

Bisuha



#### BIRESH CHANDRA GUHA

#### 1904-1962

Professor Biresh Chandra Guha, a distinguished Fellow of the National Institute of Sciences of India, died suddenly on March 20, 1962 while on a holiday trip in Lucknow, Uttar Pradesh. At the time of his death, Dr. Guha was the Rash Behari Ghosh Professor of Applied Chemistry of the Calcutta University. Dr. Guha was the doyen of the Indian biochemists and will long be remembered and honoured for his contributions to Science and for his services to the country. He had achieved eminence by his extensive work on the biochemistry of Vitamin C, B Vitamins and in food and nutrition. The bibliography of his published work, which is printed at the end of this article, will give an idea of the extraordinary breadth and scope of Guha's research interest in biochemistry.

### 1. Birth and Parentage

Biresh Chandra comes of the well known Guha Thakurtha family of Banaripara, in the district of Barisal (now in East Pakistan). He was born on the 25th Jaistha of the Bengali year 1311 (8th June, 1904) in the town of Mymensingh where his father, Sri Rash Behari Guha was posted at that time. Being the youngest child, Biresh Chandra was all along brought up in a conservative and disciplined atmosphere, under the strict attention and guidance of his parents and elder brothers.

# 2, 3. Formative influences on the development of the young scientist's mind: school and university education

From his very boyhood, Biresh Chandra imbibed the spirit of the Swadeshi Movement which was passing at that time through a critical phase in our National history. His maternal uncle, Sri Aswini Kumar Dutta, an educationist and social reformer of eminence, had a profound influence on him during the formative period of young Biresh Chandra's career. Till 1917, Biresh Chandra had his early school education in Brajamohon School of Barisal. In 1918, he came to Calcutta and was admitted in the Srikrishna Pathsala wherefrom he appeared in the Matriculation Examination of the Calcutta University in 1919. Biresh Chandra very much desired to study Arts in the Intermediate Course, but his two elder brothers, who were professors of English in two of the Calcutta Colleges, wanted him to take up Science. He was finally persuaded

to take up the science course and was admitted very late in the I.Sc. Class in the City College, Calcutta. Botany was not then taught in the City College and he had to read Botany in the evening course at the Indian Association for the Cultivation of Science, Bowbazar, Calcutta. It was at the Bowbazar Science Association Hall that the writer first came in close contact with Guha's charming personality and patriotic spirit. In 1921, Biresh Chandra passed the I.Sc. Examination by standing Second in order of merit and took admission to the B.Sc. Class in Presidency College with Chemistry Honours. Within a few months, because of his attending a banned political party meeting, he was imprisoned and finally he was compelled to leave Presidency College because of his political views and affiliations. However, Biresh Chandra succeeded almost immediately afterwards in securing admission in the St. Xavier's College from where he passed B.Sc. Examination in the First Class standing first in order of merit. While studying in the M.Sc. Class, Biresh Chandra became one of the favourite students of Acharyya Prafulla Chandra Ray. Acharyya Ray's devotion to science, selfless idealism and patriotism left a great mark on Biresh Chandra's career, as it did on many other young scholars in the twenties of this century.

After a brilliant academic career in Calcutta University and spending a year of his research career under the inspiring guidance of the late Acharyya P. C. Ray, Dr. Guha proceeded to England in 1926 and carried out during the next 5 years, pioneering biochemical investigations with particular reference to B vitamins in the laboratories of the late Prof. Jack Drummand at the University College, London and the late Prof. Gowland Hopkins at the Biochemical Laboratory, Cambridge University. He obtained both Ph.D. and D.Sc. degrees of London University.

