A. Vipra (Chief Engineer, Irrigation Department, Orissa).

BRANCHES OF THE INSTITUTE.

Poona Branch. We are giving below extracts from the Poona Branch sent by Principal D. G. Karve, who was in charge of the Branch throughout the year as the Local Secretary.

The Branch organized classes in elementary statistical methods during January, 1939. Prof. G. L. Chandrotreya, B.A. (Cambridge), Professor of Mathematics in the Fergusson College, Poona,

ANNUAL REPORT FOR 1938-39

was kind enough to give a course of four lessons which was attended by a large number of research workers employed in educational institutions and government departments. The best thanks of the Branch are due to Prof. Chandratreya for his valuable help.

Our best thanks are due to the Government of Bombay for supplying the Branch with free copies of a large number of their periodical publications. The publications are of great assistance to workers associated with the Branch and are being suitably reviewed in *Sankhya*.

The total membership continued to be the same as last year's, viz., 12 Life-members and 2 Local Associates. Prof. V. G. Kale was re-elected as Chairman and Principal D. G. Karve as Secretary for the year.

Lahore Branch. The Hon'ble Mr. Manohar Lal, Finance Minister of the Punjab, continued to be the Chairman and Dr. N. K. Basu, the Hon. Secretary of the Lahore Branch. The Hon'ble Mr. Manohar Lal kindly agreed also to act as the Chairman of the Reception Committee of the second session of the Indian Statistical Conference held at Lahore, and it was due to the active interest taken by him and other members of the Local Branch that the Lahore session of the Statistical Conference was so successful.

Mysore Branch. Prof. K. B. Madhava continued to be in charge of the branch throughout the year. As in previous years the work of the branch was conducted in active co-operation with the Departments of Statistics, Economics and Psychology of the Mysore University.

MISCELLANEOUS.

We note with pleasure that Mr. Samarendra Nath Ray, a senior worker of the Statistical Laboratory was appointed part-time honorary lecturer in the Department of Post-graduate Teaching of the University of Calcutta. Mr. Atulranath Bose, one of the senior workers of the Statistical Laboratory, was awarded the Praelectand Roychand Studentship of the University of Calcutta. Mr. K. R. Nair, another senior worker of the Laboratory, was awarded the degree of M.Sc. in statistics of the Madras University on the strength of a thesis submitted by him.

We regret to report that Mr. M. Thomas who came here from Hyderabad in July, 1938 died of meningitis on the 29th January, 1939. He was a promising young man, and had made himself popular among his fellow workers in the Laboratory. A condolence meeting was held on the next day.

SAKHYA: THE INDIAN JOURNAL OF STATISTICS.

Four issues of *Sankhya* were published in the year under review. The scientific standard of the paper was maintained at a high level; and the number of subscribers, especially outside India, is steadily increasing. Audited accounts for the year under review are given below.

Receipts and Payments Account for the year 1938-39.

RECEIPTS.		EXPENDITURE.	
	RS. A. P.	RS. A. P.	RS. A. P.
To, Subscriptions ..	518 4 4	By Establishment ...	972 11 0
.. Advertisement Charges ..	377 8 0	.. Press Bills ...	2,311 2 9
.. Donations —		.. Postage & Stationary expenses ...	545 8 0
Prof. P. C. Mahalanobis	175 0 0	.. Papers ...	660 7 5
Mr. K. B. Malliava	100 0 0	.. Balance at Bank ...	470 3 1
	275 0 0		
.. Barmarked Grants:—			
From the Govt. of India ...	2,000 0 0		
Other Grants ...	1,700 0 0		
	3,700 0 0		
.. Contribution from Institute ...	89 4 0		
	4,960 0 4		4,960 0 4

at HASTINGS STREET, CALCUTTA.
The 20th April, 1939.

Examined and Found Correct.
P. C. NANDI & Co., Hon'g. Auditors,
Chartered Accountants,
Registered Accountants.

