

SANKHYĀ

THE INDIAN JOURNAL OF STATISTICS

Edited by: P. C. MAHALANOBIS

VOL. 4.

PART 3.

1939.

SUBHENDU SEKHAR BOSE : 1906—1938.

By P. C. MAHALANOBIS

Subhendu Sekhar Bose was senior Statistician in the Statistical Laboratory from 1931 till his death in November 1938. He joined us at a time when the Laboratory was just beginning to take shape ; and during the last eight years he was so intimately connected with our work that the only way of writing the story of his life is to trace the growth of the Laboratory. Subhendu was the leading spirit among that small band of my young colleagues who lived and worked almost like the members of the same family sharing in one another's toils and troubles. It is not possible to write of this intimate personal side of our work ; but I am giving below some portions of the story which may be of interest to the many new workers who joined us later.

STUDENT DAYS

Subhendu Sekhar Bose was born in 1906 in Putsura village in the Hooghly district at a distance of about 32 miles from Calcutta. He lost his father when he was very young, and the family shifted their residence to Sonarpur, a village on the outskirts of Calcutta at a distance of about 12 miles from the city. He joined the Ballygunge Jagabandhu Institution in 1914, and matriculated in 1922. He always stood first in his class in the school ; and very early showed outstanding qualities of leadership in games and sports, and in activities in connexion with the debating club and poor fund. He was a good football player ; and was also interested in literary activities. He started a school magazine of which he was the editor all along. In 1922 he joined the Presidency College ; passed the B.Sc. examination with first class Honours in Physics in 1926, and the M.Sc. examination in Physics in 1928 standing first in the first class. For the M.Sc. examination he submitted a piece of original investigation on "the dielectric constant of carbon dioxide in a magnetic field", which received high marks from the examiners.

I first came into contact with him in 1922 when he was a young student in the first year class, and came to know him more intimately when he attended my lectures in the 4th year Honours Physics class. His lively interest and quick intelligence soon attracted my

notice ; and after college hours he would some time come to see me in my room. One event is also perhaps worth recording. With a view to study the distribution of errors in physical measurements I had at that time started collecting material with the co-operation of a number of senior students of physics. Subhendu with characteristic enthusiasm took up the work with great interest ; and we discussed the question on several occasions. Owing to pressure of other work this study was not completed although we always had the intention of taking it up again at the earliest opportunity.

FIRST CONTACT WITH STATISTICAL WORKERS

After taking his M.Sc. degree Subhendu continued his physical researches for a year or two in the Physics Laboratory adjoining my own room in the Presidency College. The Statistical Laboratory at that time had scarcely come into existence. For many years I had one or two computers working with me at my own house. After my return from long leave abroad in 1927, owing to a change of residence, this was no longer possible. For some time my computer Sudhir Kumar Banerjee (who had started work in 1924 in connexion with the *Report on Floods in North Bengal*) used to do the computation work at his own house, and came to discuss the results with me once a day. In 1928 I was asked by the Government of Bihar and Orissa to prepare the *Report on Rainfall and Floods in Orissa*. As this required engaging two or three workers (of whom one was Nistaran Chakravarti, who had just come back from Cambridge after taking an engineering degree, and is now an Inspector of Factories in Bengal ; and the other two were Surendra Nath Banerjee and Sarojendra Nath Dass Majumdar, who left the Laboratory in 1933 to join the legal profession), and as the work was of an official nature, I felt justified in housing the three workers in a small passage partitioned by two or three almirahs in the corner room adjoining my own. Subhendu, who was then working in the same room on the other side of the partition, soon became friends with the statistical workers.

The *Report of the Royal Commission on Indian Agriculture* had been published a little earlier ; and on its recommendation the Imperial Council of Agricultural Research had then just come into existence. R. A. Fisher's work at Rothamsted had by that time revolutionized the technique of agricultural experiments, and high officials in the Government of India were desirous of starting work on similar lines in India. Mr. (now Sir) Bryce Burt (then the Agricultural Expert and later the Vice-Chairman of the Imperial Council of Agricultural Research) together with Dr. N. Gangulee (who had served on the Royal Commission and was at that time a member of the Imperial Council of Agricultural Research) came to see me in 1930, I suppose chiefly because I had published a short paper on the probable error of field experiments in agriculture in 1924-25 in which I had made an attempt to eliminate the effect of soil heterogeneity. They suggested that I might ask for a small research grant for statistical studies relating to agriculture. As a result of further correspondence I was given to understand that a grant of Rs. 2,500 per year was likely to be sanctioned for three years.

EARLY STUDIES IN STATISTICS

In view of the fact that this grant would enable me to give a small stipend to a young worker, I suggested to Subhendu that it might be worth his while to consider statistics seriously as a career. He readily agreed to study statistics a little in order to find out whether he liked the subject or not. As he was still continuing his physical research, it was decided that he would work with me at my own house on Sundays and other holidays.

We were then living in a garden-house at Baranagar. I distinctly remember the day on which he started work. It was a bright, crisp, winter morning in December 1930. He came very early; and we had a long walk in the garden; after lunch we worked for a short time in the study, but again went out and spent the whole of the afternoon under a magnolia tree on the bathing ghat of a big pond. The talk on statistics was now and then broken in by my wife; and we finished the day with a ride in a furiously leaking boat.

In view of the fact that agricultural work was likely to develop in the immediate future, I started Subhendu straight on the analysis of variance, and we spent the whole day discussing the basic concepts. The power and elegance of the method caught his imagination, and he began studying the subject with great interest. In about a week's time he told me that he had decided to take up statistics seriously if I thought this advisable. I told him that I had great confidence in the future prospects of statistics; but he must make up his mind for a long period of hard and possibly unremunerative work. He did not hesitate but started work immediately.

Fortunately at this time the Imperial Council of Agricultural Research decided to review the manorial experiments conducted in the different provinces in recent years, and the Government of Bengal required a statistical worker who could do this work for the province of Bengal. Although Subhendu had been then working with me for only a short time, such was his grasp of the fundamental principles that I had no hesitation in sending him to Dacca, the head-quarters of the Bengal Agriculture Department, for this purpose. He worked there for nine months from January to September, 1931 and did a creditable piece of work in reducing a large mass of unwieldy data into some kind of statistical coherence.

FIRST APPOINTMENT IN THE STATISTICAL LABORATORY, 1931

In July 1931 our first grant of Rs. 2500 a year for statistical studies relating to agriculture was sanctioned for three years. The seniormost post was that of an assistant on Rs. 75/- per month which I offered to Subhendu, who accepted it after his return from Dacca. Thus began his official connexion with the Statistical Laboratory from September 1931, which continued for seven years till his death in November 1938.

Statistics as a scientific discipline was still unknown in India. I have reasons to believe that it was considered by many people that it was nothing short of a tragedy that a promising young man like Subhendu should have decided to take up a subject of such doubtful scientific pretensions.

STARTING OF THE STATISTICAL INSTITUTE, 1931

Things however were moving rapidly. During the first three months of the I. C. A. R. scheme we received a large number of enquiries from all over India. The ever widening field of new applications was a great stimulus, and such was the enthusiasm of the small group of five or six workers in the Laboratory that we seriously contemplated starting a Statistical Society. Looking back it now seems almost a mad project.

By 1931 the work on Orissa Floods had been completed, and our only resources were the grant of Rs. 2500 a year from the Imperial Council of Agricultural Research supplemented by what could be spared from private funds. Subhendu was the one single scientific assistant; Sudhir Banerjee was the one trained computer and there were only two other raw assistants. This was the entire staff of the Statistical Laboratory.

We were reinforced, however, from another side by the keenness and enthusiasm of another old pupil of mine, Haris Chandra Sinha. He had taken his degree in mathematics standing first in the first class in the M. Sc. examination; subsequently he took his doctorate degree in Economics and was already working as a Lecturer in the Calcutta University. It was mainly due to the enthusiasm of Subhendu Bose and Haris Sinha that gave me courage to canvass the idea of starting a Statistical Society. We were, however, fortunate in receiving a very favourable response. We hesitated as to the form of the society, whether it should be a purely technical and scientific body or whether it should also include economists and businessmen. After considerable discussion the wider basis was chosen; and the Indian Statistical Institute was started in December 1931 with the help of the late Sir R. N. Mookerjee, the undisputed leader of commerce and industry in Calcutta, who agreed to accept the office of its first President. Haris became our Joint Secretary, and the brunt of the internal work of organization fell mainly on Subhendu and Sudhir.

WORK IN THE TRAINING SECTION

In the meantime enquiries relating to agricultural experiments were increasing rapidly, and Subhendu was kept busy in working out suitable notes on the subject. This gave rise to the series of "Statistical Notes for Agricultural Workers" in the *Indian Journal of Agricultural Science* which I believe have helped materially in spreading the new technique in India.

In June 1932 the Government of Assam enquired whether we could give a short course of training in statistics to one of their agricultural officers. I immediately agreed. Subhendu and Sudhir were more cautious and were doubtful whether we should undertake this work. We discussed the question and decided that it was not possible to give any regular teaching. The officer must therefore be asked to bring his own material, and learn statistics with his own particular problem as the starting point. The first officer on deputation for training arrived in July, 1932; and this started our training section which is now such an important feature of the Statistical Laboratory.

