

ASIMA CHATTERJEE : A DOYEN IN THE CHEMISTRY OF NATURAL PRODUCTS

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The year 2017 is the birth centenary of Dr. Asima Chatterjee, a doyen in the chemistry of Natural Products. She was one of the pioneer women scientists in India. In fact, she was the first woman to be awarded the Doctorate of Science (DSc) degree by any Indian University; first woman scientist to occupy a Chair professor of any Indian university, first woman General President of the Indian Science Congress and also first woman scientist to receive the Shanti Swaroop Bhatnagar Award in Science and second person in chemical science. We know that the social and cultural taboos secluded women from the scientific research and science study; it was traditionally preserved for men for a long period throughout the world. Only a few women can come out to establish themselves due to their strong will force and unconditional love towards science. Asima Chatterjee was one of such woman scientist of India. Her major interest was on the Chemistry of Natural Products from Indian Medicinal Plants.

ASIMA CHATTERJEE née Mukherjee was born on 23rd September, 1917, in Kolkata, the capital town of West Bengal. Her father Indranarayan Mukherjee was a medical doctor and mother Kamala Devi was a housewife. She was the eldest among the two children; the younger one was her brother Sarashi Ranjan Mukherjee, who became a renowned doctor. Both the parents were highly devotional towards Indian culture as well as modern education and successful enough to inculcate this temperament among their children. Asima's parents took special care to see that she was well conversant in Sanskrit which enabled her to read two great epics the Ramayana, the Mahabharata and works of the renowned writers of ancient India. These books deeply interested her in Indian tradition and culture. India is rich in medicinal flora and has a long history of their use in the Ayurvedic system of medicine. The scientific use of these medicinal plants to treat diseases was institutionalized in India under the Ayurvedic system. Asima was keenly

interested to explore this side from her childhood days. She felt the urge to introduce this idea in modern medical system and devoted her life to separate the chemical components of plants followed by elucidation of their molecular structure, which was really painstaking work at that time. On the other hand, her brother followed the western allopathy system and later became a renowned doctor and Founder Director of Nuclear Medicine in SSKM hospital (formally known as Presidency General Hospital) and retired as the Director of SSKM hospital. He also received the Shanti Swaroop Bhatnagar Award in Medicine, this being only example of two sibling receiving this prestigious Award. He collaborated with his sister in her research on medicinal plants. Beside science, Asima was interested in vocal music since her childhood. She received training in classical music, Dhrupad and Khayal, for over fourteen years and stood second in the All Bengal Music Competition in 1933.

From her very childhood, Asima was a meritorious student. In those days, Bethune Collegiate School of Kolkata, founded by Mr. John Elliot Drinkwater Bethune was inextricably associated with higher education for

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Bengali women. Naturally her parents admitted her to that school. She successfully passed her Matriculation Examination from there in 1932 and secured a Bengal Government Scholarship. Then she joined Bethune College. In 1934 she passed the ISc Examination from Latiff-Father this College and again obtained a Bengal Government Scholarship. She also obtained the Nawab Latiff - the Father Lafnot Scholarship of the University of Calcutta and the Hemprova Bose Memorial Medal of Sadharan Brahma Samaj. She wanted study chemistry honours. At that time there was no such college in Kolkata where female students could study Chemistry Honours except the Scottish Church College. Coming from an orthodox, joint Hindu family, severe objections were raised by the elders in allowing Miss Mukherjee to study in a co-education college. It was the courage and sheer determination of her Mother which enabled Asima to study there. During that period she was the only woman student out of three admitted in the Chemistry Department of Scottish Church College to complete higher education. From there she graduated with honours in chemistry in 1936 and received the Basanti Das Gold Medal. During her post graduate studies in Chemistry in Calcutta University she came in contact with the doyens of Indian Science, like Acharya Prafulla Chandra Ray, Professors Prafulla Chandra Mitter, Pulin Behari Sarkar, Jagendra Chandra Bardhan and Dr. Prafulla Kumar Bose. She obtained her MSc degree in 1938 with Organic Chemistry and stood second in the University of Calcutta and obtained the silver medal and Jogmaya Devi Gold Medal. Now she started her research work under the guidance of Dr. Prafulla Kumar Bose, one of the pioneer natural product chemists in India. Acharya Prafulla Chandra Ray created a special fellowship for her out of his salary which he used to donate to the University of Calcutta every month. Miss Mukherjee devoted herself towards her research work and received the Nagarjuna Prize and Gold medal from the University of Calcutta in 1940 for the best piece of research work carried out in the Department of Chemistry. In 1940 Miss Mukherjee joined Lady Brabourne College as the Founder-Head of the Department of Chemistry. She received the Premchand Roychand Studentship in 1942, and the Mouat Gold Medal -one of the prestigious medals of Calcutta University. She received her DSc degree in 1944 from Calcutta University on the merit of her research contributions on Naturally Occurring Indole Alkaloids and Coumarins. Incidentally, she became the first lady to obtain the DSc degree of any Indian University. In the same year, she was appointed as Honorary Lecturer in the Department of Chemistry, University of Calcutta.