APPENDIX I. LIST OF PAPERS PUBLISHED IN 1938-39.

1. A Note on the Influence of Lunar Phase on the Rainfall in the month of July in Calcutta, 1878-1924. By P. C. Mahalanobis. *Sankhyā*, Vol. 3 (3), 1938, 232-238.
2. A Note on the Correlation between Results in the College and University Examinations. By D. P. Acharya and P. C. Mahalanobis. *Sankhyā*, Vol. 3 (3), 1938, 234-244.
3. On a Bessel Function Population. By Subhendu Sekhar Bose. *Sankhyā*, Vol. 3 (3), 1938, 253-261.
4. On the Distribution of the Means of Samples drawn from a Bessel Function Population. By Raj Chandra Bose. *Sankhyā*, Vol. 3 (3), 1938, 262-264.
5. On the Exact Test of Association Between the occurrence of Thunderstorms and an abnormal Ionisation. By Solsimlu Sekhar Bose and P. C. Mahalanobis. *Sankhyā*, Vol. 3 (3), 1938, 248-252.
6. A Geometrical Note on the use of Rectangular Co-ordinates in the Theory of Sampling Distributions connected with a Multivariate Normal Population. By S. N. Roy. *Sankhyā*, Vol. 3 (3), 1938, 273-284.
7. A Note on the Foot and Stature Correlation of certain Bengal Castes and Tribes. By Bhepandranath Datta and P. C. Mahalanobis. *Sankhyā*, Vol. 3 (3), 1938, 245-248.
8. A Review of the Application of the Statistical Theory to Agricultural Field Experiments in India. By P. C. Mahalanobis. (*Proceedings of the Second Meeting of the Crops and Soils Wing of the Board of Agriculture and Animal Husbandry, Government of India*).
9. The Distribution of Krishna Iyer's "Mean of Fisher's t^2 ". By K. Raghavan Nair. *The Current Science*, Vol. VII, (1), July 1938, 21-22.
10. Statistical Report on the Experimental Crop Census 1937. By P. C. Mahalanobis. (*Indian Central Jute Committee*, 1938).
11. A Note on Grid Sampling. By P. C. Mahalanobis. *Science and Culture*, Vol. IV (5), November, 1938, 300.
12. On the Application of the Properties of Galois Fields to the Problem of Construction of Hyper-Graeco-Latin Squares. By Raj Chandra Bose. *Sankhyā*, Vol. 3 (4), 1938, 323-338.
13. Relative Efficiencies of Regression Coefficients Estimated by the Method of Finite Differences. By S. S. Bose. *Sankhyā*, Vol. 3 (4), 1938, 339-346.
14. The Ratio Question—A Reply to Mr. Adarkar's Criticism. By H. and J. C. Sinha. *Sankhyā*, Vol. 3 (4), 1938, 393-404.
15. Indian Foreign Trade (1933-37): Its Relation to Exchange Rate. By H. K. Datta and H. Sinha. *Sankhyā*, Vol. 3 (4), 1938, 405-412.
16. Distribution of Studentised D^2 -Statistic. By R. C. Bose and S. N. Roy. *Sankhyā*, Vol. 4 (1), 1938, 19-38.
17. On Tippett's "Random Sampling Numbers". By K. Raghavan Nair. *Sankhyā* Vol. 4 (1), 1938, 65-72.
18. On Estimating Individual Yields in the case of Mixed-up Yields of Two or More Plots in Field Experiments. By S. S. Bose and P. C. Mahalanobis. *Sankhyā*, Vol. 4 (2), 1938, 183-190.
19. On a Method of Getting Confounded Arrangements in the General Symmetrical Type of Experiment. By K. R. Nair. *Sankhyā*, Vol. 4 (2), 1938, 121-126.
20. India through the Depression. By H. and J. C. Sinha. *Sankhyā*, Vol. 4 (1), 1938, 193-200.
21. First Report on the Crop Census of 1938. By P. C. Mahalanobis. (*Indian Central Jute Committee*, 1939).

