JNANENDRA NATH MUKHERJEE

(1893 - 1983)

Foundation Fellow

EARLY LIFE

JNANENDRA NATH MUKHERJEE was born on April 23, 1893 at Mahadevpur District Rajshahi, now in Bangladesh. He was the eldest son of his parents, Shri Durgadas Mukherjee and Shrimati Saratshashi Devi. His father had a brilliant academic career and became the Principal of the Raj Chandra College, Barisal. He gave it up later in favour of a Provincial Judicial Service. J nanendra Nath lost his father when he was only twelve years old, and was brought up along with his younder brother (Dr Harendra Nath Mukherjee of the then Carmichael Medical College) by his mother who 'had a strong character, intelligence, courage, business ability and determination''*.

About his early school life, Professor Mukherjee writes in About Myself as follows:

I was admitted into the Dinajpur High School in 1906. I remember . vividly that I was placed at the head of a procession with a small flag of the Indian National Congress in my hand. Everybody shouted 'Bande Mataram' and spoke of Surendranath as the national leader. I began to feel that nationalism and patriotism were very important. That was perhaps the reason I joined the Anusilan Samiti while at school at Burdwan and learnt lathi play. One day we found a big portion of the masonary of boundary wall of the Samiti had been broken and we found that all our books, papers and records which were kept in a room had been taken away. We had to discontinue our activities. I was a student of the Municipal High School, Burdwan (1907-1909). At Burdwan I came across some pamphlets issued by Christian Missionaries who were carrying on a very scurrilous campaign against Hinduism describing Goddess 'Kali' and her worship in filthy language and the motive was always to show the superiority of Christianity as against Hinduism charactarised by gross misrepresentations and distortion of facts; it created a repulsive feeling in me against Christian Missionaries.

He goes on to say, While at Tamluk I got attacks of amoebiosis which has dogged me since then throughout my life and greatly handicapped in my

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J. N. Muschenjer



activities.I had also severe and frequent attacks of malaria throughout my school days at Burdwan.I had boils inside my ears while at Tamluk and I cannot hear at all with my right ear, and the laft ear is also defective.

From the Municipal High School, Burdwan young Mukherjee appeared in March 1909 at the last Entrance Examination of the Calcutta University and got a District Scholarship.

Three teachers impressed me. The Headmaster, soft spoken but strict in discipline and a good teacher of English. The Assistant Headmaster who taught us history, took a great deal of interest in me and my classmate Renu Pada Kar. The Head Pandit was a man of integrity and character and took great interest in his students. He taught me to write verses in Sanskrit using simple rhymes (anustup and totak).

COLLEGE EDUCATION

Jnanendra Nath was a student of Presidency College (1909-1915) and received his BSc (1913) and MSc (1915) degrees of the Calcutta University. Based on his thesis for MSc Degree a paper on Electric Synthesis of Colloids was published in the Journal of the American Chemical Society (1915, 39, 292). Prafulla Chandra Ray, Jagdish Chandra Bose, Shyamadas Mukherjee, Subodh Chandra Mahalanobis, Chandra Bhusan Bhaduri and Jyoti Bhusan Bhaduri impressed him in his student days, each in his own characteristic manner.

It is interesting to note that Satyendra Nath Bose, Jnan Chandra Ghosh Meghnad Saha, Prasanta Chandra Mahalanobis, Pran Krishna Parija and Professor Mukherjee himself amongst other illustrious personalities who were classmates, became General Presidents of the Indian Science Congress Association. It is no strange coincidence that the development of scientific research and science in our country was, at the initial stages, a great deal due to the efforts of this group. The influence of the teachings of Rammohan Roy especially on the importance of education broad-based on science and technology impressed this group and it is no mere coincidence that most of this group of brilliant students took up science course. They whole-heartedly believed that the economic salvation of India depended to a great extent on the proper application of science and technology.

Opportunity for post-graduate studies in a large number of subjects, including those of science was opened by the establishment of the University College of Science and Technology at 92, Upper Circular Road (now Acharya Prafulla Chandra Road) and at 35, Ballygunge Circular Road. Presidency College also formed a part of the organization of post-graduate studies in science. Writing of this in About Myself Professor Mukherjee says, Satyendra Nath Bose Inan Chandra Ghosh, Meghnad Saha, Nikhil Ranjan Sen, Pulin Behari Sarkar Prasanta Chandra Mahalanobis (Presidency College), Sisir Kumar Mitra and myself along with some others were appointed as



lecturers in our respective subjects. Asutosh Mookerjee believed in young talents and selected promising young men and appointed them straightaway as lecturers in the postgraduate classes and provided some facilities for research also. He was the first and perhaps the last to establish a centre of academic studies at the University stage with a disinct atmosphere of learning and scholar-ship and appointed some of the best men available in the country as University Professor or Lecturers.