Personal Life

In 1945 Miss Mukherjee married Dr Baradananda Chatterjee. Professor Baradananda Chatterjee was a well-known physical chemist having versatile knowledge in soil science and corrosion. He was a member of the Railway Board on Corrosion and Head of the Department of Chemistry and Geology of Bengal Engineering College (now known as National Institute of Engineering Science and Technology). He became the Vice-Principal (Academic) of that college. He was highly open minded and extended constant inspiration to his wife. In that sense Asima was really lucky to find the right liberal environment in both her parents' and husbands' families which helped her to serve Indian science as she desired throughout her life. In 1946 they had a daughter, Julie, their only child, who latter became a Professor of organic chemistry at Calcutta University. When Julie was only 11 month old Asima got a chance to work in the USA. In early 20th century it was almost impossible even to dream that a young middle class Bengali woman – in pursuing her interests, going aboard alone with her infant. The broadmindedness and the progressive outlook of her husband and her considerable courage made that possible. She left for USA with her eleven month old daughter in 1947 along with a governess on study leave from Lady Brabourne College. In USA she came into close contact with the Ramakrishna Mission through Swami Prabhavanandaji Maharaj of Ramakrishna-Vedanta Centre and Swami Nihilanandaji Maharaj of Ramakrishna Vivekananda Centre of New York office. Thus began her lifelong association with them and subsequently with Ramakrishna Math and Mission, Belur, West Bengal. Swami Abhayanandaji Maharaj popularly known as Bharat Maharaj (one of the senior most vice president of his time) and Swami Ranganathanandaji Maharaj had great influence on her and played a dominant role in her life in providing inspiration and courage.

In USA she first worked with Professor L.M. Parks at the University of Wisconsin on Naturally Occurring Glycosides and then with Professor L. Zechmeister at the California Institute of Technology, Pasadena. At the California Institute of Technology her field of work was on carotenoids and pro-vitamins. In 1949 she went to the University of Zürich where she worked with the Nobel Laureate Professor Paul Karrer on biologically active Indole alkaloids which became her most favourite field of research. She returned to India in 1950. Chatterjee left Lady Brabourne College in 1954 to join the Department of Chemistry in the University College of Science, Calcutta University, where she worked till the end of her active academic career. She was appointed Khaira Professor of

Chemistry, of Calcutta University. She occupied this chair till 1982. She was the first lady to hold any chair professorship in any Indian University.

A Tragic year in Her Life

The year 1967 was really a disastrous year for Professor Chatterjee. She lost her father who helped her to dream throughout his life. What was more shocking was that within a period of four months she lost her husband who was her inspiration and helped to realize her dream. Unable to bear this double tragedy, she suffered a massive heart attack while she was working at the University College of Science. Immediately she was hospitalized in a critical state. She lingered between life and death for days together. She took nearly three months for her physical recovery but mentally she had broken down completely. In 1968 she returned to her normal activities.