APPENDIX 2. LIST OF ADVANCED WORKERS IN THE
STATISTICAL LABORATORY, 1938-39.

1. Mr. Parimal Roy, M.A., Lecturer in Economics, (Dacca University). May-June, 1938
2. Mr. S. P. Agarwala, M.A., LL.B., Postgraduate Student, (Lucknow University). May-July, 1938.
3. Mr. A. N. Sankaran, B.Sc. (Hons.), Department of Physical Education, (Annamalai University). June-December, 1938.
4. Mr. Bhim Sen, Defence Department (Government of India). July-September, 1938.
5. Mr. Tapobikash Bose, M.Sc., (University College of Science, Calcutta). Joined in July, 1938—still working.
6. Mr. Jagdish Chand Khosla, M.A. (through Dr. T. E. Gregory, Economic Adviser to the Government of India). July 1938—February, 1939.
7. Mr. M. Thomas, B.A., (Hyderabad State). July, 1938—January, 1939.
8. Mr. J. R. Seu Gupta, M.Sc., Meteorological Department, Alipore, (Government of India). August-December, 1938.
9. Mr. P. N. Segal, B.A., Delhi University, (on the recommendation of Dr. T. E. Gregory, Economic Adviser, Government of India). Working part-time from August, 1938.
10. Mr. Hirendra Mohan Mitra, B.Sc., (Agricultural Institute, Daulatpur). September-October, 1938.
11. Mr. Ashutosh Sen, B.Sc., (Teacher, Madani Popular Academy, Baranagar, 24-Parganas, Bengal). October, 1938.
12. Mr. A. Ananthapadmanabha Rao, B.A., (Department of Agriculture, Mysore State). November, 1938.
13. Mr. Debidas Mousmdas, M.Sc., (Calcutta University). November, 1938—January, 1939.
14. Mr. Gopal Krishna Sarcar, M.Sc., (Postgraduate Department, Calcutta University). Joined November, 1938—still working.
15. Mr. Jyotirmoy Sen, M.A., (Postgraduate Department, Calcutta University). November, 1938.
16. Mr. Nihar Kumar Sarkar, M.A., (Postgraduate Department, Calcutta University). Joined in November, 1938—still working.
17. Mr. Hemendra Nath Pal, M.Sc., Botanical Assistant, (Government of Assam). February, 1938.
18. Mr. V. G. Pendharkar, B.Sc. (Bom.), B.Sc. (London), (Sent by Principal D. G. Karve, Willingdon College, Salara). Joined in December, 1938—still working.
19. Mr. M. P. Singh, (Cotton Research Officer, Ranganwal). December, 1938.
20. Mr. Poorna Bahadur Shrestha, M.A., (Nepal State). Joined in December, 1938—still working.
21. Mr. M. P. Shrivastava, M.Sc. (Nagpur University), Joined in January, 1938—still working.
22. Mr. Kartar Singh, B.Sc., (Agricultural Assistant to the Cerealist, Punjab). January-March, 1938.
23. Mr. B. Sitaram, B.Sc. (Hons.), (Annamalai University). Joined in January, 1939—still working.
24. Mr. N. C. Ghosh, M.Sc. (University of Dacca). Joined in February, 1939—still working.
25. Mr. Srinivasan, B.A., (Madras University). Joined in February, 1939—still working.
26. Mr. S. M. Wakankar, M.Sc., (Department of Agriculture, Gwalior State). Joined in February, 1939—still working.
27. Mr. A. K. Dasgupta, M.Sc., (Calcutta University). Joined 1st March, 1939—still working.
28. Mr. Devindar Nath Phul, M.A., (through the Director of Industries, Punjab). Joined in March, 1939—still working.
29. Mr. Suprakash Sen, M.Sc., (Calcutta). Joined in February, 1939—still working.

