ASIMA CHATTERJEE

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(1917 - 2006)

(Elected Fellow 1960)

EARLY LIFE AND EDUCATION

ASIMA CHATTERJEE (Mrs) (née Mukherjee) was born in Calcutta (now known as Kolkata) on September 23, 1917, being the elder of two children of Late Dr Indranarayan Mukherjee and Late Smt. Kamala Devi. She passed her Matriculation Examination in 1932, from Bethune Collegiate School, Kolkata, (founded by Mr John Elliot Drinkwater Bethune on 7th May 1849) securing a Bengal Government Scholarship. In 1934 she passed the ISc Examination from Bethune College and obtained a Bengal Government Scholarship, Nawab Latiff and Father Lafnot Scholarships of the University of Calcutta and the Hemprova Bose Memorial Medal. She graduated with honours in chemistry in 1936 from Scottish Church College and received the Basanti Das Gold Medal. She was the only woman student out of three admitted in the Chemistry Department of Scottish Church College to complete higher education. 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 her to do so. Incidentally, it was the only college in Kolkata where female students could study Chemistry Honours at that time.

During her post-graduate studies at the University of Calcutta she came into close 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, who later joined Bose Institute as Professor and Head of the Department of Chemistry. She obtained her MSc degree in 1938 with Organic Chemistry as special paper and received the University of Calcutta silver medal and prize (ranking 2nd in the first class) and Jogmaya Devi Gold Medal. Miss Mukherjee 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 fellowship for her (amounting to rupees seventy five at that time) out of his salary which he used to donate to the University of Calcutta every month. Miss Mukherjee received the Nagarjuna Prize and gold medal of the University of Calcutta in 1940 for the best piece of research work carried out in the Department of Chemistry, the Premchand Roychand Studentship in 1942, the Mouat Gold Medal (one of the prestigious medals of the University) and the DSc degree of the University of Calcutta in 1944 on the merit of her research contributions on Naturally Occurring

Indole Alkaloids and Coumarins. Incidentally, she was the first lady to obtain the DSc degree of any Indian University.

Miss Mukherjee 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. Her parents took special care to see that she was well conversant in Sanskrit which enabled her to read the great *epics* of the renowned writers of ancient India.

In 1940 Miss Mukherjee joined Lady Brabourne College (one of the prestigious colleges in Kolkata) as the **Founder-Head** of the Department of Chemistry. She was appointed **Honorary Lecturer** in the Department of Chemistry, University of Calcutta, in 1944.

Dr (Mrs) Chatterjee (née Miss Mukherjee) left for USA in 1947 on study leave from Lady Brabourne College. She showed considerable courage in taking her eleven month old daughter with her along with a governess. There she came into close contact with Late Swami Nikhilanandaji Maharaj and Late Swami Prabhabanandaji Maharaj of the Ramakrishna-Vivekananda Centres in USA. Thus, began her life-long association with them and subsequently with the Ramakrishna Math and Mission, Belur, West Bengal. Late Swami Abhayanandaji Maharaj (the senior most Vice-President of the Ramakrishna Order; popularly known as Bharat Maharaj) and Late Swami Rangathanandaji Maharaj (Former President of the Ramakrishna Order) Ramakrishna Math and Mission, Belur, played a dominant role in her life in providing inspiration and courage.

Dr (Mrs) Chatterjee worked with Professor LM Parks, University of Wisconsin, on *Naturally Occurring Glycosides* (1947-1948), with Professor L Zechmeister, California Institute of Technology, Pasadena, on *Carotenoids* and *Provitamin* A (1948-1949). In recognition of this work she was awarded the coveted *Watumull Fellowship*. Mrs Chatterjee worked with Professor P Karrer, NL, University of Zürich, Switzerland (1949-1950) on *Biologically Active Indole Alkaloids* which became her life long interest.