A Historical Come Back

The patent system in India at that time follows the Act of 1911 designed by the British Ruler on their interest. The ambiguities and deficiencies in that Act were fully exploited by the foreign owned pharmaceutical companies called Trans National Corporations which was detrimental for the Indian companies. Bengal Chemical and Pharmaceutical Works Ltd., Kolkata, a dream project of Acharya P.C. Ray, was involved in one of such historic legal battles with Hoechst Co. Ltd. over infringement of a patent right involving a 'Sulphonamide Derivative' in the year 1968. Late Professor Dukshaharan Chakraborty (the then Head of the Department and Sir Rashbehary Ghose Professor of Chemistry, University of Calcutta) was the principal witness for Hoechst Co. Ltd. Hoechst Co. Ltd. was confident enough to win the case as the Bombay high court had already given a positive verdict in a similar case as their's. Bengal Chemical and Pharmaceutical Works Ltd. at that time running through an acute financial problem. Due to her profound respect and devotion for Acharya Prafulla Chandra Ray Asima agreed to be the principal witness for the Indian Company on condition that she would not accept any fees. Mr. Rathin Deb and Mr. Somnath Chatterjee (Former-Hon'ble Speaker of the Lok Sabha) were the lawyers for Bengal Chemical and Pharmaceutical Works Ltd. Asima's profound knowledge of Organic Chemistry, courage and conviction helped Bengal Chemical Pharmaceutical Works Ltd. in winning the legal battle. In spite of her mental condition she had answered literally hundreds of questions in Chemistry for days together in the Calcutta High Court, standing in the Witness Box. If the company had lost the case it would

have to go into liquidation on account of the astronomical amount of libel suit sought by Hoechst Co. Ltd. The case was historical in three ways-

- i) Bombay high court in a earlier similar case gave the verdict just opposite to the Calcutta high court.
- ii) It saved Bengal Chemical from liquidation.
- iii) India Govt. has changed her patent law after that.

Really it was only possible for a person like her with extraordinary temperament to advocate this.

Research Carrier

Asima Chatterjee's research carrier started under the guidance of Dr. P.K. Bose, a pioneer in natural products chemistry in India. Her thesis for DSc was on the chemistry of Plant Products and Synthetic Organic Chemistry. It was sent to Nobel Laureate Professor A.R. Todd and other two foreign Examiners. Another significant initial work was on the chemistry of coumarins. Her work on coumarins started with two most common herbal plants of our country. One is wood apple popularly known as *Bel* (*Aegle marmelos*), which yielded an edible fruit, and is the only member of the monotypic genus *Aegle*, a species of tree native to India and the countries of South East Asia. Its fruits and bark are effective against gastrointestinal disorders and the bactericidal properties are attributed to the essential oils present in it. The different parts are used in folk medicine. Beside these, she and her group isolated a large number of coumarins bearing interesting substitution patterns from other Indian medicinal plants belonging to the families Rutaceae, Umbelliferae, Compositae, Euphorbiaceae and Thymelaeaceae. She had worked for over four decades on Rauwolfia alkaloids. She isolated Rauwolscine, a central nervous system stimulant, local anesthetic and aphrodisiac, from Rauwolfia and successfully worked out its structure. To study the structures of different alkaloids she extensively used spectroscopic techniques-almost new at that time, and chemical transformation studies. Her investigations on the alkaloids of *Rhazya stricta* have an important bearing on the biogenetic pattern observed in this species. Beside alkaloids, her work on terpenoids and coumarins are highly praiseworthy, specially her study on the structures of new terpenoids.

As an Author and Editor

On the request of renowned scientist Professor Satyendra Nath Bose, FRS, she wrote *Madhyamik Rasayan Vidya* (Vol I &II), on chemistry for Secondary School Students. It was published by Bangiya Bijnan Parishad, an

Institute founded by Professor Satyendra Nath Bose for the popularization of science through Bengali mother tongue. Another important work of Dr. Chatterjee was the edition of the *Bharatiya Banashoudhi*, a six-volume treatise on Indian medicinal plants. She revised, updated and edited those, which were originally edited by K. P. Biswas. During 1973-1977 those volumes were published by Calcutta University. She was the Chief Editor of the six-volume *Treatise on Medicinal Plants*, which described seven hundred medicinal plants and published by Council of Scientific and Industrial Research (CSIR).