Although Subhendu had felt doubtful of the wisdom of undertaking the training work, he began to participate in it with great enthusiasm from the very beginning. His work was much appreciated, and the section developed rapidly. Subhendu was a born teacher, and within a short time he practically assumed the entire responsibility for the training section. In fact, in later years, Subhendu was the training section.

During the seven years from July 1931 to June 1938 more than one hundred persons came for training from different parts of India. This gave us the opportunity of making a large body of actual workers familiar with the use of statistical tools. Most of them had no previous knowledge of statistics. Two or three months' work in the Statistical Laboratory, however, gave them some insight into the basic concepts, and enabled them to have considerable practice in the actual computational work and the use of routine methods. Even more important was the change in the psychological attitude. Under Subhendu's influence they left the Laboratory almost invariably not only with respect for statistical methods, but in most cases also with a great deal of enthusiasm for the subject.

Subhendu had exceptional ability in making statistics not only intelligible but interesting. He also had charming social qualities which put him into vital human contact with every person who came to the Laboratory. One of the most valuable aspects of the training section was, in fact, the touch it established between the Laboratory and the many individual statistical workers scattered all over India. After going back to

their work, the officers would write freely asking for advice and help in solving their difficulties. This was valuable both from the point of view of the officers concerned as well as from that of the Statistical Laboratory itself, as we were kept in daily touch with the live problems and difficulties of everyday work in statistics. Although official references would normally be addressed to me, in actual fact most of the correspondence was informal and was kept up by Subhendu.

It is difficult to exaggerate the importance of the training section in popularising the new developments in statistical methods in India ; and the credit is due almost entirely to Subhendu and Subhendu alone. He was so friendly, so cheerful, and so eager to help that everybody felt it a pleasure to seek his advice. The real secret of the rapid growth of the training section lies here. Without this intimate personal contact very little could have been achieved. Once an officer worked in the Statistical Laboratory he felt that he belonged to it. It was this spirit which more than anything else helped in the rapid growth of the Laboratory.

We have always looked upon the Statistical Laboratory as an All-India centre of work. It was largely due to Subhendu that this idea could be actually translated into terms of personal friendship. Although a staunch Bengalee in the sense of having great interest and pride in the cultural history and traditions of Bengal, Subhendu was completely free from any provincial or communal bias. This was why he had no difficulty in becoming friends with men belonging to the different provinces and communities in India. Subhendu's death, therefore, came as a personal bereavement to everybody who had come into contact with him.

AUTUMN RECESS OF 1932

During the Puja vacation of 1932 Subhendu was one of the party of 8 or 10 workers which accompanied me to Giridih. Besides the work in agricultural experiments, we studied various questions relating to rainfall and floods. Subhendu took the lead in organizing many expeditions to the Paresnath and Ranchi Hills and the beautiful undulating country of Chota Nagpur. He was coming back with me to Calcutta in a motor car when on the way we had a serious accident and I sustained a number of injuries on the head ; my wife's hand was fractured. Subhendu fortunately escaped practically unhurt ; he rendered first aid and arranged to put us into a passing lorry carrying jute. He himself rode back all the way to Calcutta lying on the top of bales of raw jute in the open lorry. In December he went with me to Patna and for the first time presented statistical papers before the Indian Science Congress in the Sections of Agriculture and of Mathematics and Physics. His exposition was clear and interesting and was greatly appreciated.

A CRISIS IN THE LABORATORY, 1933

In March 1933 a serious crisis occurred in the history of the Laboratory. I happen to be a member of the Indian Educational Service and am liable to transfer from one post to another. In 1929 the Government of Bengal had decided to send me as the principal of a college outside Calcutta ; but after much effort I succeeded in averting this. The same question again came up in 1933. My transfer from Calcutta would of course mean the extinction of the Statistical Laboratory. I decided that, if necessary, I would resign from the Service rather than give up the statistical work. I explained the situation to both Subhendu and Sudhir, asked them to keep this possibility in view, and advised them to try and secure suitable posts elsewhere as soon as possible. After considering the position for two or three days both of them told me that they had decided to continue

their work in statistics ; and in case I was obliged to resign my post they would keep with me. Subhendu said that we could earn something by giving lessons in physics and mathematics ; this would give us breathing space to start consultation work in statistics on a business basis. Fortunately the crisis passed as the result of a visit of the Hon'ble Minister and the Secretary of the Education Department to the Statistical Laboratory. This incident however served to create a real nucleus which was something more than a mere collection of workers.

STARTING OF SANKHYĀ, 1933

We had been considering the question of starting a statistical journal for a long time. Owing to various difficulties, of which finance was not the least important, little progress was made in the beginning. The Council of the Statistical Institute approved of the idea, but was unable to undertake the financial responsibility. In the Laboratory we felt that a journal of our own was essential in order to consolidate the position of statistics in India. After the crisis in connexion with the question of my transfer was over I decided to start the journal without any further delay. Both Subhendu and Sudhir were a little nervous, chiefly, I believe, on my account as they did not like my undertaking the financial responsibility for the venture ; but once the decision was made both of them worked extremely hard and succeeded in getting the first number of *Sankhyā* out in June 1933. In addition to his multifarious duties, Subhendu had all along to give me assistance not only in editing but in correcting the proofs and even in despatching the journal to its contributors.

In 1933 I persuaded Raj Chandra Bose, who was then working as a lecturer in Ashutosh College in Calcutta, to start studying statistics. He began coming to the Laboratory in the evenings after finishing his work in college. During the summer vacation he and some other workers went with me to Darjeeling, while Subhendu remained in charge of the Laboratory in Calcutta. Subhendu was also giving a great deal of his time to the work of the Institute ; and, although he preferred to keep himself in the background, I persuaded him to serve as a member of the Council of the Institute from this year.

NEW ACTIVITIES IN 1934

In 1934 there were many new developments. In February I was appointed a member of the Bengal Board of Economic Enquiry, and a large mass of material collected by Government regarding the indebtedness of cultivators in Bengal was turned over to us for analysis. This involved heavy computational work which kept us busy practically during the whole of the summer vacation. On Subhendu fell as usual the greater part of the responsibility for carrying through the laborious statistical tabulations. We had a short interlude in a journey in a cargo boat round the wild country of streams and forests in the Sundarbans. Subhendu with six or seven other workers of the Laboratory formed the party ; and we had a most pleasant holiday.

During the Puja vacation of 1934 both Subhendu and Rajchandra were with me at Giridih ; and work on mathematical statistics was seriously started at this time. After our return to Calcutta, Rajchandra however fell very seriously ill, and we passed through a most anxious time. Subhendu, ably assisted by Sudhir, was in constant attendance in the patient's cubicle in the hospital. Samarendranath Roy, who had started work a little earlier in the Laboratory, not in statistics but in making certain numerical computations in connexion with a paper on Relativity, also took a share in attending the sick-bed ; he began to be more closely associated with the statistical workers from this

time. Fortunately, Rajchandra recovered after a series of sharp crises, and we were free to give our attention to the normal work of the Laboratory. The Indian Science Congress was held in Calcutta in January 1935, and Subhendu presented a number of papers and actually participated in some of the discussions. He also had to work hard in showing round the many visitors who came to the Laboratory.

PREMCHAND ROYCHAND STUDENTSHIP IN STATISTICS, 1935

Mathematics and Physical Sciences had been announced as subjects for the award of the Premchand Roychand Research Studentship in 1935. This is the highest prize open to persons who have passed the M.A. or M. Sc. examination of the Calcutta University, and carries a studentship of about Rs. 2,400/- per year for 2 years. After some hurried consultation, it was decided that Subhendu should submit a thesis in statistics for this important studentship. As the time was very short, he had to work hard and just succeeded in getting his thesis ready in time. His work was considered to be of a high standard, and the studentship was divided between him and another worker in theoretical physics. This was most encouraging ; for the first time statistics was recognised in Calcutta as being of sufficient importance to justify the award of the premier Studentship in the University.

EXTENSION OF WORK

In 1935 the Imperial Council of Agricultural Research agreed to increase our annual grant to Rs. 7,500 and also to create two posts on Rs. 150-10-200 for two scientific assistants, one on the applied and teaching side and the other for theoretical work. The recruitment was made through the Federal Public Service Commission which interviewed about half a dozen candidates for each of these posts. Subhendu got the first nomination for the teaching post, and Rajchandra the first nomination for the post for theoretical work ; and they started their work under the enlarged scheme from June 1935.

In the same year Subhendu visited a number of agricultural stations in Assam at the request of the Director of Agriculture of the province. His tour was a great success ; and a little later he visited some of the agricultural stations in Bengal. His visit was so helpful and was so greatly appreciated by the officers concerned that I began to receive many requests to allow him to visit different centres of work more frequently. Heavy pressure of work in the Laboratory made it necessary to refuse most of these invitations. I could see, however, that his activities were opening out in a new direction ; and I had the intention of allowing him full scope for this work in future, but this opportunity never occurred.

Work in the Laboratory was also expanding in many directions. In September 1934 during a visit to Simla, I had the opportunity of getting some of the high officials of the Government of India interested in our work ; and as the result of visits to the Laboratory in the same year of Sir George Anderson, the Educational Commissioner with the Government of India, and of the Hon'ble Sir James Grigg, the Finance Member, an annual grant to the Institute was sanctioned by the Government of India for the first time from April 1935.