FAMILY BACKGROUND

In 1945 Miss Mukherjee married Dr Baradananda Chatterjee, FNA, a well-known physical chemist who was an authority on Soil Science and Corrosion and was a permanent member of the Railway Board on Corrosion. He became Professor and Head of the Department of Chemistry and Geology and Vice-Principal (Academic) of Bengal Engineering College (now known as Bengal Engineering and Science University). Professor Chatterjee had a profound influence on his wife. Without his constant inspiration, encouragement and co-operation it would have been impossible for Mrs. Chatterjee to dedicate herself to the cause of Science. Her only child, Dr (Mrs) Julie Banerji, former Head of the Department of Chemistry,

University of Calcutta, and son-in-law Dr Avijit Banerji, former Head of the Department of Chemistry, University of Calcutta, and now Programme-Coordinator, UGC Centre of Advanced Studies on Natural Products including Organic Synthesis, are Professors in the Department of Chemistry. Her only grandchild, Dr. Aniruddha Banerji, has a brilliant academic career. He is inclined to life sciences – Zoology in particular. Working with a CSIR-NET Fellowship he obtained his PhD degree in life Science working at the Chittaranjan National Cancer Research Institute, Kolkata and has joined as Lecturer at St. Xavier's College (one of the prestigious and the only autonomous College in West Bengal) in the newly opened Department of Biotechnology (offering a five year MSc integrated course).

The year 1967 proved disastrous for Professor (Mrs) Chatterjee. She lost her father and then her husband within a period of four months. Unable to bear this double tragedy, she suffered a massive heart attack at the University College of Science and had to be hospitalised in a critical state. She lingered between life and death for days together. It took nearly three months for her recovery but by then she had broken down completely. It was through the influence and affection of Late Swami Abhayanandaji Maharaj of the Ramakrishna Math and Mission, Belur, that she regained her mental strength. The love and affection of her students, colleagues and staff members of the Department of Chemistry, helped in bringing her back to normal activities.

PROFESSIONAL CAREER

After her return to India in 1950, Dr (Mrs) Chatterjee started research on alkaloids and coumarins. She had rejoined her service as Head of the Department of Chemistry at Lady Brabourne College and Honorary Lecturer in the Department of Chemistry, University of Calcutta. In those days scholarships were rare and financial assistance most inadequate. As a result, the students often had to work in shifts. Those were indeed hard days for any teacher and frustrating for students who pursued research. Dr Chatterjee kept up the morale of her students through her own dedication.

In 1954 she was appointed Reader in the Department of Chemistry, University of Calcutta. At that time there was only one post of reader in the department. Soon she gained reputation as a teacher of rare distinction and a unique research guide. In 1962 she became the Kumar Guruprasad Singh Khaira Professor of Chemistry, a chair she held till her retirement in 1982.

In 1969, she became the Head of the Department of Chemistry, University of Calcutta, a post she continued till 1979. Due to her untiring efforts, understanding and coordination with her colleagues and under her dynamic leadership and foresight the department earned international reputation as a leading Centre of Teaching and Research in Chemistry. One would remember her eloquent address as General President at the 62nd Session of the Indian Science Congress in Delhi in 1975.

"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".

Professor Chatterjee was not satisfied with merely transmitting the facts of science to her students but she instilled in them an awareness of the significance of all they were learning - a rare skill which required a high degree of competence in the art of communication. In recognition of the work carried out in the Organic Section of the Department of Chemistry, the University Grants Commission sanctioned in 1972 the Programme of Special Assistance to selected departments for intensifying teaching and research on *Natural Product Chemistry* with Professor (Mrs.) Chatterjee as its Honorary Programme-Coordinator. She continued in this post till 2003. This department was upgraded to the Centre of Advanced Studies on Natural Products in 1985 and since 2003 as the Centre of Advanced Studies on Natural Products including Organic Synthesis with Professor Avijit Banerji as Honorary Programme-Coordinator. In the period 1975-1978 the Organic Section of the Department of Chemistry received the first phase of the UNESCO-UNDP assistance with substantial grants for purchase of equipments and fellowships for teachers and one technician of this section for training abroad. Incidentally, this was the only organic department in this country to receive such an assistance at that time. The second phase of the assistance continued till 1982. At that time there was serious dearth of space in the department. Professor Chatterjee brought funds from the University Grants Commission (New Delhi) and three floors were constructed in the NR Sen Building. The rooms have been used for installation of sophisticated instruments, as research laboratories for teachers and for expansion of the departmental library.