RESEARCH AND PROFESSIONEL CAREER

School of Colloid Science

Professor Mukherjee's first work done independently, while he was an MSc student of the Presidency College, was on colloids which he could publish in the Journal of the American Chemical Society in 1915. In 1919 he and Jnan Chandra Ghosh joined the University College, London to work in the Physical Chemistry Laboratory under the charge of Professor FG Donnan FRS. Professor Mukherjee continued his research on colloids and his major line of work was to develop his theory of the electrokinetic double layer and its ionic constitution. "At the .. Discussion on the 'Physics & Chemistry of Colloids', jointly sponsored by the Faraday Society and Physical Societies of London, Professor Mukherjee presented his paper on Origin and Neutralisation of the Charge of Colloids which received a highly laudable mention by the reviewer of the proceedings of the discussion published in Nature. The reviewer wrote, "Perhaps the most important paper of the whole discussions, in that it represented a distinct advance in theory was that by Mr JN Mukherjee in the Section of 'Precipitation in Cataphoresis and Electroendosmosis". Professor Disperse Systems: Theodor Gyedberg, the Nobel Laureate presided over the discussions. The proceedings were published in 1921. A subsequent paper On the Adsorption of Ions, published in the Philosophical Transactions in 1922, was a further development of the theory, and is recognised as a definite step forward in understanding the complex colloid chemical reactions.

Professor Donnan was quick to recognise the high quality of Professor Mukherjee's research and his lucid interpretation of the complex behaviour of colloidal particles in suspension and their interaction with ions in solution. He therefore, trusted him with his junior research students and even class lectures in his absence.

Another crowning glory of Professor Mukherjee, while at Professor Donnan's laboratory, was the development of the Boundary Method for the determination of the cataphoretic speed of colloidal particles. A paper describing the apparatus and its working was published in the *Proceedings* of the Royal Society in 1928. Later, Dr Arne Tiselius developed a more refined apparatus and won the Nobel prize. It is unfortunate that text books on colloid refer to the U-tube method of Professor EF Burton FRS which



Professor Mukherjee proved to be unreliable but does not mention his technique. However, Professor Freundlich and Dr Zeh, Dr W Hackar and Professor I Traube used his technique with great advantage. The Boundary Method was further refined after his return to Calcutta in which he obtained balanced ionic environment for the development of a sharp boundary.

A paper by Professor Mukherjee and NN Sen on Coagulation and Effect of Dilution published in the Journal of the Chemical Society, London had a similar fate. For instance, the text books on colloids mention about Burton-Bishop rule based on a similar but much later work by them even though it was a less complete work than that of Mukherjee-Sen. Examples of such studied injustice and negligence by the scientific community of the Western world were, to say the least, most irritating. But they had to be put up with. There were however, sympathetic and understanding ones amongst the greatest of them who did not take such biased views of the scientific work of Indians.

The work published by Professor Mukherjee was of so fundamental a nature on the study of colloids that it at once attracted the attention of the stalwarts in the field. He received spontaneous appreciation and approbation from almost all quarters. Many of the complexities which were less understood or vaguely understood could be clarified on the theory put forward by him. Colloid chemists throughout the world have either written to him personally or mentioned in their publications in laudatory terms about his contributions.

School of Soil Science

Dr Mukherjee was able to foresee how basic soil colloid studies could be of help in understanding many of the soil properties and problems. Sir John Russell, FRS, in his report to the Government of India wrote that Dr Mukherjee's work "was clearing up a lot of difficulties in regard to chemical constitution of clay substances in the soil, which is of fundamental importance for the study" and that "his investigations on soil colloids are recognized in Europe as being both sound and important". His approach was not only original, but perfectly thorough. He brought to use in the study of the soil all the tools and techniques he had been developing and improving through years of patient research. The applications of refined measurements of physical and colloid chemistry to problems of soil, an apparently crude object of research appeared far fetched even to well-meaning people. Hence the "luxury research", as his schemes were often labelled in official quarters was granted financial aid perhaps on the merits of his The study of soil is now a science and to make it so personality alone., Professor Mukherjee's contribution has been of great significance. His presidential address at the 39th Session of the Indian Science Congress (1952) is a blueprint of his ideas in respect of what pure science can achieve in such 'applied material as the soil.



The major constituents of soil clay are silica and alumina. How astounding his fundamental approach to the problem was can easily be judged by the fact that he first started detailed investigations with the colloidal sols of silica and alumina. The next approach was to study clay fractions isolated from different soils of India, and subsequently the clay minerals which constitute the major portion of soil clays. Thus he created a group of soil workers which has been aptly termed the "Calcutta School of Soil Science" by Professor CE Marshall. To this School belong his students who are today occupying eminent and responsible positions, in the country. The series of papers on Nature of Reactions Responsible for Soil Acidity, published in the Indian Journal of Agricultural Science, will remain as a monumental piece of original investigations in soil science.