#### 4. Contribution to Science

On his return to India in 1932, Guha was recommended by his London Professors to take up the newly created post of Professor of Biochemistry at the All India Institute of Hygiene and Public Health. Because of Guha's political affiliations and also due to the fact that he was not a medical biochemist, the post could not be offered to him. Later Guha joined the Bengal Chemical and Pharmaceutical Works and initiated there many lines of work on the preparation of vitamin concentrates and biologically active compounds from glandular products. However, all the original ideas he had on some of the aspects of carbohydrate metabolism, particularly on the biosynthesis of ascorbic acid, could not be developed in full vigour with the limited facilities available at the research laboratories of the Bengal Chemical and Pharmaceutical Works. An opportunity to work on such lines presented itself when he was appointed in 1936 at a comparatively young age to the chair of Applied Chemistry at the University College of Science, Calcutta. Soon he applied himself with zeal to the

building up of an active school of biochemistry at the Science College. Two years later, on the award of a Ghosh Travel Fellowship from the Calcutta University, he visited the United Kingdom and the Continent again to study the organization and development of Biochemistry in these countries.

During the period 1936 to 1943, Guha and his associates worked on the vitamins and minerals contents of several types of Indian food, fresh water and sea fish used for edible purposes, on the factors affecting the biosynthesis of ascorbic acid in animal tissues and also on the nature and properties of oxytocin from the posterior pituitary gland. As part of the problem of biosynthesis, considerable time was devoted to elucidate the changes in the nature and the concentration of reducing substances present in living tissues. It was also during this period that he and his co-workers found the presence of ascorbic acid in the combined form as "ascorbigen". Many years later from the same laboratory emerged the report on the isolation of "niacinogen", a form of nicotinic acid found in cereal embryos and cereal brans where the vitamin is complexed with a polypeptide. The isolation of this niacin complex in the crystalline form and establishment of its nature was indeed a very elegant and notable piece of work. The role of the combined forms of vitamins such as ascorbigen and niacinogen in metabolism is still obscure. There is some evidence to indicate that these complexes break down to release free vitamin, in the case of niacinogen, to meet the needs of the cells during germination for extra coenzymes.

The man-made famine that starked Bengal in 1943 drew Guha from the seclusion of his laboratory and literally pushed him to the fore of public causes. He applied all his knowledge of Biochemistry and Food Technology to prepare cheap protein foods and digests for the treatment of extreme cases of starvation and emaciation. The wanton suffering of millions of people ensuing out of the denial of the elementary need of a properly balanced and nutritious food left a deep impression on Guha and this was indeed the primary factor that transformed him from a research worker confined to the 'ivory tower' of his academic circles to the uncompromising advocate for the voice of science in the counsels of

Government for the speedy implementation of its policies.

In 1944 he took up the assignment of Technical Adviser to the Food Department of the Government of India. Here he initiated plans for an integrated programme of nutrition surveys for the whole country. Although diet surveys had been conducted in different parts of the country from time to time and it was well known that the common Indian dietaries were deficient in proteins and vitamins, due to many factors, the Government had not yet become alive to the serious nature of the food problem in all its dimensions. During those days there was only talk of increasing the caloric content of the diets and all emphasis was laid for more output of cereals and tubers towards the objective of providing more calories.

It is apt to mention here that during his association with the administration of the Food department, Guha drew liberally from his early experience and training in Nutrition Biochemistry acquired while working for his Doctorate degree in London and Cambridge. As a happy coincidence, his former Research guide, Sir Jack Drummond was at that time the Nutrition Adviser to the United Kingdom. Studies made by Sir Jack on children compelled to live on rationed food due to the exigency of 'Blitzkrieg' in London and surroundings had revealed that with restricted calories as compared to pre-war non-ration days, the children were comparatively free from many common ailments and were growing surprisingly at a faster rate than had been recorded before war. This was due to the fact that although the food was rationed, under the advice of the Technical Experts, care was taken to see that the rations provided were adequate with respect to proteins, minerals and vitamins. Guha had available to him all this knowledge but due to several factors he could not implement any of them on a large scale. While associated with the Food Department, he conceived of plans for a Food Technological Research Institute and gave the idea some concrete shape with the active cooperation of Dr. V. Subrahmanyan of Bangalore who was then a 'Planning Officer' in CSIR, New Delhi. Subsequently, when the Council of Scientific and Industrial Research decided to establish such an Institute at Mysore, late Dr. S. S. Bhatnagar induced Dr. Guha to serve in its Executive Council for many sessions during its formative stages.