Indian Science Congress

Dr. Asima Chatterjee was very closely associated with the Indian Science Congress throughout her life. She was the treasurer and general secretary for a term of three years each and later General President. Consequently she became first women General President of this most prestigious scientific organization. One would remember her eloquent address as General President at the 62nd Session of the Indian Science Congress in Delhi –

“Universities constitute the backbone of scientific and technological training and university research still forms the spearhead of scientific progress and provides a reasonably good barometer to the standard of science and technology in the country. Hence universities should receive top national priority”.

“The endeavour of scientists, teachers, and all those who in one way or other are engaged in the pursuit of science, should be to help not only the students but also the people at large, to understand the value of such pursuit. The facts of history and also the requirements of scientific progress will point to the supreme need for promoting the public understanding of science. The success of this effort will depend on our sincerity and zeal as also the depth of team spirit with which we would address ourselves to this enlightened task.”

“... all efforts to develop Science and technology will be futile if human implications of science are not given due consideration... the aim of Science and technology is not only to meet the materialistic needs of the country but also to create a better world with higher objectives and with a conception of global community. The time has come for nations to act in this vision.”

Research Institute at Salt Lake

Since the beginning of her teaching and research carrier Professor Chatterjee felt the urge to establish an

Institute for carrying out research on Indian medicinal plants, for developing new Ayurvedic formulations along with an Ayurvedic hospital for the people of West Bengal. To give reality to this dream, she approached the then Hon'ble Chief Minister of West Bengal, Mr. Jyoti Basu who donated to her about 10 bighas of land in Sector V, CN 4 Block, Salt Lake City, Kolkata, free of cost, on behalf of West Bengal government. On the other hand, the Ministry of Health and Family Welfare, Government of India, sanctioned the building grant. This unique Centre-State collaboration gave birth to the Regional Research Institute on Ayurveda. It gradually upgraded to the National Research Institute on **Ayurvedic Drug Development** under the direct administration of the Ministry of Health and Family Welfare, Govt. of India. Professor Chatterjee served here as Honorary Principal Coordinator for many years. The unique research work in this centre started with the development of Ayush 56, a combination drug (Indian Patent No. 141170 dt. 14th July 1976) used for the treatment of epilepsy and the anti-malarial drug, Ayush 64, which is a combination of different parts of four herbs, (Indian Patent No. 568/Del. 70, 7th August 1979). Both these were patented by the Central Council of Research in Ayurveda and Siddha (under the Ministry of Health and Family Welfare), Government of India and sold in the market in relatively low price. These two combination-drugs are landmarks in developing “alternate lines of treatment”. Late Professor S.N. Bose, F.R.S. took personal interest in the development of Ayush- 56. In its early stage he regularly used to visit the Bon Hoogly Hospital for Crippled Children where the drug was being administered to the patients.

As a Teacher

As a teacher Professor Asima Chatterjee was highly dedicated and always cared for the well-being of her students. Her first PhD. research student Dr. S.C. Pakrashi, commenting on her influence on students wrote: “...I joined Chatterjee's group in 1952 as a PhD student. It was not easy those days to carry out research in ill-equipped university laboratory and with meager funds and hardly any prospect of research as a profession. Still she could motivate, inspire and instill in her students the sense of commitment, integrity, sincerity, tenacity and all the essentials of a good research worker by her own example. As a teacher she was never satisfied with the performance so far as work was concerned. As a human being she was kind hearted and understanding. She would go out of her way to help not only her own associates, but anybody who would approach her.”