Agricultural Research Development

Besides making pioneering contributions in the domain of Soil Science, Dr Mukherjee played a key role in the development of agricultural research and education in the country. Soon after his appointment as Director of the Imperial (now Indian) Agricultural Research Institute, New Delhi, in 1945. Dr Mukherjee began to reorganise the research and educational activities of the Institute vis a vis the country as a whole. Under his direction the Institute expanded considerably in terms of its academic activities and scientific performance. He initiated research in the area of soil-plant studies. Some of the sections he created in the Division of Soil Science and Agricultural Chemistry are Soil Survey Soil Physics, Agricultural Chemistry, Soil Fertility, Soil Microbiology Biochemistry, Organic Chemistry and Spectroscopy. Recent expansion of some of the sections such as Soil Survey, Microbiology Biochemistry, Agricultural Chemicals, Agricultural Physics to full-fledged divisions bears testimony to his great foresight.

The credit for initiating systematic studies on micronutrient elements in soils and plants and also on clay mineralogy of soils with the help of sophisticated instruments and modern techniques goes to him. He initiated work in the Institute on the nutritive value of foods, feeds and fodders, on insecticides and fungicides, and on the chemistry of plant products.

He was the first in the country to lay great emphasis on the importance of soil surveys for agricultural development and underlined the importance of uniformity in the methods of survey, classification and nomenclature of the soils of India. At his suggestion the Ministry of Agriculture of the Government of India established in 1949 the Central Committee on Soil Science with him as chairman. The terms and reference of the Committee were practically in conformity with the objectives of the All India Soil and Land Use Survey Organization established in 1956 with four regional centres.

He collaborated with Dr B Viswanath and Mr AC Ukil in the preparation of the soil map of India published in 1944 by the Imperial (now Indian)

Agricultural Research Institute, portraying the different climatic types on the basis of N S Quotients. The soil map of India revised under his guidance (scale 1" = 70 miles) showing 20 soil classes was published in 1954. He also developed the concept of the basic soil regions in the classification of the soils of India based on similar characteristics of land viz., the climate, topography, vegetation and soils.

Agricultural Education

In the field of postgraduate training in agriculture and related sciences, the Indian Agricultural Research Institute offers facilities which are unequalled in the country. The post-graduate courses of two years' duration leading to the Associateship of the IARI were instituted at Pusa (Bihar) in 1923, but it was not until 1945 that regular syllabi of studies were laid down, and courses of instruction consisting of lectures, practicals, and field work introduced. The courses were followed by examination of the students in which senior external examiners drawn from the Universities and Government Agricultural Institutions were associated. The modernised system of teaching had a remarkable impact on the training programme. Professor Mukherjee nourished the idea of making the IARI a regular University. His dream did become a reality. In 1958, on the recommendation of the Indo-American Team on Agricultural Research and Education and with the generous aid of the Rockefeller Foundation, the Post-Graduate School was established at this Institute by the Government of India. The Institute now enjoys the status of a University under the University Grants Commission Act of 1956. The school has been developed to provide training leading to the award of MSc and PhD degrees in major fields of Agricultural Science comparable in quality, breadth and intensity to those of the best institutes in the world.

ORGANIZATION AND DEVELOPMENT OF LEARNED SOCIETIES

Professor Mukherjee believed that science in any country cannot develop properly unless the scientists have a proper forum to discuss and exchange their experience and to disseminate the knowledge acquired. He became the Founder-Secretary of the Indian Chemical Society which he founded under the Presidentship of Acharya P C Ray in 1924. He was also one of the members of the Foundation Committee of the erstwhile National Institute of Sciences of India (now the Indian National Science Academy). The importance of a Society of Soil Science was realised by Professor Mukherjee long before the Soil Science Society of America was founded. He was mainly instrumental in the foundation of the Indian Society of Soil Science in 1934, and was its Secretary (1934) and President (1935-1936). The Society has since expanded its activities and is publishing its own journal and occasional bulletins and monographs. The Society, its journal and bulletins and



monographs today enjoy a world-wide reputation. He took particular care to nurse the Indian Association for the Cultivation of Science and The Indian Science Congress Associations to their present stature.

After relinquishing the Directorship of the IARI, Professor Mukherje took up the Directorship of the Central Building Research Institute, Roorkee, UP in 1950. In 1954, he was appointed Administrator of the Board of Secondary Education, West Bengal. From 1956 to 1958, he was a Member of the Union Public Service Commission, New Delhi.