Although Guha took up his duties at the Food Department and later at the Damodar Valley Corporation with enthusiasm and a sincere desire to apply all his scientific knowledge to the problems posed by them, the administrative delays involved in the routine work of Government and the general apathy of policy makers to changes were situations with which he could not compromise. It was, therefore, with considerable relief that he returned to the University Professorship in 1953 after almost a ten years' spell (interrupted by 1 year only) of administrative assignments. He soon introduced the newer activities in microbiological assays and other techniques like radioactive isotopes and got back into his primary interest in the biosynthesis of ascorbic acid. Due mainly to his untiring efforts, the Calcutta University agreed to open a two-year Post-graduate course in Biochemistry and a new Department of Biochemistry under the Applied Chemistry Wing. Still later, a Centenary Professorship in Biochemistry was created and myself and Dr. V. Subrahmanyan, the two experts chosen for the Selection Committee of the University, induced Dr. Guha to accept this assignment. His premature death created a void which has not yet been filled.

The contributions made by Guha and his colleagues on ascorbic acid synthesis have been now recognised in all 'reviews' and authoritative monographs on the subject. It is known that all animal species except the primates and guinea pigs synthesize their requirements of ascorbic

acid and, therefore, do not become scorbutic. Primitive organisms like bacteria do not require ascorbic acid at all for cellular oxidations. The nature of the precursors of ascorbic acid and the metabolic pathway leading to its biosynthesis have been under active investigation in many laboratories all over the world ever since Szent-Gyorgyi isolated and identified the vitamin from adrenals and cabbage leaves. The classical work of Mapson, King and others have established that the chemical pathway leading to the biosynthesis of ascorbic acid is according to the general scheme:

#### D-Glucuronolactone --→ L-Gulonolactone --→ 2-Keto-Lgulonolactone --→ L-ascorbic acid

The enzymes, D-glucurono reductase and L-gulono oxidase mediating two of the important steps in the biosynthesis of ascorbic acid, are present in abundance in the microsomal fraction of rat liver. Work carried out under Guha's supervision has shown that these enzymes could be solubilized from microsomes by deoxycholate treatment. These enzymes are specific for the lactone forms and are presumably flavoprotein in nature. The level of these enzymes in rat liver are subject to wide fluctuations depending on the nutritional status of the animal, the enzyme activity falling significantly in conditions of other vitamin deficiencies particularly that of riboflavin and in endocrine imbalances like thyrotoxicosis.

The significance of Guha's work on ascorbic acid biosynthesis lies in its evolutionary implications. In the amphibians and reptiles, the key enzyme systems mediating ascorbic acid synthesis are mainly localized in the kidneys or embryologically related tissues. In most of the avian species the kidneys continue to be the main site for these enzymes until we reach the recent natural order 'Passeriformis' where the liver takes over the function from the kidneys. In some species the synthetic function continues to be shared between the kidneys and the liver. As evolution proceeded in the spiral towards the primates, the ability of the liver to mediate the key enzyme reactions was lost irreversibly, imposing on these animals a condition of dependency on exogenous supply of the vitamin for their survival. Guha's work laid thus the basis at the molecular level for the biochemical mechanism involved in this dependence or independence from the growth factor in different species in the evolutionary scale. This work demonstrates how a judicious use of precise methods of investigation to a fundamental problem of biosynthesis can lead to significant results capable of a more comprehensive interpretation and general application than thought of at the beginning. This work has also shown the importance of biochemistry as the connecting link between the two extremes of molecular genetics and species evolution in life sciences.