Professor Chatterjee travelled far and wide, not only in connection with the dissemination of the fruits of her research to the world community, but also to gain knowledge on the progress of research in her area of specialisation. She acted as Chairperson and delivered lectures in the UNESCO Symposia on Phytochemistry held in Kualalampur (1957) and Hongkong (1961), in the IUPAC Symposia on Chemistry of Natural Products held in Zürich (1955), Australia (1960), Japan (1964) and USSR (1970). She participated in the meetings of the British Association for the Advancement of Science in 1970 and 1971. As a member of the Indian delegation she visited several Universities and Institutes in USSR in 1965 on an Indo-Soviet Cultural Exchange Programme. She delivered invited/plenary lectures in the Indo-Soviet Symposia in USSR (Riga - 1971; Tashkent - 1973; Tbilsi (Georgia) - 1983), the Sri Lanka Science Congress in 1976, the International Symposium on Isoprenoids in Poland in 1979 and the first Princess Congress on Natural Products in Bangkok in 1987. As a guest of the German Academy of Science in 1975 Professor Chatterjee visited the Universities of Berlin, Frei, Ruhr and Bonn on a lecture/study tour. She

also delivered lectures in the Universities of Manchester and East Anglia and visited the Imperial Chemical Industries, U.K., as a guest of the British Council in 1975. As a member of the national delegation, Government of India, Professor Chatterjee attended the World Congress of Women in Prague, Czechoslovakia, which was organised by WIDF (Women International Democratic Federation) and spoke on "Women and Work, including Rural Women" in 1981. She re-visited USA in 1981 on a lecture tour and also Germany in 1981, 1986 and 1987. She went to Bulgaria in 1986 and 1987 and revisited Zürich in 1986. As she began taking more and more life-saving drugs she was compelled to stop all visits abroad and as the condition of her heart deteriorated still further she could not leave Kolkata and was only permitted to come to the University College of Science (Calcutta University) which was a few kilometres away from her home.

In 1968 Professor Chatterjee was involved in one of the historic legal battles in the country over infringement of a patent right involving a "Sulphonamide Derivative" between Bengal Chemical and Pharmaceutical Works Ltd., Kolkata (now a Government of India Enterprise) and Hoechst Co. Ltd. Due to her profound respect and devotion for her teacher, Late Acharya Prafulla Chandra Ray (Founder of Bengal Chemical and Pharmaceutical Works Ltd.), she agreed to be the principal witness for the Indian Company on condition that she would not accept any fees. 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. Mr Rathin Deb and Mr Somnath Chatterjee (now the Hon'ble Speaker of the Lok Sabha) were the lawyers for Bengal Chemical and Pharmaceutical Works Ltd. while the lawyers for Hoechst Co. Ltd. were eminent patent lawyers from abroad. Professor Chatterjee's profound knowledge of Organic Chemistry, courage and conviction helped Bengal Chemical Pharmaceutical Works Ltd. in winning the legal battle. She literally had to answer hundreds of questions in Chemistry for days together in the Calcutta High Court, standing in the Witness Box. It was a critical situation for the Indian Company for had it lost the case it would have to go into liquidation on account of the astronomical amount of libel suit sought by Hoechst Co. Ltd. Even today, the judges and lawyers of the Calcutta High Court, who were present at that time, remember Professor Chatterjee with devotion, awe and profound respect as several of them recalled this historic legal battle to her daughter on learning of her passing away.

NOTABLE SCIENTIFIC CONTRIBUTIONS

The research activities of Professor Asima Chatterjee extended over a period of nearly sixty years. Her major interest was on the chemistry of natural products from Indian Medicinal Plants. She, along with her scores of research students and research associates, made significant contributions in diverse classes of natural products of which alkaloids, polyphenolics and terpenoids deserve special mention, and also on

structural and mechanistic organic chemistry. Besides her keen interest on fundamental research, Professor Chatterjee always stressed on the utilization of phytochemicals from indigenous plants as drugs and drug-intermediates. Only some of her important contributions have been highlighted.