HONORARY LECTURER IN STATISTICS, CALCUTTA UNIVERSITY, 1936

Up to this time most of the persons who were coming to the Laboratory for training were agricultural officers ; but henceforth advanced workers in other branches of statistics also began to come to us. This naturally widened the scope of the training section, and

greatly increased Subhendu's responsibilities in this connexion. He soon acquired a reputation as a successful teacher; and a little later in July 1936 he was appointed an honorary lecturer in statistics in the department of post-graduate teaching in the Calcutta University and started giving lectures to the M.A. classes. This was a high distinction, and I think gave him great satisfaction.

VISIT OF SIR JOHN RUSSELL, 1937

At the end of 1936 Sir John Russell came to this country at the request of the Government of India to enquire into the various schemes financed by the I. C. A. R. and to report on the policy to be adopted in future. Our scheme for statistical studies stood in a very singular position. A large statistical section was already in existence at the headquarters of the I. C. A. R. and doubts had been expressed whether there was not unnecessary duplication of work in giving a grant for statistical studies outside this section. We felt that everything depended on the impression which Sir John Russell would form of our work. His visit to the Laboratory in January, 1937, was therefore a most important event for us. Unfortunately just at this time I fell ill. Sir John very kindly postponed his visit until it could not be delayed any longer; but I was still unable to come to the Laboratory. In this situation the responsibility fell on Subhendu to receive Sir John Russell and show him round the Laboratory. Subhendu, ably assisted by Rajchandra, Samar and Sudhir, did his work so successfully that Sir John Russell was greatly pleased. He was in fact so favourably impressed that he made a point of coming and seeing me at my bed-side, and congratulated me on having such an able and loyal band of young workers in the Laboratory. Fortunately, owing to a subsequent change in Sir John's programme, I had later the opportunity of meeting him on more than one occasion, and thus came to know even better the very high opinion he had formed of Subhendu and my other young colleagues.

Sir John Russell strongly recommended in his Report the continuation of the grant to the Statistical Laboratory, and for the time being the future of our work was assured. This was a great relief. The I. C. A. R. also accepted my proposal of creating two senior posts on Rs. 200—500 for Subhendu and Rajchandra. I had hoped that this would enable both of them to settle down to work free from financial worries. But Subhendu fell ill before the post could be created; and I did not have the satisfaction of seeing him appointed to a post worthy of his abilities.

WORK IN 1937

During the summer of 1937 Rajchandra and Samar went with me to Simla; and the heavy task of running the Laboratory during the most trying season of the year again fell on Subhendu, and he, as usual, remained in Calcutta. At the invitation of the Tea Research Association, he was, however, able to go out for two months to their experimental station at Tocklai in Assam. Most of the scientific officers here were British; but Subhendu made friends with them as quickly as with his own countrymen. The visit was so useful that in 1938 the invitation was again repeated; and Subhendu himself was looking forward to a second spell of work at Tocklai. But he had already fallen ill and the idea had to be given up.

We were very busy during the Puja vacation of 1937. The Government of Bengal were anxious to improve the forecast of the Jute crop, the most important cash crop of the province. At our suggestion a scheme was sanctioned to explore the possibilities of using the method of random sampling survey for this purpose. A small scale field experiment

was designed, and Subhendu and Sudhir were entrusted with the work of supervision which kept them busy throughout the autumn recess.

INDIAN STATISTICAL CONFERENCE

In 1937 arrangements were being made for the Jubilee session of the Indian Science Congress which was to be held in Calcutta in January 1938, and was to be attended by a large number of eminent scientific workers from abroad. The general feeling in the Laboratory was that we should ask for a separate section for Statistics. I had several informal talks with the authorities of the Science Congress in this connexion; but found no encouragement. Independent sections were created for Physiology, Geography and Entomology, which were all respectable scientific subjects; while, as somebody told me, a section for Statistics was as unthinkable as a section for Astrology. After very anxious discussion among ourselves, we decided to organize an independent Conference for Statistics to be held at the same time as the Jubilee session of the Science Congress. It was again, I think, Subhendu's enthusiasm which really decided the issue.

VISIT OF H. E. THE VICEROY, 1937

November and December, 1937, were strenuous months in the Laboratory. The jute census work was in progress; and arrangements had to be made for receiving His Excellency the Marquess of Linlithgow, Viceroy of India, who was coming to visit the Laboratory in December. As usual the greater part of the drudgery fell on Subhendu and Sudhir; and Subhendu's was the harder task as he had to look after the heavy work in the computing section, and also give me assistance in scientific matters.

VISIT OF PROF. R. A. FISHER, 1937-1938

In the meantime I had ascertained that Prof. R. A. Fisher was willing to come to India during the winter season of 1937-1938. Subhendu was enthusiastic over the idea of Fisher's visit; but he spoke to me with restraint as, I suppose, he felt that this might throw a good deal of additional responsibility on me. I could see, however, that his mind was continually dwelling on the possibility of coming into personal contact with Fisher. In fact, to Subhendu, Fisher was like a legendary hero, and the idea of meeting him in person was like something happening in a fairy tale. Rajchandra and Samar were, of course, equally eager to have an opportunity of meeting Fisher. We thought nothing could be better than to be able to start the Statistical Conference with Fisher as the first president. A quick decision was necessary. Working out the financial and other arrangements would take a good deal of time; but we had no time to lose, and I sent a cable to Fisher on my own responsibility. Everything, however, turned out well, and we received support from all over India in our decision to start an independent Statistical Conference of our own, and also to invite Fisher to be its president.

As regards Fisher's programme it had been decided that after landing in Bombay he would visit a number of places before reaching Calcutta. We felt that some one from our Laboratory should accompany him during his tour; and the choice inevitably fell on Subhendu. H. E. the Viceroy came to the Laboratory on the morning of the 15th December 1937, and on the same night Subhendu left for Bombay. He accompanied Fisher in his tour; and after visiting Poona, Allahabad, Agra, Cawnpore and Benares, arrived in Calcutta on the 1st January, 1938.

The Science Congress started its session on the 2nd January, and the Statistical Conference was opened on the 7th January. It was an extremely busy week, and the greater part of the administrative duties in connexion with the Statistical Conference fell on Subhendu's shoulders. This was followed by another week of lectures and conferences by Fisher, which was a time of intense intellectual activity in the Laboratory in which Subhendu participated to the full. The only cloud was Samar's illness which caused us some anxiety at one time ; but he slowly recovered after a long convalescence.

JUTE CENSUS SCHEME, 1938

After Fisher's departure from India my own health became indifferent ; things became so serious that I made arrangements for Subhendu to take charge of the Laboratory in case I had a break-down. At this time the question of our taking up the Jute Census work on a much larger scale again came up. This was a big scheme, involving an expenditure of over one lakh of rupees per year, for estimating the area under jute in Bengal by the method of a random sample survey. Our workers, especially Subhendu and Sudhir, were reluctant to add to our responsibilities. I felt however that it was a distinct challenge to us to show what modern statistical methods could achieve in practice. I agreed that we must insist upon complete freedom on the technical side and full facilities for the work. If any inconvenient conditions were sought to be imposed, we should have no hesitation in refusing to have anything to do with the Scheme ; but in case our terms were all accepted we had no right to shirk the responsibility. Owing chiefly to the personal efforts of Mr. A. P. Cliff, Secretary to the Indian Central Jute Committee, everything was made smooth for us and all difficulties standing in the way of our taking up the Scheme were removed.

VISIT TO DARJEELING, MAY, 1938

With Samar and some 15 other workers I went to Darjeeling in May 1938. We had to work hard, but we were in the cold and bracing climate in one of the best hill stations in the Himalayas. Subhendu, together with K. Raghavan Nair (who had joined the Laboratory in October, 1936), K. Kishen (who joined us in May, 1938) and Sudhir remained in charge of the work in Calcutta in the sweltering heat of an Indian summer. It was arranged that Subhendu and Sudhir should go up to Darjeeling for some time ; owing to heavy pressure of work they could not, however, do so until the middle of May.

This was the last holiday that Subhendu enjoyed. On the afternoon of the 24th May Subhendu and I went out for a long walk by the Auckland Road to Ghum. It was cloudy but the sky was clearing up. Subhendu was not quite happy over the Jute Census work. He felt that a great deal of the work in this Scheme was of the routine type, and he was apprehensive that it might interfere with the research side of our activities. I explained to him the reasons why I thought that we had no alternative but to accept the work. The question was of outstanding importance for national welfare ; we could not possibly hold aloof if necessary facilities were provided for the work. I think he was convinced. Our thoughts then turned to other things—the future of Bengali literature, social and political conditions in India, menace of war in Europe, oscillations in human civilization ; and half-seriously we agreed that for peace of mind our only safe recourse was to accept a statistical view of life.

In the middle of our talk the clouds lifted for a few moments and we had a fleeting view of the Kinchinjungha with its supporting peaks in the east glowing in the rays of the setting sun. Light showers were falling when next day he left for Calcutta.