Guha also initiated fundamental studies on the comparative metabolism of normal and malignant tissues and the biochemistry of nucleotides. Due

to lack of several essential biophysical instruments, he could not pursue his interest in molecular biology and cellular biochemistry intensively. Side by side with the above fundamental studies, Guha pursued his

interest in certain aspects of Applied Chemistry and Biochemistry also. Probably to justify his appointment as Professor of Applied Chemistry, he worked for a while on problems of coal gasification and waste utilisation in the interest of national economy. Working under a CSIR Scheme, Dr. Guha and his co-workers proved that all the samples of blast furnace slag obtained from Jamshedpur and Kulti-Burnpur area could be utilized for cement by quenching with water. These results, however, were not made use of by private steel mills or Public Sector enterprises for the making of cements, though this commodity remained in short supply ever since. In collaboration with the Food Technology Department at Jadavpur, he set up a small pilot plant for carrying out parboiling of rice as a unit operation under controlled conditions. The various conditions worked out by him and his colleagues have been published in a series of papers in the new Journal, 'Biotechnology and Bioengineering', of which he was a Founder Editor. It is gratifying to note that the improvements suggested by Guha and his colleagues as a result of these investigations on the traditional methods of parboiling have been accepted by the Government for large scale extension throughout the country. At the Applied Chemistry Department he further initiated work on new lines like the utilization of coal, coal gas, jute wastes, the large scale retting of jute, fermentative production of citric and gluconic acids, etc. He was also responsible for planning a comprehensive study on the biochemistry of tea leaves from the green stage to its maturation, curing, storage, blending, etc.

After the shocking experience of the famine of 1943, Guha became actively interested in the problem of protein malnutrition. Realising the acute shortage of animal proteins in the country, he not only advocated the use of leaf proteins but also developed a number of semi-commercial and economic processes for the preparation of edible proteins from grasses and such unconventional sources as the water hyacinath. In 1944, Calcutta University lent the services of Guha to the Ministry of Food, Govt. of India, where he took up the assignment of Chief Technical Adviser. In this official capacity, he soon organized in the Food Department a Technical Wing for inspection, analysis and standardization of foods and gave plans for the development of food processing industries and for an integrated programme of nutrition surveys for the whole country. While working in the Food Ministry, Guha was deputed to serve the UNESCO in Paris as India's representative and counsellor in Agricultural Sciences. After returning to India, he joined his Calcutta University post for a pear and in 1948, persuaded by the late Dr. Shyama Prasad Mookeyee and

late Dr. B. C. Roy, joined the newly constituted Damodar Valley Corporation as a member from West Bengal. In this new assignments

Guha within a short time displayed considerable skill in the administration and organization of this multi-purpose project of river valley development.

These heavy administrative responsibilities, however, did not prevent him from associating with a number of scientific and research organizations in the country. He was actively associated with the administration of the Indian Science Congress Association, Association of Scientific Workers of India, Indian Council of Medical Research, Council of Scientific and Industrial Research, National Institute of Sciences of India and in the executive council of several National Laboratories.

Energetic as he was, in the midst of all these research preoccupations, Guha found time to vigorously champion the cause of scientific development, particularly Biochemistry in the country. His experience, gained through frequent international contacts with the most progressive biochemists of the Western World, and mature counsel were sought by many organizations and Government Departments. His integrity and independence of views expressed in a forthright manner commanded respect from all quarters. Although as a champion of the cause of scientific workers in general his place is assured in the annals of recent history, it is for his signal service to the recognition of Biochemistry as an independent discipline in the country that generations to come should feel indebted to him. One of the most important assignments shared by Guha and myself in the last few years was the membership of the Biochemistry Review Committee appointed by the University Grants Commission. The birth of this Committee was due to Guha. The members of the Committee visited all the University laboratories where Biochemical research was in progress and made a comprehensive report on the subject to the University Grants Commission. The upgrading of the Departments of Biochemistry at Calcutta, Lucknow and Nagpur received his blessings and he could make many of the Universities accept the concept of a separate chair for Biochemistry. Previous to the advent of this Review Committee, facilities for Post-graduate training in Biochemistry were available only at Bangalore, Madras and Calcutta. Thanks to the untiring efforts of Guha and his colleagues in the Review Committee, a nucleus for Biochemistry courses at Post-graduate level has been established in about half a dozen centres.