Alkaloids

Professor Chatterjee is well known for her research on the chemistry of indole alkaloids, a field in which she evinced keen interest since the beginning of her research career in 1938, when she started work on the chemical investigation of the alkaloids of *Rauwolfia canescens*. Her interest in this field received further impetus while working with Professor Paul Karrer, NL, at Zürich University (1949-1950) on the investigation of corynantheine and related compounds. On her return to India she extended her investigations to different *Rauwolfia* species and also to other genera of *Apocynaceae*. Her work on *Rauwolfia* species brought her into close association with Late Professor Dr. Salimuzzaman Siddiqui, FRS, former Director of Husein Ebrahim Jamal Post Graduate Institute of Chemistry, University of Karachi, Pakistan. For her contribution on *Rauwolfia* species she was invited to write two reviews "Rauwolfia alkaloids - A Chatterjee, *Zechmeister's Fortschritte der Chemie Organischer Naturstoffe*, **10**, 382 (1953)", and "Recent development in the Chemistry and Pharmacology of Rauwolfia alkaloids - A Chatterjee, SC Pakrashi and G Werner, *Zechmeister's Fortschritte der Chemie Organischer Naturstoffe* **13** 346 (1956)". Her pioneering work on the alkaloids of *Rauwolfia, Vinca, Alstonia, Rhazya* and *Kopsia* made immense impact on the researches that followed in the field of indole alkaloids both in India and abroad. Professor Chatterjee and her associates investigated the chemistry of almost all the principal types of indole alkaloids. This included, in addition to several bis-indoles of novel structures, monomeric C_{19}-C_{20} indolic bases of the *corynantheinoid, yohimbinoid, heteroyohimbinoid, strychnos, sarpagine-ajmaline, vobasine, picraline* and *aspidosperma* types. Among her earlier work in this area mention may be made of her studies on the structure and stereochemistry of rauwolscine, the major alkaloid of *Rauwolfia canescens*. This work not only revealed the occurrence of yohimbinoid bases in *Rauwolfia* species, but also helped to elucidate the structure of reserpine and other related alkaloids of *Rauwolfia*. She also made notable contributions to the elucidation of the structures of ajmaline and sarpagine. The correct stereo-configuration of the latter was first suggested by her group. Her later work on *Rauwolfia reflexa* revealed the presence of a novel dimeric bis-indole alkaloid, flexicorine, in addition to other indole alkaloids of new structural patterns.

One of the most fruitful areas of her research had also been the investigation of various *Alstonia* species. More than twenty new alkaloids had been isolated from *Alstonia venenata*.

Extensive studies on echitamine, a quaternary alkaloid of *Alstonia scholaris*, established the presence of a pyrrolidino-indoline moiety in the compound. Another challenging problem had been the structure of nareline, isolated from the same plant. It possessed a new skeletal pattern (indolo-2-aza-adamantane) and was biogenetically derived from the picraline-type bases. It featured a modified E-ring with a C_5-C_{12} rather than the usual N_4-C_5 bond. The exocyclic C_5 was present as an aldehyde group which formed a cyclic hemiacetal with a hydroxyl attached to N_4.

The work on *Alstonia macrophylla* was highlighted by the investigations on the chemistry of the dimeric alkaloids villalstonine, macralstonine and the structure of the monomeric O-benzoyl-vincamajine.

Her research on *Rhazya stricta* was widely acclaimed. This involved the structural studies on aspidospermine (rhazidine), sarpagine (rhazine), picraline (strictamine and rhazinaline) and tetrahydro-β-carboline (rhazinine) types. The isolation of the novel alkaloid rhazinilam from the same source was made from her laboratory.

Professor Chatterjee made extensive investigations on the alkaloids of *Voacanga grandifolia*. This resulted in the isolation and structure elucidation of the bis-indole alkaloid grandifoline and a number of its congeners. The structure of grandifoline was established and was shown to possess an isovobtusine stereochemistry at the spiro-carbon, C_{14}, and an oxide bridge flanked C_2 and C_3.

In connection with her work on indole alkaloids, Professor Chatterjee published a number of papers dealing with their biogenesis. A notable contribution in this connection was the isolation and characterisation of geissoschizine, a key precursor in the biogenesis of indole alkaloids, from *Rhazya stricta*. Another interesting observation made on *Alstonia venenata* and *Vinca major* was the isolation of venoterpine, a monoterpenoid pyridine base, whose co-occurrence with C_{19}-C_{20} indole alkaloids provided evidence in favour of the currently accepted biogenetic theory.

Professor Chatterjee made significant contributions on mechanistic, stereochemical and transformation studies of a number of indole alkaloids. These included conversion of yohimbinoid alkaloids to their 3,4-secoderivatives, studies on the stereochemical course of ketone reduction in yohimbone and rauwolsone with different reagents, conformational analysis of various yohimbine isomers and novel chemical transformations of ajmaline and ajmalicine.

Synthetic studies were carried out on a number of complex indole, quinoline and isoquinoline alkaloids through novel routes. A simplified and novel procedure for the synthesis of β-phenylethanol amines in connection with alkaloid synthesis was developed by her. Synthesis of alkaloids under physiological conditions was also carried out. The synthesis of calycotomine, pseudocodanine and pseudolaudanine deserve special mention.