THE SECOND SESSION OF THE INDIAN STATISTICAL CONFERENCE, LAHORE, 1938.

THE OPENING CEREMONY: 5TH JANUARY, 1938.

The first session of the Indian Statistical Conference held in Calcutta in January, 1938 with Prof. R. A. Fisher as General President was so successful that it had been decided to hold annual sessions in future. The second session was held in Lahore in the first week of January, 1938 in active co-operation with the Indian Science Congress. The Conference was opened by His Excellency Sir Duffield Craik, Governor of the Punjab, in the Hall of the Forman Christian College at 11-0 a.m. on Thursday the 5th January, 1938.

The Hon'ble Mr. Manohar Lal, Finance Minister, Punjab, and Chairman of the Reception Committee, in welcoming the delegates and guests on behalf of the Reception Committee referred to the great importance of statistics in a world growing in immensity of fact and mass of observations. Statistical analysis furnishes the only means of reaching an objective description of facts without which no progress is possible.

His Excellency Sir Henry Duffield Craik, in extending his welcome to all present, referred to the pioneer work of Prof. P. C. Mahalanobis and stated that the Punjab lagged behind other provinces in deriving full advantage from the study of statistics, but hoped that the holding of the second session of the Statistical Conference in Lahore would give a much needed impetus to statistical studies in the province. His Excellency referred to the appropriateness of the description of statistics as the "arithmetic of human welfare", and stressed its importance for the proper understandings and solution of any problem affecting the welfare of mankind, and mentioned in this connexion the most vital problem of over-population in India. He hoped that in transforming India from a poor agricultural country into a wealthy and semi-industrialized state the help of modern statistical science would be availed of to the full. With sincere wishes for a successful session His Excellency declared the Conference open.

Dr. T. E. Gregory then delivered his presidential address in which he discussed the broad problem of the relations between the statistician and the community. He first referred to the relation between the statistician and the State. There was unfortunately no longer merely a threat of the prostitution of science and scientists—the process was in full swing. Unfortunately over a large part of Europe, racialism and economic autarchy were poisoning the very sources of statistical science. Scientists could no longer afford to take a merely passive attitude. They must fight for the preservation of intellectual freedom and the spiritual value of truth and reason. The statisticians must help the State in improving the collection of information and in interpreting them. In this connexion he emphasized the importance of training and research.

He then turned to the relation between statistics and other social sciences, and pointed out the danger of substituting a mechanical process for creative thought and of drawing uncritical conclusions from imperfect data. Lastly he discussed the relations of the statistician to the public, and emphasized the need of popularizers who would be able to educate the public in statistical matters.

Professor P. C. Mahalanobis, General Secretary, then presented a brief report of progress in statistics during the year under review.

Dr. N. K. Bose, Local Secretary, concluded the proceedings with a vote of thanks to His Excellency the Governor for having kindly agreed to open the Conference and to Dr. Gregory for having agreed to act as the General President.

SECTION FOR ECONOMIC AND BUSINESS STATISTICS.

On the afternoon of Thursday, the 5th January, 1938, the Section for Economic and Business Statistics met under the Chairmanship of Dr. T. E. Gregory.

The first paper on "Distribution of Expenditure of working class families in Bombay and Madras Cities" by Mr. A. R. Sinha was, in his absence, presented by Dr. H. Sinha. This was followed by a paper on "Economic and Business Statistics" by Dr. H. Sinha (Calcutta).

Professor P. C. Mahalanobis then gave a summary of an attempt to measure the reproductive rate based on a random sample survey of about 500 middle class Bengali families in Calcutta

INDIAN STATISTICAL INSTITUTE

conducted some time ago in the course of which the age at marriage of husband and wife and the age of the mother at the birth of each child were recorded. He enquired whether the present method could not be used with advantage to study the question of differential fertility for different castes, economic groups, or different geographical regions. This paper gave rise to a lively discussion in which Mr. L. S. Vaidyanathan (Bombay), Mr. A. C. Mukherjee (Baroda), Prof. K. B. Madhava (Mysore) and others took part. It was suggested that a special enquiry relating to growth of population might be undertaken at the time of the 1941 Census.