LAST ILLNESS

A few days later I came down to Calcutta for a week, and heard that Subhendu was ill. At first everybody thought it was influenza. I was, however, seriously alarmed, and told the other workers in the Laboratory to see that adequate arrangements were made for his medical treatment without any loss of time. I had to go back to Darjeeling, and we had an anxious time up there while Subhendu's illness dragged on. When we came back to town in July he was a little better; and, when I went to see him at his house in Sonarpur village, he was looking cheerful. Fever had practically gone down, and he was hoping to come back to work very shortly. He went on improving, and in August he even came to the Laboratory for a few hours. Unfortunately there was a set-back in September, and we decided to remove him to Calcutta. Sir Nilratan Sircar, the leading physician of the town, was consulted. There was no cause for immediate alarm; but neither was there any appreciable improvement. It was decided that as soon as the weather improved sufficiently he should go out of town for a change. During the Pujah vacation a large party of workers with Rajchandra and Samar went with me to Giridih. A small house was engaged for Subhendu, and we were expecting to be able to remove him there almost any day. I came down to Calcutta on the 26th October; there was not much change in his condition. In the meantime he had read my first Report on the Jute Census Scheme; his imagination had already been kindled, and he was eager to discuss the lines of future progress. As he was very weak, I changed the topic; and I told him that we were all looking forward to his coming to Giridih. I went back to Giridih on the 28th October. During the next three or four days we did not hear anything.

Samar had in the meantime gone down to Calcutta. On the 3rd November, 1938 a most unexpected telegram came from him intimating that Subhendu had passed away after an emergency operation on the night of the 2nd November, 1938 in the Medical College Hospital, Calcutta. I knew Subhendu was seriously ill; but I had never imagined that the end was so near.

MEMORIAL FUND

We came back to Calcutta, and on the 7th November we had a meeting in the Laboratory in his memory. I spoke a few words and some of the senior workers of the Laboratory followed me. Many of our old workers were also present. It was decided at this meeting to raise a fund for perpetuating his memory in a suitable form. We issued an appeal and the response from his numerous friends and fellow workers was prompt and generous. Later on at a meeting of the Council of the Indian Statistical Institute it was decided that the Institute would take custody of the funds and administer it. Samarendra Ray and Sudhir Kumar Banerjee were appointed Joint Secretaries to prepare a scheme for this purpose. A list of contributions is given in an Appendix.

MEMORIAL MEETING IN THE VILLAGE

Arrangements were also made to hold a memorial meeting on the 20th November, 1938, in Subhendu's own village, Sonarpur, which was presided over by Professor N. R. Sen, Head of the Department of Applied Mathematics, Calcutta University. Almost the whole village attended the meeting; his co-workers and many old school and college friends from the city were also present. The feeling of keen sense of loss which found expression in the meeting showed what a large part he used to play in the life of the village. Although he spent the greater part of the day, from 9 or 10 A.M. in the morning till 8 P.M. or later at night, away from the village, he was closely associated with all the social and educational activities and movements. He took the initiative in starting a

Middle English School for girls in the village ; and it was one of his cherished wishes to transform it into a High School.

* * * * *

Rabindranath Tagore, who knew him personally, wrote :—

"I have been greatly distressed at the news of Subhendu's untimely death. We have few men of real ability in our unfortunate country. Sometimes by good fortune we get one; and when he passes away before fulfilling his promise we do not know the measure of our loss."

(Translated from a Bengali letter).

We received similar letters from a large circle of friends and colleagues of Subhendu ; and we are publishing a few extracts in an appendix.

Condolence resolutions were also adopted by the Executive Committee of the Department of the Post-Graduate Teaching in Arts of the Calcutta University, and the offices of the Director of Agriculture, Assam, and the Agricultural Research Laboratory, Dacca.

* * * * *

Subhendu had a quick and receptive mind, a cheerful and genial temperament and an exacting sense of responsibility. He used to make friends with every visitor to the Laboratory ; and he helped more than anybody else in building up good-will for the Laboratory. His temperament was quite different from my own, which was in fact most fortunate for us, as it enabled him to make up for my lack of ability in getting into human touch with our workers and visitors. Subhendu had a great deal of scientific curiosity, and under more favourable circumstances would have no doubt done scientific work of importance. He came into statistics, however, at a time when there was little leisure for theoretical researches. We were overwhelmed with enquiries from all over India ; the demand for training in statistics was rapidly growing. All this left very little time for his own researches. His own temperament was also sympathetic towards work of this type. He was a born teacher ; and I think he was happy in his work. Although the lack of leisure for purely scientific researches must have caused some disappointment, I believe he realized that he was doing invaluable work in consolidating the position of statistics in India. He was over-worked, but I think he would not have had it otherwise even if he had any choice in the matter. Although only 32 years old at the time of his death, he was a great pioneer in the statistical movement in India. It was his life and labour which made the Statistical Laboratory what it is today.

STATISTICAL PAPERS OF S. S. BOSE

BY SAMARENDRANATH ROY

When Subhendu Sekhar Bose joined the Laboratory in 1931 the statistical movement in India was in its infancy and agricultural and other workers were not familiar with the scope and usefulness of modern statistical methods ; and enquiries of a statistical nature began to be received in large numbers by the Statistical Laboratory from all over India. This led to the publication for the use of agricultural workers of a series of non-technical statistical notes in the Indian Journal of Agricultural Science on such problems arising out of the inquiries as were of considerable general interest. "A note on the variation of percentage infection of wilt disease in cotton" (Note No. 5), was published in 1932, in collaboration with Prof. Mahalanobis. Other notes followed in fairly quick succession ; and it was mainly through Subhendu's efforts that as many as twenty-three statistical notes for agricultural workers covering a wide range of topics appeared in the *Indian Journal of Agricultural Science* in the course of 4 or 5 years. In these notes, methods of handling various types of agricultural data were lucidly explained ; stress was laid

on the importance of suitably designed agricultural lay-outs and appropriate statistical analysis; and uniformity trials were analysed in detail to yield information on the optimum size and shape of plots for different crops.

Besides these statistical notes, Subhendu Sekhar contributed a number of papers on applied statistics which appeared from time to time in *Sankhyā*. In a paper on the effect of manufacturing processes on the quality of tea at Tocklai Experimental Station, (*Sankhyā*, 2 (2), 1935, 33-42), the Latin Square lay-out was used to investigate the effect on the quality of tea of manurial dressings and various manufacturing processes. In another paper (*Sankhyā*, 3(3), 1938, 249-252), the exact P(chi-square) test for 2×2 contingency tables when the frequencies are small was used to investigate the association between the occurrence of thunderstorms and ionization of the Kennelly-Heaviside layer near Calcutta. He also made a detailed investigation of the estimates of individual yields in the case of mixed-up yields of two or more plots in field experiments (*Sankhyā*, 4(2), 1938, 103-120) and the test of significance of the treatment effects.

He collaborated in the construction of a table of random samples from a normal population (*Sankhyā*, 1(2 & 3), 1934, 289-328), which are being extensively used in conducting model sampling experiments for testing various statistical theories; and constructed the 5 per cent and 1 per cent values of regression co-efficients for testing the significance of linear regressions in the case of time-series and other single-valued samples (*Sankhyā*, 1(2 & 3), 1934, 277-288).

He also did considerable work in the theory of sampling distributions in statistics, which formed part of the thesis on which he was awarded the Premchand Roychand Scholarship for 1935 by the Calcutta University. His investigation of the sampling distribution of the ratio of variances for the two variates in a sample drawn from a given bi-variate correlated population (*Sankhyā*, 2(1), 1935, 65-72) was quite a useful piece of work. In his "Relative efficiencies of regression co-efficients estimated by the method of finite differences" (*Sankhyā*, 3(4), 1938, 339-346), he gave interesting approximate methods of calculating regression coefficients for even and odd numbers of pairs by the method of differences of the values of the dependent variable. Finally, in his important paper "On a Bessel Function Population", (*Sankhyā*, 3(3), 1938, 253-264), he used a certain expression involving the Bessel function, (which had been found earlier in this Laboratory as the distribution function of the Classical form of D^2 -Statistic) for graduating empirical frequency curves, and showed that the Type III Pearsonian curve comes out as a special case of the Bessel Function distribution. A complete list of papers of which he was the single or a joint author is given below.

LIST OF PAPERS

1. **On the Variation of the Percentage Infection of Wilt Disease in the Cotton Plant in Surat.** By P. C. Mahalanobis and Subhendu Sekhar Bose. *Ind. Jour. Agri. Sc.*, Vol. II (6) 1932, 704-709.
2. **Effect of Different Doses of Nitrogen on the Rate of Shedding of Buds, Flowers and Bolls in the Cotton Plant in Surat.** By P. C. Mahalanobis and Subhendu Sekhar Bose. *Ind. Jour. Agri. Sc.*, Vol. III (1), 1933, 147-154.
3. **Effect of the Time of Application of Fertilisers on the Yield and the Rate of Shedding of Buds, Flowers and Bolls in the Cotton Plant in Surat.** By P. C. Mahalanobis and Subhendu Sekhar Bose. *Ind. Jour. Agri. Sc.*, Vol. III (1), 1933, 139-146.
4. **Certain Varietal Studies on the Cotton Plant.** By P. C. Mahalanobis and Subhendu Sekhar Bose. *Ind. Jour. Agri. Sc.*, Vol. III (2), 1933, 339-344.
5. **Analysis of Manurial Experiments on Wheat conducted at Sakrand, Sind.** By P. C. Mahalanobis and Subhendu Sekhar Bose. *Ind. Jour. Agri. Sc.*, Vol. III (2), 1933, 345-348.
6. **Analysis of Varietal Tests with Wheat Conducted at Sakrand, Sind, 1931-32.** By P. C. Mahalanobis and Subhendu Sekhar Bose. *Ind. Jour. Agri. Sc.*, Vol. III (3), 1933, 544-548.