National Policy in Scientific and Agricultural Development

The administrative and organizing ability of Professor Mukherjee and his deep foresight were recognised at all levels-Central, State, Universities and Corporate bodies. Of his various associations only a few may be enumerated. In 1938, he was the Chairman of the Sub-Committee on Soil Conservation and Afforestation of the National Planning Committee of the Indian National Congress. In 1944-1945, he was a member of the Policy Committee on Agriculture, Forestry and Fisheries of the Viceroy's Executive He rendered valuable assistance in the coordination of the scientfic work of the different Ministries of the Government of India as a member of the Coordination Committee in Science, of which the Prime Minister was the chairman. As a member of the Board and of the Technical Committee of the Council of Scientific and Industrial Research, from its inception till 1952, he helped in the promotion of the objectives of the Council and was the chairman of its Chemical Research Committee. As nominated chairman of the Soil Science Committee and the Chemistry and Physiology Committee of the Indian Council of Agricultural Research, and also as a member of the Indian Sugarcane Committee and of the Scientific Committee of Indian Central Jute Committee he contributed greatly towards the development of agricultural research in India on these crops.

He has been a member of the Agricultural Research Committee of West Bengal for over two decades. As a part-time adviser to the Government of West Bengal in the Department of Agriculture, Animal Husbandry and Forestry and the first President of the Governing Body of the State College of Agriculture, he has substantially contributed to the development of agricultural research and education in West Bengal. In 1963, he was entrusted by the Chief Minister of West Bengal to report on the reorganization of agricultural research in the State. The 134-page report bears the characteristics imprint of his remarkable thoroughness, critical analysis of problems and originality of approach.

Positions Held

Professor Mukherjee led a very illustrious life holding several important positions. Some of them are: Professor of Chemistry, University College of Science and Technology, Calcutta; Director, Indian Agricultural Research

Institute; Founder Director, Central Building Research Institute, Roorkee; Part-time Scientific Adviser, Departments of Agriculture, Animal Husbandry, Irrigation, Forest, Community Development, Govt. of West Bengal; Administrator, Board of Secondary Education, West Bengal; Member. Union Public Service Commission; President, State College of Agriculture of West Bengal; President, Indian Science Congress ciation; President, Indian Chemical Society; President, Indian Society of Soil Science; President, Indian Association for the Cultivation of Science; Founder-Honorary Secretary of Indian Chemical Society; President, Indian Science News Association; President, Indian Society of Soil and Water Conservation; Vice-President, Indian Statistical Institute; Foundation Committee; Fellow, Indian National Science Academy; Fellow, Asiatic Society; Life member, Chemical Society, London; Member, General Assembly, Board of Executive Committee of the International Council of Scientific Unions; Chairman, Export Fertilizer Committee; Chairman, Homeopathic Enquiry Committee; Chairman, Research Committee, Department of Agriculture, Govt. of West Bengal; Chairman Land Utilization Board, Govt. of West Bengal; Chairman, Research Committee, CSIR; Member, Technical Committee and Board, CSIR; Member, Senate and Board of Accounts, University of Calcutta; Secretary (Science), Reorganization Committee, University of Calcutta; Chairman, several scientific committees of ICAR; Leader of the Indian Delegation to (i) the VI Committees of the International Society of Soil Science, Holland; (ii) the Third Congress of the International Society of Soil Science, Oxford; (iii) the Imperial Agricultural Bureau Review Conference, London; Member, Indian Scientific Misson of the Govt. of India to UK, USA, and Canada; Member, Indian Delegation to the Royal Society Empire Scientific and British Commonwealth Offical Scientific Conference, London; Member. Indian Delegation to the United National Scientific Conference on the Conservation and Utilization of Resources, Lake Success, USA: Member, Indian Delegation to the Second Congress of the Pan Indian Ocean Scientific Association, Perth, Australia; Delegate to the Conference on Tropical and Subtropical Soils, Rothamsted; President, Board of Trustees; Surendranath Trust, Calcutta.

FAMILY AND LAST DAYS

In Professor Mukherjee, we find a rare combination of superb intellect, strong discipline and hard work. He has been guiding and illumining, for more than half a century, his associates in diverse fields connected with agricultural research, education and development in this country. Shrimati Ajita Devi, wife of Professor Mukherjee and the eldest daughter of Shri Jogesh Chandra Chaudhuri, Bar-at-Law, died of typhoid on August 18, 1927 when their only son and issue, Deba Priya, was $2\frac{1}{2}$ years old. Deba Priya got MSc degree of Cambridge University in 1950 and joined Burmah Shell & Company as an executive but retired voluntarily in 1966 to start his own business at Jamshedpur and Ranchi.



Since early 1982, Professor Mukherjee was failing in health and could hardly move out of the house. He was suffering from severe lung congestion. The end came peacefully on 10 May, 1983. Just about a fortnight back, the Indian Chemical Society and the Indian Society of Soil Science jointly celebrated his 90th birthday at Calcutta.

SK MUKHERJEE

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