In this connexion Dr. T. E. Gregory stated that it would be useful if a small Committee could be set up to make definite recommendations in regard to statistical questions relating to the Census. Mr. L. S. Vaidyanathan (Bombay) strongly supported the proposal, and a resolution was passed appointing a Committee with a power to co-opt consisting of Mr. L. S. Vaidyanathan (Bombay); Prof. P. J. Thomas (Madras); Mr. A. C. Mukherjee (Baroda); Dr. H. Sialha (Calcutta) with Prof. K. B. Madhava (Mysore) and Prof. P. C. Mahalanobis as joint convenors.

Prof. Thomas then presented his paper on "Economic results of Prohibition in Salem District, Madras," and pointed out that most of the money formerly used for drink had been directed to the purchase of food, clothing, other consumable goods and for the payment of debt; so that there was a significant change in the patterns of consumption. Although experience of one single year was not conclusive, the results suggested that in case prohibition is continued to be enforced, it was likely to prove distinctly beneficial to the working classes. The paper was followed by a short discussion regarding the methods of collecting information and the analysis of the material in which Prof. Mahalanobis and Mr. L. S. Vaidyanathan among others participated.

Mr. Paripurnasanda of the Federation of Indian Merchants' Chamber then gave a summary of a paper "On the Need for a Provincial Trade Balance and Economic Census," which was followed by a paper by Mr. T. Ghose (Calcutta) on "Sampling in Family Budget Enquiry."

Mr. P. N. Nayer (Imperial Institute of Sugar Technology, Cawnpore) then described the changes in the prices of sugar and gur during the post-production period. In the increasing consumption of sugar an important factor probably was the growth in the habit of drinking tea. Dr. Gregory thought it would be useful to know how far sugar was being substituted by gur.

The following papers were taken as read: "Trends of Foreign Trade of India" by Messrs. N. Sundarra Ram Sastri and N. T. Mathew; "The Statistical Estimates of Internal Trade" by Dr. D. C. Ghose; "Zakat: Its Economic Basis" and "Bengal Public Health Statistics" by Mr. J. M. Datta; "The Size of Indian Cotton Mills in 1936" by Mr. G. V. Krishnaswami and "The Problem of the Ratio" by Dr. B. P. Adhakar.

SECTION FOR THEORETICAL STATISTICS.

The session for Theoretical Statistics was held jointly with the Physics and Mathematics Section of the Indian Science Congress at 11 A.M. on Friday the 6th January, 1939, under the Chairmanship of Prof. S. N. Bose of the Decca University.

Prof. P. C. Mahalanobis opened the discussion on "The Technique of Random Sample Survey" with special reference to geographical or regional enquiries such as crop census, forest survey or crop-cutting experiments, and illustrated his remarks with results obtained during two experimental crop census conducted in Bengal in 1937 and 1938. He mentioned that in the case of the jute crop in Bengal, which was scattered over 70 lakhs of individual plots out of 11 or 12 crores of plots covering an area of 55,000 square miles, the cost of a complete enumeration had been estimated at anything between 12 or 15 and 20 or 25 lakhs of rupees. In a random sample survey on the other hand it should be possible to obtain a provisional estimate with an accuracy of the order of three or four per cent at a cost of about two lakhs of rupees. He emphasised, however, the need of an efficient sampling technique, and the great importance of a proper selection of the size of the sampling unit and its number or density per square mile. By a wrong choice of the sampling unit the cost could be easily increased four or five times. He also pointed out a number of problems of theoretical and mathematical interest which had arisen in the course of the work many of which were still unsolved. The paper was followed by a brisk discussion relating to the theoretical problems in which a large number of persons including Professors S. N. Bose, N. R. Sen (Calcutta), K. Krishnan (Calcutta), K. B. Madhava (Mysore), Dr. K. R. Ramanathan (Poona), and others participated. Mr. S. N. Ray (Calcutta Statistical Laboratory) discussed one special problem which had arisen in the same connexion. He showed that the exact distribution of a mean of a number of correlated variates (each pair of which had the same intra-class correlation) was given by the usual Gauss-Laplacian formula.