Professor Chatterjee also studied other groups of alkaloids. She made significant contributions to the chemistry and synthesis of steroidal alkaloids, particularly on the new and interesting 5α-pregnane derivatives from *Apocynaceae* and *Buxaceae*. The structure of kashmirine, isolated from *Fritillaria roylei* (*Liliaceae*), having a C-nor-D-homo steroidal skeleton bearing a *cis* D/E ring juncture was hitherto unknown in this type of steroid alkaloid. In addition, more than half a dozen of steroidal alkaloids had been isolated from *Sarcococca pruniformis* of which the structure and stereochemistry of saracocine, saracodine and saracodinine all bearing the 5α-pregnane skeleton had been established.

The novel synthesis of several isoquinoline and indole alkaloids using "diazoketone intermediates" was developed by her. Synthetic chemists who had been frequently using the "diazoketone intermediates" for the synthesis of terpenoids were surprised at this application of what they considered as their **reagent**. Of the several alkaloids synthesised by her using this intermediate, mention may be made of a few, (±)-2,3-dimethoxy berbine, (±)-norcoralydine, (±)-demethoxy carbonyl dihydrogambirtanine, (±)-17,18-dimethoxy hexadehydroyohimbanes (±)17-methoxyhexahydroyohimbane, (±)-rauwolscine and (±)-2,3-dimethoxyhexahydroberbine.

Terpenoids

Professor Chatterjee's contributions in the field of terpenoids once again reflected her varied interest in other groups of natural products. More than a dozen plant species were thoroughly examined of which studies on the plants *Aphanamixis polystacha, Walsura tabulata* and *Cedrela toona* (all *Meliaceae*), *Zanthoxylum rhetsa* (*Rutaceae*), *Artemisia vulgaris* (*Compositae*), *Croton caudatus* (*Euphorbiaceae*) and *Callicarpa macrophylla* (*Verbenaceae*) deserve special mention. She made significant contributions on the transformation of terpenoids. Her novel work on the correlation of terpenoids of different skeleta through Lewis acid catalysed rearrangements led to a better understanding of their structural relationships. The partial synthesis of triterpenoids from readily available natural substrates through novel rearrangements once again reflected her deep understanding of mechanistic organic chemistry.

Coumarins

Coumarins are yet another group of natural products which bear the imprint of her outstanding contributions. A significant number of new coumarins of biogenetic interest and bearing interesting substitution patterns were isolated by her research group from Indian medicinal plants belonging to the families *Rutaceae, Umbelliferae, Compositae, Euphorbiaceae* and *Thymelacaceae*. Her research in this field began with the elucidation of the structure of luvangetin, isolated from *Luvanga scandens* (Rutaceae) in 1940. It was first observed by her that γ,γ-methylallyl ethers of hydroxycoumarins when subjected to the conditions of Claisen rearrangement suffered degradation to

phenolic coumarins and isoprene instead of undergoing any molecular rearrangement. She had made extensive studies on the action of Lewis acids on prenylated coumarins using natural products as substrates. This resulted, not only in the synthesis of coumarins already isolated from nature, but also in the discovery of new and interesting reactions and rearrangements. In fact, several natural coumarins bearing unusual types of functionalised isopentenyl side chains could be synthesised in the course of these rearrangments. She also developed new synthetic routes to other coumarin systems, an example being the 4-phenyl coumarins, dalbergin and nor-dalbergin.

Mechanistic and synthetic studies also constituted another important area of her research activity. The mechanism of the acid-catalysed hydramine fission of β-phenylethanol amines had been thoroughly investigated by her research group. It was observed for the first time during these studies that the substituents on the aromatic rings played an important role in determining the nature of the products formed and steering the course of the reaction.

She introduced the use of periodic acid as a reagent for the detection and location of terminal and exocyclic double bonds in organic compounds and was the first to show that this method was a good alternative to ozonolysis.

Professor Chatterjee made outstanding contributions to the chemistry of indoles. Her studies on the reactivity of the indole and substituted indole nuclei towards various electrophiles for two decades resulted in the discovery of new and novel reactions, correction of complex structures of products reported earlier in the literature and discovery of newer facets of the Plancher Rearrangement. Her studies have opened up a New Chapter in Indole Chemistry.