- *7. **Tables for Testing the Significance of Linear Regression in the case of Time-Series and Other Single Valued Samples.** By Subhendu Sekhar Bose. *Sankhyā*, Vol. 1 (2 & 3), 1934, 277-288.
8. **Tables for Random Samples from a Normal Population.** By P. C. Mahalanobis with the co-operation of Subhendu Sekhar Bose, Prabhat Ranjan Ray, and Sudhir Kumar Banerji. *Sankhyā*, Vol. 1, (2 & 3) 1934, 289-328.
9. **A Statistical Note on the Effect of Pests on the Yield of Sugarcane and the Quality of Cane-Juice.** By P. C. Mahalanobis and Subhendu Sekhar Bose. *Sankhyā*, Vol. 1 (4), 1934, 399-406.
- *10. **A Note on the Mathematical Expectation of the Variance of the Regression Coefficient.** By Subhendu Sekhar Bose. *Sankhyā*, Vol. 1 (4) 1934, 432-434.
11. **The effect of Manurial dressings, Weather conditions, and Manufacturing processes on the Quality of Tea at Tocklai Experimental Station.** By C. H. Harrison, Subhendu Sekhar Bose and P. C. Mahalanobis. *Sankhyā*, Vol. 2 (1), 1935, 33-42.
- *12. **On the Distribution of the Ratio of Variances of Two Samples drawn from a Given Normal Bivariate Correlated Population.** By S. S. Bose. *Sankhyā*, Vol. 2 (1), 1935, 65-72.
13. **On Estimating Individual Yields in the case of Mixed-up Yields of Two or More Plots in Agricultural Field Experiments.** By Subhendu Sekhar Bose and P. C. Mahalanobis. *Science and Culture*, Vol. I (4), 1935, 205.
14. **On the Distribution of the Ratio of Two Samples drawn at Random from two Uncorrelated Populations of Type III.** By Subhendu Sekhar Bose. *Science & Culture*, Vol. 1 (6), 1935, 365.
15. **On the Influence of Shape and Size of Plots on the Effective Precision of Field Experiments with Juar.** By R. K. Kulkarni, Subhendu Sekhar Bose and P. C. Mahalanobis. *Ind. Jour. Agri. Sc.*, Vol. VI (2), 1936, 460-474.
16. **A Complex Experiment on Rice at the Chinsurah Farm, Bengal, 1933-34.** By S. C. Chakrabarti, Subhendu Sekhar Bose and P. C. Mahalanobis. *Ind. Jour. Agri. Sc.*, Vol. VI (1), 1936, 34-51.
- *17. **Statistical Analysis of a Manurial Experiment on Napier Grass by the Method of Co-variance.** By Subhendu Sekhar Bose, S. C. Sen Gupta and P. C. Mahalanobis. *Ind. Jour. Agri. Sc.*, Vol. VI (2), 1936, 183-194.
18. **The Effect of Different Methods of Harvest on the Estimated Error of Field Experiments.** By S. C. Chakravarti, Subhendu Sekhar Bose and P. C. Mahalanobis. *Agri. Livestock in India*, Vol. VI (6), 1936, 814-825.
19. **Frequency Distribution of Plot Yields and Optimum Size of Plots in an Uniformity Trial with Rice in Assam.** By Subhendu Sekhar Bose, P. M. Ganguly and P. C. Mahalanobis. *Ind. Jour. Agri. Sc.*, Vol. VI (5), 1936, 1107-1121.
20. **Studies in Tiller Variation.** By K. C. Banerjee, Subhendu Sekhar Bose and P. C. Mahalanobis. *Ind. Jour. Agri. Sc.*, Vol. VI (5), 1936, 1122-1133.
21. **A Statistical Study of the Yield of the Permanent Manurials, Pusa.** By T. V. G. Menon and Subhendu Sekhar Bose. *Ind. Jour. Agri. Sc.*, Vol. VII (1), 1937, 193-204.
- *22. **A Statistical Study of the Deterioration of Yields of the Permanent Manurials, Pusa.** By Subhendu Sekhar Bose and T. V. G. Menon. *Ind. Jour. Agri. Sc.*, Vol. VII (1), 1937, 205-213.
23. **On a Bessel Function Population.** By Subhendu Sekhar Bose. *Sankhyā*, Vol. 3 (3), 1938, 253-261.
24. **On the Exact Test of Association between the occurrence of Thunderstorms and an abnormal Ionisation.** By Subhendu Sekhar Bose and P. C. Mahalanobis. *Sankhyā*, Vol. 3 (3), 1938, 249-252.
25. **Relative Efficiencies of Regression Coefficients Estimated by the Method of Finite Differences.** By S. S. Bose. *Sankhyā*, Vol. 3 (4), 1938, 339-346.
- *26. **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, 103-111.
- *26a. **The Estimation of Mixed-up Yields and their Standard Errors.** Vol. 4 (2), 1938, 112-120.

Papers in the Press.

- (1) **A Study of Forty-three Years of Rainfall in Calcutta, 1893-1935.** By S. S. Bose.
- (2) **Note on the Optimum Shape and Size of Plot for Sugarcane Experiments in Bihar.** By S. S. Bose, K. L. Khanna and P. C. Mahalanobis. (*Ind. Jour. Agri. Sc.*)

[Papers marked with an asterisk formed the basis of the thesis for the Premchand Raychand Studentship which was awarded to Subhendu Sekhar Bose, by the University of Calcutta, for the year 1935.]

It was the first work of Jaganmohan Bose.



SUBHENDU SEKHAR BOSE : 1906—1938.

PERSONAL REMINISCENCES OF LABORATORY WORKERS

Sudhir Kumar Banerjee :

My acquaintance with Subhendu dates back to 1929. At that time I was doing some computational work for Professor Mahalanobis. The idea of starting the Statistical Laboratory had not probably taken any definite shape even in his mind. Subhendu had just started his life as a Research Student in Physics ; and was working on one of the long tables fitted up in the room which forms at present our main computation room. It was the first week of January. Subhendu was looking worried and was pacing up and down the room. A mercury lamp with which he was working had been damaged by some unknown hand. The apparatus being costly, Subhendu was considerably perturbed over it. We were then just two or three of us, doing statistical computation, and sharing the room with Subhendu in the Physics Laboratory. Our presence there used to be looked upon with disfavour in many quarters and we were regarded as unwanted intruders. Our disappearance from there would have been welcome. Here, then, was an occasion which could easily be turned to our disadvantage had Subhendu so desired it. We were the only people who had access to his table, and even a low whisper against us would have discredited us. But Subhendu was above this—he would much rather have borne the loss and indignity himself than shift it to others. This incident, trifling though it was, brought me in close touch with him for the first time.

Hitherto we had watched Subhendu from a distance, praised him for his scholarship, and liked him for his pleasant smile. Now, for the first time, I saw Subhendu from close quarters—an upright young man who in future years was going to be our hero. As our acquaintance ripened into intimacy I came to have nothing but love and admiration for him—the passing years merely brought forth in full blossom the seeds of greatness that we had seen in him in his early life.

The years 1931 to 1938, a period of seven long years, saw us working together in the closest possible association. From 8 A.M. to 8 P.M., sometimes even on Sundays and holidays we sat together, the best of friends and colleagues. Subhendu had now and then been offered a job outside, but I always stood in the way. The idea of losing him from the Laboratory was too painful. Who could then imagine, that death would cut him off from the Laboratory for ever and that so soon !

When Professor Mahalanobis was busy starting a Statistical Laboratory on modern lines, the science of statistics in India was in its infancy, and was commonly regarded as skill in remembering figures and working out averages. Even with his acknowledged sway over his students, Professor Mahalanobis was finding it extremely difficult to attract talented students for his new venture. In the teeth of much opposition, some of it coming from scientists of great repute, Subhendu decided to take up seriously the study of a subject which was then considered to be more a dilettante's hobby than a science. His coming in at this crucial stage turned the tide. His love of scientific work prevailed over every obstacle. He continued to take interest in Physics, but he remained all through a true votary of statistics.

Subhendu was by temperament a democrat in the best sense of the word! Indeed, his popularity itself sometimes came in for adverse criticism from the Professor himself as it was considered to be interfering with work. It would, however, be no exaggeration to say that but for this "popularity" of Subhendu, which formed a part and parcel

of his self-effacing character, it would have been impossible for statistics (then a dry and despised science) to take its roots so firmly and spread itself so quickly in the Indian soil.

Like all great pioneers and true seekers after knowledge, Subhendu had to toil very hard to advance the cause which was so dear to his heart. Through his self-less endeavours, he was able to collect round him a devoted band of workers whom he inspired with his unflinching zeal and unsurpassed energy. More than anyone else, he helped to bring the science of statistics to its present position of pride in India. Nothing would give his spirit greater delight than that his life's work should be carried on successfully by his devoted followers. That, indeed, is the real homage we can pay to the departed great, and the most enduring monument we can raise to his memory.