ANNUAL REPORT FOR 1938-39

The joint session was resumed after lunch. Prof. K. B. Madhava (Mysore) discussed the broader aspects of the sampling technique in random surveys, and stressed the importance of proper stratification and the use of necessary "control". This was followed by a paper by Messrs. R. C. Bose and S. N. Roy on "The Distribution of Studentized D'-Statistics appropriate to any pair out of k given set of K equidispersional populations distinct in sets of means." The following papers were taken as read:—"On generalized inter-action" by R. C. Bose and K. Kishen; "On the Completely Orthogonalized Hyper-Gravco Latin Square" by Mr. R. C. Bose; "Use of the Median in Tests by Randomization" by Mr. K. R. Nair; "Rainfall in Calcutta, 1893-1938" by late Mr. S. S. Bose; "Rain-storm and River Floods in Orissa" by Prof. P. C. Mahalanobis and "A Note on Examination Marks" by Mr. Q. M. Hossain.

SECTION FOR AGRICULTURAL STATISTICS.

The Section for Agricultural Statistics was held jointly with the Agricultural Section of the Indian Science Congress at 11 A.M. on Saturday the 7th January, 1939 under the Chairmanship of Prof. K. B. Madhava of the Mysore University.

Dr. R. J. Kalamkar (Nagpur) opened the discussion on "Crop Cutting Experiments and Sample Surveys in Agriculture" by describing the results of certain recent crop cutting experiments in Central Provinces. Discussing the usual "anna" estimates of crop forecasts, he pointed out how these were clearly biased by the psychological attitude of the reporters. Dr. L. A. Ramdas (Poona) discussed the use of meteorological data in preparing crop estimates and the need of carefully planned experiments. He mentioned in this connexion a special scheme on which work was expected to be started at an early date. Prof. Mahalanobis pointed out the need of inter-provincial co-operation in evolving standard methods for crop-cutting experiments, and proposed the appointment of a small committee for collecting information relating to such experiments. Mr. A. C. Mukherjee (Baroda) and Mr. Maszar Hossain (Hyderabad) supported this proposal and the following resolutions were passed unanimously.

- (i) Resolved that a Committee with powers to co-opt consisting of Bhai Balmukam (Jalgaon), Mr. Maszar Hossain (Hyderabad), Dr. R. J. Kalamkar (Nagpur), Mr. Khatam (Bomday), Mr. A. C. Mukherjee (Baroda), Mr. Gopala Krishna Raju (Madras), Dr. L. A. Ramdas (Poona), Dr. B. L. Sethi (Cawnpore), Rao Biholar N. Vaidyanathan (Delhi) and Prof. P. C. Mahalanobis as Secretary be appointed to collect information and report on available material relating to crop-cutting experiments and other sample surveys in agriculture which have been recently or are now being conducted in different provinces and States in India with a view to the formulation of suitable all-India standards with necessary regional modifications in regard to the sampling technique.

- (ii) Also resolved that the work should be done as far as practicable with the help of and in active co-operation with the Imperial Council of Agricultural Research.