To the last moment of his life, Guha was working for the realisation of his dream of putting India on the biochemical map of the world. The idea of holding a Summer School in Biochemistry was his and actually during his last visit to Lucknow, he was busy finalising the programme for the Summer School at Srinagar after discussion with my former colleagues in Biochemistry Division of the Central Drug Research Institute at Lucknow. He was eagerly looking forward to this meet of Biochemists at Srinagar but destiny had planned otherwise.

of Biochemistry held successively at Cambridge, Paris, Brussels, Vienna and lastly, at Moscow. He was also a Sectional Chairman of the International Symposium on Enzymes held at Tokyo in 1960. In India the success of the symposium on proteins held at Mysore in August 1960 was in no mean measure due to his dynamic leadership.

## 5. Marriage, Wife, Children, reminiscence of private life

Guha married rather late in life (41 years) in 1944. His talented wife, Dr. Phul Renu Guha, a Ph.D. in Languages from a French University. Dr. Guha had known this lady for quite some time but in the earlier years he did not wish to get himself tied up in a settled life as his own political aspirations made him a 'marked man' in the eyes of the British Administrators of those days. The marriage with Dr. Phul Renu Guha, now a Member of the Indian Parliaments proved to be a turning point in his life's work and career in more than one ways. But for the wise counsel and devoted guidance of his wife, Guha, with his indomitable spirit, aggressive mentality and a burning desire for breaking the shackles and obtaining freedom for his country, would have landed himself behind the prison bars and would be lost for ever to the world of Science. Almost all his colleagues, co-workers, and friends were of the same opinion with the writer that the genial influence of his wife channelised his creative energies into a fruitful academic and laboratory life and into various social and cultural activities in which both of them joined almost with equal zeal and devotion. It was evidently a case of a married couple who shared amongst themselves quite a few common interests in social welfare work, music, culture, poetry and painting. The marriage however did not produce any child, though Biresh was very deeply devoted to young children and would have perhaps been happier if they had a issue of their own.

Guha's interests were broad and ranged far beyond the sciences. He was deeply read in 'Sanskrit', 'Bengali' and 'English' literature and could recite freely passages from Kalidasa, Tagore or Shakespeare. Guha's unusual combination of gifts included an ability to deliver a good lecture and write in a clear and attractive style. Vivid phrases recurred and gave his articles and editorials a freshness, not often found in scientific literature. Guha cultivated the art of public speaking and had given often outstanding exhibition of his 'gift of the gab'. As a public speaker he was frequently in demand and usually gave his services unstintingly. Latterly, he developed the knack, when an involved discussion appeared to be thoroughly bogged down, of being able to sum up the arguments in the problem with detachment and clarity, so that rational decision appeared possible once more. As a Chairman of certain Committees, he was superb-

If one has to recall certain reminiscence of Guha's private thing would stand out pre-eminently and that is, his vigorous, equilient,

aggressive and often dominating personality. He was far from being a timid, quiet, passive and a non-interfering individual like many of his other colleagues at the University. He had the quality of a torrential stream gushing through gorges and not a placid, smooth current of water with gentle ripples on its surface. A 'stormy petrel' of science, Guha was more in tune in a committee fight or a group debate than in a sedate and peaceful atmosphere. He believed in the dictum of the great Japanese Philosopher and Nation-builder, Yoshida Torajiro and often used to say "It is better to be a crystal and be broken, rather than remain for ever as a tile on a house top". A man of great personal charm and of manysided talents, Guha will long be remembered by his friends, colleagues and students with deep affection and respect. He was not only a very capable and respected scientist but also a man of high moral standing and humanistic outlook. In the shifting sands of time, men will come and men will go. Some can leave behind a bold mark of leadership which remains indelible for quite sometime. Guha undoubtedly succeeded in leaving such a memory trace in the fluorescent screen of many contemporary minds.

May his soul rest in peace.

B. MUKERII

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