Honour

Asima Chatterjee, no doubt, was a doyen in the field of Natural Products Chemistry in India. Her tireless efforts in research give us a new dimension. Naturally in India and abroad she was been conferred with many prestigious awards. She had invited to delivered lectures in almost all renowned universities throughout the world. The chronological order of various honours, conferred on her is as follows:-

- i) 1940-: *Nagarjuna Award and Gold Medal* of Calcutta University.
- ii) 1942-: *Premchand Roychand Studentship* of Calcutta University.
- iii) 1944-: *Mouat Medal* of Calcutta University.
- iv) 1949-: *Watmull Fellowship* from *Watmull foundation, USA*.
- v) 1960-: *Fellow of the Indian National Science Academy, New Delhi*.
- vi) 1961-: *Shanti Swarup Bhatnagar Award*.
- vii) 1974-: *Sir P. C. Ray Award* of the Indian Chemical Society.
- viii) 1975-: *Woman of the Year* by the Bengal Chambers of Commerce.
- ix) 1975-: *General President* of the 62nd Session of the Indian Science Congress, New Delhi.
- x) 1975-: "*Padma Bhushan*" by the Government of India.
- xi) 1976-: *DSc Degree (honoris, causa)*, University of Burdwan.
- xii) 1981-: *Bhuban Mohini Das Gold Medal*, by the University of Calcutta, for the best contribution in Bengali for compiling in six volumes the "Bharater Bonousadhi"
- xiii) 1982-: *Sir C. V. Raman Award* of the Hari Om Trust by the University Grants Commission.
- xiv) 1982-: *DSc degree* from Banaras Hindu University.
- xv) 1982-84&1984-1990-: *Nominated Member of Parliament (Rajya Sabha) - nominated by the President of India as a Scientist-Academician*.
- xvi) 1984-: *Sisirkumar Mitra Lectureship* of the Indian National Science Academy.
- xvii) 1988-: *Professor P. K. Bose Award* of the Indian Chemical Society.

- xviii) 1989-: *Sir Asutosh Mookerjee Memorial Gold Medal* of the Indian Science Congress Association.
- xix) 1992-: *Goyal Prize and Gold Medal* of the Goyal Foundation, University of Kurukshetra.
- xx) 1994-: *Dr GP Chatterjee Lectureship* of the Indian Science Congress Association.
- xxi) 1994-: *Indira Gandhi Priyadarshini Award* of the All India Unit Conference.
- xxii) 1995-: *Silver Jubilee Award* of the Central Council for Research in Ayurveda and Siddha, Government of India, (1995).
- xxiii) 1997-: *Eminent Teacher Award* by the University of Calcutta .
- xxiv) 1997-: *Rathindra Award* of Visva-Bharati.
- xxv) 1998-: *Academy Medal* by the West Bengal Academy of Science and Technology.
- xxvi) 1999-: *DSc* from University of Kalyani.
- xxvii) 1999-: "*Bijnayan Bharati*" "*UPADHT*" from Sanskrit College, Kolkata on the occasion of its 150th Anniversary..
- xxviii) 1999-: *Sir Devaprasad Sarbadhikary gold medal* from Calcutta University.
- xxix) 2001-: *PC Chandra Purshkar* of the PC Chandra Group.
- xxx) 2006-: *DSc* from Vidyasagar University.
- xxxi) 2006-: *Honoured* by the then Mayor of Kolkata, Shri Bikash Ranjan Bhattacharjee, as an "*Honoured Citizen of the City*"

Conclusion

Asima Chatterjee was a passionate devotee of Shri Ramakrishna and Holy Mother Sarada and had ardent faith in the Philosophy of Swami Vivekananda. She believed in the "Karma Yoga" of the Geeta. Her record of achievements, her idealism, devoted commitment to the teaching vocation and total dedication to work proved that in true sense she was a "Karma Yogi". She often commented that "I want to work till the last day of my life" and that she did till two weeks before she was hospitalized, never to return. Mrs. Chatterjee passed away on 22nd November, 2006. If we follow her Karma yoga, in our field of work perhaps that will be real tribute to this great personality.