Raj Chandra Bose :

By the untimely death of Subhendu Sekhar Bose at the young age of 32, the cause of Statistics in India has received a great set back. He had not only an exceptionally sound grasp of the principles of theoretical statistics, but he brought to bear on his statistical work a rare judgment, born of experience and his strong common sense, which enabled him to have a deep physical insight into the problems confronting him. In fact it is this insight which is the distinguishing mark of a great applied worker, for it is through this, that the gulf between abstract science and physical reality is bridged. He had to do a very large amount of advisory work, as experimenters in various fields of work usually wanted his advice on the statistical interpretation of the data gathered by them. Besides this he was a born teacher, and was extremely popular with the large number of officers who are sent to our laboratory for statistical training. But with all his learning and devotion to work he was as simple as a child, and everybody who came in contact with him was charmed by his magnetic personality. In an institution such as ours, where with only a limited staff an enormous amount of work has to be done, overwork is inevitable ; and Subhendu Sekhar Bose worked himself to death. But in spite of this hard work, during the long years that I was in contact with him, I never saw him without his usual smile. By his death Bengal has lost a great scholar and a greater man.

Haricharan Ghosh :

Subhendu Babu is no more. A brilliant student, an unostentatious worker, a true type of the ancient Indian scholar—his life has been cut short in the prime of youth. The outside world knew him as a scientist. But within the Laboratory we can never forget his genial smile, his never failing courtesy, his generous consideration and lovable personality ; and we miss the individual even more than the statistician.

Kunwar Kishen :

I had the privilege of first coming in contact with Subhendu Sekhar Bose in the summer of 1936 when I was on deputation from the Department of Agriculture, Punjab, for a course of training in statistics under his guidance. The few months it was given to me to spend with him I regard as one of the happiest and most instructive periods of my life ; and it was with some reluctance that I returned to the Punjab after the completion of the period of my training. In 1938 he was largely instrumental in bringing me back to the Statistical Laboratory, and I looked forward with the greatest pleasure to the prospect of serving under him. I do not, therefore, know in what words to express my sense of personal loss at the passing away of Subhendu Sekhar Bose.

* * A friend to all, bearing malice to none, and always ready to render whatever help he could to those who approached him for it, his personality shed a radiance all around.

Naresh Chandra Mukerjee :

From the very beginning of my connexion with the Statistical Laboratory in September 1935 I came into intimate personal contact with Subhendu Babu and was charmed by the uncommon sweetness of his character. Besides passing eight or nine hours in the Laboratory in his company I would often accompany him on my way home—as we both used to travel on the same section of the Railway from Sealdah. The hours which I had thus the privilege of passing in his company outside the Laboratory were precious to me ; and it was always a pleasure to hear him on any subject—from the recitation of beautiful poems to the conversation on the most ordinary topics of life.

K. Raghavan Nair :

The late Subhendu Sekhar Bose had a brilliant record of academic honours. His teaching abilities stand yet unsurpassed as has been testified to by his numerous students throughout India. Although my contact with him lasted only for two years from October, 1936 till the time of his death, I had the privilege of working in closest association with him all this time. I was being trained as his understudy to do his work during his absence and thus had ample opportunities of studying him. I was simply full of admiration for his methods of work.

His published works are by no means an adequate measure of his activities in the Statistical Laboratory. In fact the visible output would have been much larger if he had not made great sacrifices for the more humdrum but none the less the essential everyday work of the Laboratory.

Apart from his scholarship what impressed even a stranger on a first talk with him was the intrinsic charm of his personality. He had a touch of the sublime in his character. He had nothing in him of 'a man of God' of the traditional type, but he was essentially a spiritual being, believing in all that is great and true in every religion, and with love for everybody. His friends in Calcutta must be numberless, for I used to see regular streams of visitors coming to see him throughout the day with no other ostensible purpose but to enjoy his company. To many of them he was a friend, philosopher and guide.

I had little opportunity of spending much time with him in his family surroundings, his house having been situated some ten miles from Calcutta. But the homage paid by the people of his village on the occasion of the meeting held in his memory, which I had the privilege to address, bears ample testimony to the unique hold he had over his fellow villagers.

He was always informal in the Laboratory. His attitude towards his subordinates was that of a brother. He had an inherent power to infuse enthusiasm into them when they were plodding along with drudgery of computations. He was the soul of the Laboratory, and nobody could even imagine that the Laboratory could ever go on without him. His place will never be filled ; but we are confident that his self-less devotion will continue to inspire his fellow workers in years to come,

Samarendra Nath Roy :

To me and to all other who ever came into his orbit, the death of Subhendu Sekhar Bose has been a loss almost too personal to be shared with the public. It is with some hesitation therefore that I shall say a few words regarding the part he played in building up the Statistical Laboratory.

From the modest beginnings full of uncertain hopes and fears, through long weary years when prospects often looked so gloomy, down to the time of his death when dreams had already begun taking shape, he had been such a vital part of the Laboratory that it would be difficult to think of it in isolation from him. Apart, of course, from the founder's his was the spirit which sustained and animated, and gave encouragement to all who came here in pursuit of knowledge. Great as a scholar who knew a large part of the subject so well, great as a teacher who by lucid exposition made his science so popular, he was even greater as a man. Of his deep knowledge, his perpetual good humour, his genial personality and his wide sympathies much will be said by others. There are just one or two things about him which may not be known to those who knew him only through statistics.

He had a flair for experimental physics which he had developed early in his life, and he would most probably have gone in for physical research had it not been for the rather exceptional circumstances which called him to statistics almost immediately after he had passed out of the university. As a matter of fact modern physics specially on the experimental side continued to be his second love till the very end, and it is remarkable how in the midst of his all engrossing duties in the Statistical Laboratory he managed to keep himself fairly well posted in the recent developments of some of the main lines of modern experimental physics.

Mention must be made here of another gift of his which is not very common among scientific workers either in India or abroad. He was a lucid and forceful writer on current topics of science, specially of physics. He had at his command a good Bengali prose built up on years of wide study of Bengali literature, specially of Tagore, and he turned it to good use in his copious contributions spread over 9 or 10 years on current scientific topics to various popular Bengali periodicals.

He was a keen lover of Bengali poetry and music and was a great admirer of Tagore, many of whose pieces he had got by heart and would often recite with great feeling. He was something of a poet himself and in his College days he had quite a reputation among his fellow students for his facile poems which were good for his years. Indeed poetry and music helped not a little to form and keep up that fine idealism which on the positive side creates all that is worth while in life—all that really matters to humanity, and which on the negative side perhaps makes one a little blind to some of the ugly realities of the world.

We all mourn his loss in sorrow and silence and cherish his memory with pride and reverence.

J. M. Sengupta :

I first came in touch with Subhendu Babu when I started work as an untrained computer in 1932. I knew him primarily as a teacher. With his remarkable powers of exposition he was for us a sure guide for solving every kind of doubt and difficulty. But he was not merely our teacher and guide, he was also above everything else our friend. With the increase in the number of persons coming to the Laboratory for training from outside, his touch with us decreased, but we knew that whenever any

difficulty arose we could count on his help. Looking back on our early struggles we can only remember with gratitude what he did for us.

Our loss is incalculated, but yet greater is the loss to the science of Statistics in India. Our only consolation is that he has left us a rich heritage of selfless and silent service, which is often the only lot of some of those who do not wait for enjoying the fruits of their struggle but who labour in order that science may flourish, and that their country may prosper.

Sadasiv Sen Gupta :

Subhendu died young in years, but with assiduous care he had already richly laden his life with knowledge and love. Educated in the great school of poverty and self-help he brought a touch of sympathy and understanding in his dealings with men which endeared him to all who came in contact with him.

I had opportunities of knowing him in his private life, and in his family surroundings. Here also we saw the same picture of courtesy, kindness, and consideration for others. I vividly remember that even in the midst of terrible sufferings during his illness, his affable and sweet nature was never ruffled. He always took the hard blows of life quietly and with dignity; and he went in for his last operation with undaunted spirit, and the never failing smile on his face.

In life he gave of himself generously and without reserve. Students approached him for guidance, his large circle of friends for his enjoyable company, journalists for his illuminating articles, people of his own village for light and direction in matters social and educational, and members of his family for help and advice to get along in life. Above all statistics demanded of him his zealous allegiance. For all he had the same answer "certainly, I shall see what I can do" ; and he always kept his promise. He worked hard and worked himself to death, giving himself unstintedly to all who wanted his help.

As I write these lines as my humble tribute to his memory, a sense of hesitancy comes upon me. Knowing him as I did, I knew he was no admirer of formal tributes to a departed soul. For us, his old colleagues at the Statistical Laboratory, the question of perpetuating his memory does not seriously arise. We can never forget him. Almost every file, the old books and the journals, the pages of 'Sankhya', the old machines, the profiloscope, and indeed every little thing here bear his touch and impress.

Life passes away but memory remains. Let us then be true to the memory of one whom we so much miss to-day.

Harischandra Sinha :

The sad and untimely death of Subhendu Sekhar Bose is so recent, and the sense of loss so keenly poignant that it is difficult for me to write anything about him at length. I knew him for only seven years, yet he filled such a large space in my life that the sense of emptiness and void still presses on me. My memory goes back clingingly to those early days of the Indian Statistical Institute and of the Statistical Laboratory when there was so much work to be done and when there were so few persons to do it. Like several other of my colleagues, I had to do my share by working long into the night after my duties at the Calcutta University. But I know that it would have been utterly impossible for us to work like this but for Subhendu Babu's companionship. He radiated energy and enthusiasm all around. It was his smiling face and undaunted spirit that inspired us to action. I recall with pride that I first taught him the special techniques for handling

economic data and I also recall with pleasure his exceptional ability and quickness in grasping a new subject. Subsequently, on many occasions, I found discussions with him on my own subject eminently helpful and stimulating. What I owe to him, I can never accurately assess. I know that this feeling is shared by most of our colleagues in the Statistical Laboratory. He sacrificed himself with eagerness and alacrity, in order to be of help to others. His soul was like a star that dwelt apart. Had he been merely a clever research worker, we could have misunderstood him. Had he been only a subtle statistician, we could have mistrusted him. Had he been merely a man of high intellect, we could not possibly have taken him to our hearts as our very own. What he was to me and to others like me, I cannot describe. What he still is to me and to others is enshrined only in our memory.