She delivered a number of *Oration* and *Convocation* lectures in Universities and Institutes throughout India. A large number of students obtained their Ph.D. and D.Sc. degrees under her guidance, many of whom are occupying topmost positions in academia and industry in India and abroad. Many of them have developed their Schools on Natural Product Chemistry and are playing key-roles in the development of this area in India and abroad, in colleges, research institutions, universities, industries and policy-making bodies.

Professor Chatterjee's interest on plant products occurring in Phanerogam was also extended to lower plants, particularly Cryptogam. From *Marsilea minuta* (water fern) the sedative and anticonvulsant drug, marsilin, was isolated and it's structure established. The pharmacological activity of marsilin had been established through decades of research and clinical trials at the **Bon Hoogly Hospital for Crippled Children** in collaboration with her doctor brother, Late Professor Sarashi Ranjan Mukherjee, MBBS, MS, PhD (a Bhatnagar Awardee in Medical Sciences), former Director of Sett Suklal Karnani Memorial Hospital (SSKM; formerly known as Presidency General Hospital), Kolkata, and former Professor and **Founder-Director**, Department of Experimental and Nuclear Medicine, Institute of Post-Graduate

Medical Education and Research, Sett Suklal Karnani Memorial Hospital. Marsilin has been found to be effective in the treatment of epilepsy and in curing behavioural epileptic disorders. It is now being used as a highly successful rehabilitation drug in combination with *Nardostachys jatamansi* under the code-name Ayush 56 (Indian Patent No. 141170 dt. 14th July 1976). The anti-malarial drug, coded Ayush 64, which is a combination of different parts of four herbs, is yet another successful drug developed by Professor Chatterjee (Indian Patent No. 568/Del. 70, 7th August 1979). Both these *combination-drugs* have been patented by the Central Council of Research in Ayurveda and Siddha (under the Ministry of Health and Family Welfare), Government of India. The patents have been purchased by the National Research Development Corporation, Government of India, and the drugs are being marketed by several companies and also exported. The discoveries of these two combination-drugs are landmarks in developing "alternate lines of treatment" leaving no side effects.

Since the beginning of her teaching and research profession she had dreamt of establishing an Institute for carrying out research on Indian Medicinal Plants, developing new Ayurvedic formulations and of building an Ayurvedic hospital for the people of West Bengal. She received a donation of 3½ acres of land in Sector V, CN 4 Block, Salt Lake City, Kolkata, free of cost, from the then Hon'ble Chief Minister of West Bengal, Mr Jyoti Basu. Professor Chatterjee obtained a building grant of rupees 4 crores from the Ministry of Health and Family Welfare, Government of India. This unique Centre-State collaboration gave birth to the Regional Research Institute (Ay), now upgraded to the Central Research Institute (Ay), under the direct administration of the Ministry of Health and Family Welfare. Professor Chatterjee served as Honorary Principal Coordinator for many years. This Institute has, in addition to the Ayurvedic Hospital, Centres for carrying out research on Chemistry, Botany and Pharmacology of drugs isolated from Indian Medicinal Plants. Ayurvedic formulations are developed and clinical trials are systematically carried out. Ayurvedic formulations are prepared and sent to different parts of India.

On the request of Late Professor Satyendra Nath Bose, FRS, she wrote in Bengali *Saral Madhyamic Rasayan*, a book on chemistry for secondary school students, published by Bangiya Bijnan Parishad, an Institute for the Popularisation of Science founded by the renowned scientist, himself. She had edited and rewritten *Bharater Bonousadhi*, a treatise in Bengali on Indian Medicinal Plants in six volumes (Volumes 1-5; 1973; Volume 6; 1977) (originally compiled by Late Dr KP Biswas) and published by the Calcutta University Press. As an author/principal-editor she compiled in English *The Treatise on Indian Medicinal Plants* published in six volumes earlier by the Publication and Information Directorate, CSIR, then by the National Institute of Science Communication, CSIR and now by the National Institute of Science Communication and Information Resources, CSIR – (Volume 1 – First Edition: 1991,

Reprinted : 1994, 1997; Revised and Updated Edition : 2005; Volume 2 – First Edition: 1992; Reprinted 1995; Revised and Updated Edition : 2006; Volume 3 – First Edition : 1994; Reprinted : 2003; Volume 4 – First Edition : 1995; Reprinted : 2003; Volume 5 – First Edition : 1997; Reprinted : 2003; Volume 6 – First Edition : 2001).