Mr. K. Kishen (Calcutta) then read his paper on "Split-plot technique in field experimentation" and a Note on $3 \times 3 \times 3$ factorial arrangement and also presented a paper on "The Application of Co-variance technique to field experiments with missing or mixed up yields" by Mr. K. R. Nair (Calcutta). In this paper Bartlett's method of co-variance introducing certain pseudovariables has been used for obtaining estimates of missing values and yields of K mixed up plots as also the appropriate treatment sum of squares in the case of Randomized Blocks and Latin Squares. Mr. G. K. Sent (Madras) read his paper on an estimate of error from unreplicated experiments. The following papers were taken as read: "Sampling in Sugarcane Experimental Work" by Mr. M. Subbaia; "Some balanced confounded arrangements for the S_r type of experiment" by Mr. K. R. Nair; and "A 10×10 quasi-factorial experiment at Chinsurah with 100 strains of Rice" by Messrs. K. K. Nair, S. C. Chakravarti and P. C. Mahalanobis.

DISCUSSION ON STATISTICAL METHODS IN ANTHROPOLOGY.

A special discussion meeting "On Statistical Methods in Anthropometry" was arranged jointly with the Anthropology Section of the Indian Science Congress on the 7th January, 1939 under the chairmanship of Dr. D. N. Mazumdar of Lucknow University, the president of the Anthropology Section.

Dr. Mazumdar emphasized the need of co-operation between Statisticians and Anthropologists in order to put Anthropometry on a scientific basis, and pointed out the importance of standardisation in technique, the size of samples and the number of characters. He concluded by saying that

INDIAN STATISTICAL INSTITUTE

"the present plight of the science of Anthropometry in India and elsewhere was not the fault of anthropologists alone; the statisticians must also share the responsibility. It was essential that the statistician and the anthropologist should recognise each other's limitations and work out a practical scheme which would raise the prestige of the science and increase its usefulness."

Prof. P. C. Mahalanobis then discussed the question from the point of view of statistical science. The first thing necessary was a standardization of definitions and the technique of measurements especially on living subjects. For this it was necessary to investigate carefully the question of personal equation or individual variation; controlled experiments for this purpose should be undertaken without further delay. The second thing necessary was the setting up of a standard list of characters with necessary regional modifications. The characters selected must be such as are capable of being measured with objective reliability by different observers, and should be as far as practicable statistically independent, and yet have a high discriminating power for distinguishing between different racial groups. As regards methods of analysis he supported the proposal of R. A. Fisher to use "Mahalanobis's generalized distance" and "Fisher's directional vectors". He emphasized the need of restricting the number of characters, if possible to seven or eight or ten, as otherwise computational labour would become unmanageable. It might be necessary and desirable to have a short basic list which will be supplemented by suitable characters for particular regions or special studies.

After some discussion in which Prof. K. P. Chattopadhyaya (Calcutta) participated the following resolution was passed.

"The Joint Session of the Anthropology Section of the Indian Science Congress and the Indian Statistical Conference is of opinion that steps should be taken to prepare a list of standard anthropometric measurements on living subjects for India with such regional modifications as may be considered necessary; this list to consist of such characters as (a) are capable of being measured with objective validity; (b) are as statistically independent as possible; and (c) are efficient for purposes of racial discrimination."

SOCIAL FUNCTIONS.

Besides the scientific meetings, a number of social gatherings were also arranged. On Thursday the 5th January the Bharat Insurance Co. Ltd. gave a tea party at "Bharat Bhawan" followed by a special demonstration of the Power-Samas mechanical calculating machines. On the same night, the Hon'ble Mr. Manohar Lal, Chairman of the Reception Committee, gave a dinner to the President, and delegates to the Conference. On the afternoon of Saturday the 7th January the Reception Committee arranged a tea-party to meet the delegates to the Conference at which the members of the Reception Committee and a number of local residents were present. Such social functions gave excellent opportunities for establishing personal contacts between workers from different parts of the country, and were highly appreciated by the members and delegates.

FUTURE PROGRAMME.

It was decided that the third session of the Indian Statistical Conference should be held in Madras in the first week of January, 1940 in active co-operation with the Indian Science Congress.

P. C. MAHALANOBIS,
Hon'y. Secretary.