Prabhat Ranjan Ray :

Most of the people who came in contact with him came to know of his profound devotion to the cause of Statistics, but only some of us knew what a dutiful brother he was. He had cut down his personal expenses to a minimum, and every penny that he could save this way went to pay for the education of his brothers. Excepting the little money that he used to spend on his plain dress (dhuties, ready-made shirts and punjabis, and a cheap pair of shoes) his only other item of personal expenditure was a 3rd class monthly pass for the train journey from Sealdah to Sonarpur and back. For fourteen long years, from the day he joined the Presidency College as a student, until he fell ill he walked everyday from the Railway Station to the Laboratory. Even on a scorching day in summer, or in pouring rain he would never ride in a bus or a tram. In fact he used to say that the road to the station had grown so familiar to him that he could almost walk blind-fold. This sacrifice of personal comforts, so unostentatious and yet so genuine, only showed the man in him. Had he been spared the normal span of life he would not only have gone down as an able statistician but as a man for our youths to emulate and follow.

Jaladhar Sarma :

I knew Subhendu Babu for ten years. When I first joined the Laboratory I used to work both as a steno-typist and as an untrained computer, and I had my first lessons of computations from him. Later on with increasing pressure of work we used to meet him only during the tiffin hour. We had a small room set apart for the purpose, which has since been encroached upon for lack of accommodation, and usually between 3 and 4 P.M. we used to break off for our tiffin. Subhendu Babu, as in all other things, was the most regular member, while the other workers joined him off and on. Almost everyday there used to be a regular crowd, eating and chatting, laughing and discussing the burning problems of the individuals of our little world. His tiffin which he used to bring from his own home knew little variation. A few pieces of home-made *chapatis* with fried potato and vegetables and little sugar or *gur* and a pinch of salt. He used to bring his modest fare in a green plantain leaf wrapped in a piece of cloth which was washed every day. The food was typical of him with nothing fancy about it, home-made, wholesome and pure. Although he did not bring a large quantity, almost everyday he shared it with some of his friends who gathered round him. Taking our tiffin with him was one of the pleasures of our life. Some times we were unlucky ; Subhendu Babu had to finish his meal quickly, and we also dispersed after a short time. On other days, when we had a little more leisure, we used to prolong our tiffin and enjoy his company.

LETTERS FROM FRIENDS AND COLLEAGUES

We are giving below extracts from the numerous letters which we received from the friends and colleagues of Subhendu Sekhar Bose.

Bhai Balmukund, M.A., M.Sc., *Professor, Punjab Agricultural College, Lyallpur.*

I came into close contact with Mr. S. S. Bose in January, 1938, at the Calcutta Session of the All India Statistical Conference, the responsibility for the whole arrangement for which seemed to rest on his shoulders. He bore the burden cheerfully and capably. I was very much impressed by his magnetic personality; though scholarly and serious-minded, he was always with a smile on his face. . . . His death is a great loss to our country but to those who knew Mr. Bose well, it has come as a personal bereavement.

E. A. R. Banerjee, M.Sc., *Selwyn College, Cambridge.*

The sad news of Subhendu Babu's death reached me from an unexpected quarter, and I could not believe it until I was shown a letter. I cannot express how keenly I feel the loss. We have not only lost a sincere friend but a great man. I can easily realize what his loss means to the Statistical Laboratory. The Laboratory may get another able statistician but not the same genial personality. As for us, he will always live in our memory.

Kiran Chandra Basak, B.A. (Cantab), *Statistician with the Indian Jute Mills Association.*

. . . His devotion to statistics, born out of a genuine scientific spirit, made a profound impression on me during the eight years of my close association with him. In those pioneering days when the Statistical Laboratory was struggling through its infancy, the cheerful leadership of Subhendu was a source of inspiration to us. As a man he was great, as a colleague he was ideal.

P. H. Carpenter, F.I.C., F.C.S., *Chief Scientific Officer, Tocklai Tea Experimental Station, Assam.*

It is with very great regret that I and other members of Tocklai have learnt of the death of Subhendu Sekhar Bose. We very greatly appreciated his visit to Tocklai, and we had hoped that this would be repeated, because he had a particular gift for imparting his statistical knowledge to those not very conversant with such work. I regarded him as a brilliant teacher and we shall undoubtedly miss greatly his very able help.

Indubhusan Chatterjee, *Physiological Chemist, Government Farm, Dacca.*

Mr. Bose started his professional career as a temporary statistician at Dacca Government Farm from March to August, 1931. He was engaged in writing a statistical report on agricultural experiments in the province, and I was placed in charge of the work as Agricultural Officer. I still have the most vivid recollection of how devotedly he worked at his problems here. During my fifty years of life I have rarely come across a man who combined such sterling worth of head and heart. Young in years, he was not known so widely except within the circle of his fellow workers and friends, but he carried within him the attributes of a great personality. . . . I earnestly hope that his noble example, his courtesy and selfless service will form an enduring link between the outside workers and the Institute.

R. A. Fisher, Sc.D., F.R.S., *Galton Professor of Eugenics, London.*

I was sincerely grieved to hear of the sudden death of your assistant S. S. Bose, whom I had the pleasure to accompany during my pre-Congress tour last winter in India.

I need hardly say that on that occasion he made himself infinitely helpful, and was an interesting and attractive companion in all circumstances.

He was as modest as he was accomplished, and his untimely death must be a serious loss to the Statistical Laboratory.

Kazi Motaher Hossain, M.Sc., *Lecturer in Physics, Dacca University.*

My association with late Subhendu Sekhar Bose was one of unmingled pleasure. . . . He was one of those men who disclose their whole being all at once. His charming manners and his characteristic smile endeared him to all who came in contact with him. I still remember how

patiently he would be seated hour after hour surrounded by a host of young as well as grown up workers who had come to the Laboratory from all over India. I often wondered how he could keep it up week in and week out. It was his love for teaching that gave him strength.

He had other interests besides statistics. Once I discovered in his drawer a horoscope in his beautiful handwriting. On being asked about it, he admitted that it was his hobby, and that he regarded astrology as a system of statistical inferences based on a huge mass of data. . . . He was also a keen lover of poetry. . . . Indeed he had a touch of the poet in himself. And this was, perhaps, the secret of his delicate sense of proportion in his dealings with men.

I saw him last at his house at Sourpur whilst he was still ailing. He seemed quite cheerful, and said that most probably he was to be spared this time. In the course of conversation I remarked that his illness had forced on him a quietude that he had seldom enjoyed in the midst of his work. He smiled a little, and said that communion with one's own self and contemplation of the problems of the bigger life were essential for happiness, and he looked forward to living a fuller life than before. But alas! this was not to be, and he was snatched away with many of his hopes still unrealized.

V. N. Likhite, Ph.D., Deputy Director of Agriculture, Baroda.

It really came as a great shock to me at Lyallpur when I heard of the premature death of our brilliant, hardworking and ever helping friend Subhendu. One feels dazed when one gets such news unexpectedly. I remember the happy days I passed with him when I joined the Laboratory in Calcutta. How happy we were playing cricket or making jokes after the statistical work of the day was over. . . . He looked on life and its woes always with a cheerful smile on his face.

K. B. Madhava, M.A., A.I.A., Professor, University of Mysore.

Subhendu Sekhar Bose was taken away in the prime of his youth while his powers were at the peak effectively working in the fruitful field of agricultural statistics. I had occasion to adjudicate more than once on his thesis for Premchand Roychand Scholarship, the highest prize open to the alumni of the Calcutta University, and I found his work of uniformly excellent quality. In awarding him the scholarship, the Calcutta University not only rewarded his great ability, but also recognised the high place that statistical study and research has attained in a modern university. I came into intimate contact with Bose a number of times; and during our long talks, which often glided into late evenings, he revealed many aspects of his work and interests in science, in art and letters, and in the human values of life. We, and our subject, and his smaller circle of blood relations, are no doubt poorer by his loss, but may the fund that is raised to perpetuate his memory serve to ever widen his influence over coming generations of statistical workers in India.

S. K. Mitra, D.Sc., Director of Agriculture, Assam.

We are all sorry to have lost Subhendu Sekhar Bose so suddenly and at a time when he was developing into a statistician of all-India standing. He ungrudgingly helped us in planning and interpreting many an agricultural experiment and we, in Assam, keenly feel the loss that agricultural research workers all over India have sustained in his death.

G. G. Nawathe, B.Ag., Agricultural Inspector, Kalol, Baroda.

. . . . He was always so sociable and kind that it was simply a pleasure to be with him. His power of explaining the intricacies of the subject were truly extraordinary, and he was ready at all hours to help us, whatever may be the difficulty. . . .

Satyabrata Roy, M.A., Board of Economic Enquiry, Bengal.

I cherish the memory of my close association with Subhendu Babu since 1934. In him love of research was stronger than ambition, and the spirit of service deeper than the lure of worldly success. Even within the short period for which he worked as an honorary lecturer of the Calcutta University he left a lasting impression among students and teachers alike. . . . His cheerfulness never failed him; and we shall never forget the smile with which he greeted us on his way to the Medical College, where he was being removed for an operation from which he never recovered.

K. C. K. E. Raja, L.R.C.P. & D.P.H., D.T.M. & H., Assistant Public Commissioner with the Government of India.

. . . He gave of himself freely and ungrudgingly to the building up of the Statistical Laboratory and the Indian Statistical Institute under the inspiration and guidance of Professor P. C. Mahalanobis.

He had the prospect of a long and brilliant career before him in the field of statistical science and it is sad to think that premature death should have cut off the promise of such fine achievement.

S. P. Raychaudhury, D.Sc., *Agricultural Chemistry Section, Dacca University.*

The news of the passing away of Subhendu Babu came as a shock to me. He was known to the young agricultural workers all over India and it is extremely unfortunate that the career of an enthusiastic and ardent research worker like his should end so soon. In the experiments on manurial trials of the University of Dacca on the nutrition of rice plant we depended mainly on his statistical advice and we consider his death an irreparable loss to us.

A. T. Sen, Ph.D., *Agricultural Chemist, Burma, Mandalay.*

I am indeed very sorry to learn that Subhendu Sekhar Bose passed away so early in life. It would be no exaggeration to say that in the sphere of Agricultural Statistics, Bengal has lost in him a very brilliant research worker whom it will be hard to replace. The affection that grew up between us through personal contacts will make me mourn his loss for ever.

Boshi Sen, *Vivekananda Laboratory, Almora, U. P.*

I heard the sad news of Subhendu Sekhar Bose's death only two days ago. It is a great personal loss for all of us who have known him. He was such a true research worker and a real teacher as well. His charm, his enthusiasm and his willingness to help others endeared him to everybody. India has too few workers of his type, and to lose him at this early age is a great blow to all of us and to statistical science in India in particular.

S. Sen Gupta, M.A., B.L., *Chittlagong.*

It can well be imagined how much distressed I am at the death of Subhendu. I came to know him as my brother's friend, but we soon became the closest of friends ourselves. I am not competent to assess the extent of his achievements in science. What I feel is the loss of a sincere and intimate friend. He was a real gentleman and had a heart of gold.

B. L. Sethi, M.Sc., Ph.D., *Economic Botanist to Government, U. P., Cawnpore.*

I had the privilege of coming into personal contact with Mr. Bose in 1936 when I went to Statistical Laboratory, Calcutta for a course of training in statistics. I was highly impressed by his ability, courtesy and charming personality.

An all-round statistician with a broad scientific outlook, Mr. Bose had a considerable volume of successful research to his credit; and his name will be always associated with the improvement of statistical methods in India.

As a post-graduate teacher he acquired a reputation throughout India; and many officers occupying responsible positions in the Provincial Agricultural Departments owe much to his wise guidance and the training in statistical methods which he gave them.

P. V. Sukhatme, D.Sc., *Assistant Professor of Vital Statistics and Epidemiology, All-India Institute of Hygiene and Public Health, Calcutta.*

I came to know him first in June, 1936, when I worked with him as a colleague in the Statistical Laboratory. He was a born teacher, immensely loved by the students and officers who came to the Statistical Laboratory on deputation for training in statistical methods. He was greatly interested in research in theoretical statistics but was at his best on the applied side. By his versatile interests he found a number of applications of statistics to problems of research arising in branches of science ranging from Agriculture and Physics to Astrology. He was a worker of great promise of whom much was expected. He had a charming personality and an everlasting smile on his face.

A. C. Tunstall, B.Sc., *Mycologist, Tocklal Experimental Station, Assam.*

Although I cannot claim a long and intimate acquaintance with Subhendu Sekhar Bose, I feel his death to be a personal loss. He was a rare combination. Though a brilliant scholar himself he had the patience and ability to explain his ideas fully to those with duller wits. His own power to grasp a new subject, clearly and quickly, was exceptional. His sound commonsense allied to a profound knowledge of his subject never failed to illuminate. Yet with all this exceptional ability he remained a very lovable man, keenly alive to the human aspects of his science. I look back with pleasure to the few days I spent with him at the Presidency College a little more than a year ago. He seemed so much alive then; it is difficult to realise that he is dead now.

Rao Bahadur M. Vaidyanathan, M.A., L.T., F.S.S., Statistician, I. C. A. R., New Delhi.

The untimely death of Mr. S. S. Bose came to us like a shock. Though a keen statistician, he was a teacher by temperament. Every agricultural officer under training in the Statistical Laboratory, Calcutta, was all praise and admiration for him, and those who were trained by him have expressed to me in glowing terms the ease with which he used to explain the intricate ideas of modern statistical methods.

When statistics is still in its infancy in India, we could ill afford to spare him at this moment. His charming manners and simple personality had captivated every one of us, and his death is a personal loss to every one who had come into close contact with him.

S. N. Venkataramanan, B.A., B.Sc., (Ag.), Marketing Officer, Madras.

The news of the passing away of Subhendu Bose comes as a great shock to me, and I feel that something very good has passed out of my existence. I had the good fortune to spend one year of useful life in the Statistical Laboratory, that liberal institute of learning at Calcutta, and in that period I came into daily contact, with Subhendu, and drew from him the benefit of help and guidance which he gave so freely to all workers. To them and particularly to the younger workers in statistics, he was a tower of strength. Possessed of a high intellect, he combined it with a simplicity of manners and sweetness of temperament all his own, and I have never come across an instance when his temper was ruffled or when his help was not readily forthcoming. To me personally, he was very helpful on all occasions, whether in the field of pure mathematics or in the application of such knowledge to practical problems. He was a great fundamentalist, and I have found him give a clear lead in many aspects of different sciences such as genetics, animal nutrition, field experiments, medical science and the large list of miscellaneous problems which come to the Statistical Laboratory for solution.

I had also the good fortune to know something of his private life, which was eminently one of sacrifice and simplicity. Like all intellectuals, he possessed also the element of independence—but in him, it was something lovable. He was one of those who could sacrifice greatly for a principle. Words cannot express sufficiently well those qualities, which made him universally liked, and both in the Laboratory and among his friends his passing away leaves a void which cannot be filled.

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Messages of condolence have also been received from the following persons:—

Mr. Durgaprasanna Acharya, *Department of Physics, Hooghly College*; Mr. Nakibuzzaman Ahmed, *Inspector, Agricultural Training College, Jorhat*; Mr. B. Arora, *Statistical Officer, E. B. Railway*; Mr. K. C. Banerji, *Rice Research Officer, Bankura*; Dr. S. K. Banerji, *Offg. Director General of Observatories, Poona*; Mr. R. D. Bose, *Superintendent, Botanical Section, Pusa*; Mr. Sukumar Basu, *I.C.S., Secretary, Imperial Council of Agricultural Research, New Delhi*; Major D. N. Chakravarti, *I.M.S., Brigade Laboratory, Allahabad*; Mr. Nistaran Chakravarti, *Inspector of Factories, Bengal*; Mr. Padam P. Chandra, *Deputy Cane-Development Officer, Meerut*; Mr. Amarendranath Chatterjee, *Department of Agriculture, Bengal*; Mr. Sachindranath Chakravarti, *Science Master, Government High School, Cawnpore*; Mr. Moziruddin Ahmad Chaudhury, *Department of Agriculture, Bengal*; Mr. K. Das, *Institute of Agricultural Research, Hindu University, Benares*; Mr. Dhirendranath Ganguly, *Indian Central Jute Committee, Calcutta*; Mr. Paresb Mohan Ganguly, *Karimganj Agricultural Farm, Sylhet*; Mr. Phani Bhusan Gupta, *Patna*; Mr. Imam Ahmed, *Agricultural Advisor, Rampur State*; Mr. Abdur Rashid Khan, *Punjab Agricultural College, Lyallpur*; Mr. R. S. Koshal, *Cotton Technological Laboratory, Bombay*; Mr. M. N. Majumdar, *Hindu School, Calcutta*; Mr. A. L. Mukherji, *Department of Agriculture, Bengal*; Mr. Debnarayan Mukherji, *Secretary, Intermediate Board, Allahabad*; Mr. Anilchandra Nag, *Actuarial Department, National Indian Insurance Ltd., Calcutta*; Mr. C. E. Nayagam, *Pachaiyappa's College, Madras*; Mr. G. M. Panchang, *Irrigation Research Laboratory, Karachi*; Mr. A. F. Patel, *Assistant Cotton Breeder, Amreli, Kathiawar*; Mr. L. N. Phukan, *Agricultural Laboratory, Jorhat*; Dr. B. N. Pramanik, *Assistant Agricultural Chemist, Shajahanpur*; Mr. Sankatha Prasad, *Department of Pharmaceutics, Hindu University, Benares*; Mr. Deva Raj, *Department of Economics, Christ Church College, Cawnpore*; Mr. G. K. Sant, *Institute of Plant Industry, Indore*; Mr. K. V. Sastry, *"Danavayi Peta", Rajahmundry*; Mr. Bhagat Ram Sehgal, *Cotton Research Laboratory, Lyallpur*; Mr. Raghunath Shangloo, *Department of Agriculture, Kashmir*; Dr. B. N. Singh, *Irwin Professor of Agriculture, Hindu University, Benares*; Mr. R. Thomas, *Deputy Director of Statistics, Hyderabad, Deccan*.