AWARDS AND HONOURS

Professor Chatterjee was elected a Fellow of the National Institute of Sciences of India (now known as Indian National Science Academy) (1960), was awarded the Shanti Swarup Bhatnagar Award, CSIR (India) (1961), Sir PC Ray Award of the Indian Chemical Society (1974), elected General President of the 62nd Session of the Indian Science Congress, New Delhi (1975), elected "Woman of the Year" by the Bengal Chamber of Commerce (1975) (International Women's Year), received the DSc Degree (honoris causa), University of Burdwan (1976), Benaras Hindu University (1982), University of Kalyani (1999), the Vidyasagar University (2006), honoured with "Padma Bhusan" by the Government of India (1975), received the Bhuban Mohini Das Gold Medal, by the University of Calcutta, for the best contribution in Bengali for compiling in six volumes the "Bharater Bonousadhi" (1981), was nominated by the President of India as a Member of Parliament (Rajya Sabha) as a Scientist-Academician (February 1982-84; May 1984 - May, 1990), was Leader of the Indian Delegation to the VII Indo-Soviet Symposium on Natural Products (1983), received the Sisirkumar Mitra Lectureship of the Indian National Science Academy (1984; lecture delivered in 1985), received Sir CV Raman Award of the Hari Om Ashram Trust by the University Grants Commission (1982, awarded in 1985), Professor PK Bose Award of the Indian Chemical Society (1988; lecture delivered in 1991), was honoured by the Indian Science Congress in the Platinum Jubilee Celebration, Pune (1988), received Sir Asutosh Mukherjee Memorial Gold Medal, the most prestigious award of the Indian Science Congress Association (1989), the Goyal Prize and Gold Medal of the Goyal Foundation, University of Kurukshetra (1992), the Dr GP Chatterjee Lectureship of the Indian Science Congress Association (1994), the Indira Gandhi Priyadarshini Award of the All India Unit Conference (1994), the Silver Jubilee Award of the Central Council for Research in Ayurveda and Siddha, Government of India, (1995), the Eminent Teacher Award by the University of Calcutta (1997), the Rathindra Award of Visva Bharati (1997), honoured by the West Bengal Academy of Science and Technology and awarded the Academy Medal (1998), awarded the special title of "Bijnyan Bharati" "UPADHI" on the 175th Anniversary of the Sanskrit College, Kolkata (1999), honoured by the Indian Chemical Society in the Platinum Jubilee Celebration in recognition of her life-time achievements in Promoting the Standard of Organic Chemistry Research in India (1999), received Sir Devaprasad Sarbadhikary gold medal, the most prestigious award of the University of Calcutta, (1999) for her contributions to science and the

PC Chandra Purshkar of the PC Chandra Group (2001) for her contributions to research in basic and applied science.

A week before she slipped into coma, the Mayor of Kolkata, Hon'ble Shri Bikashranjan Bhattacharyya, visited her at her residence and conferred on her the award of "HONOURED" citizen of Kolkata.

A PERSON TO BE REMEMBERED

Her rise to her present eminence had been possible due to her sincere devotion to duty, hard work and unquenched thirst for knowledge. She had been learning throughout her life and she never hesitated to learn even from her students. A true "Karma Yogi" as she was, she believed in carrying out her duties and her responsibilities without aspiring for the results and rewards. She was passionately devoted to the ideals of Shri Ramakrishna and Holy Mother Sarada and had ardent faith in the Philosophy of Swami Vivekananda. It was possibly this *selfless devotion* which refrained her from accepting any royalties for the development of drugs, and books written or for accepting fees from Bengal Chemical and Pharmaceutical Works Ltd., Kolkata, for the still "well-known legal battle" of 1968 in the Calcutta High Court.

Her life was and would always remain as a unique example of commitment and harmony between the professional and her private life. By her grace, she had made herself adorable to all her students and acquaintances. Professor Chatterjee was a very good human being steeped in Indian Culture. She inspired and encouraged a legion of students in the active pursuit of teaching and research. She nurtured a well-recognized School of Chemistry of Natural Products. Her record of achievements, her idealism, devoted commitment to the teaching vocation and total dedication to work were exemplary and had added lustre to the glorious heritage of the University of Calcutta, the pioneer and great seat of learning. Her simplicity and affability, warmth and boundless love had won her a permanent place in the hearts of those who ever came in contact with her. Her students reverentially called her "Master" (teacher), her younger contemporaries "Didi" (elder sister) and others "Ma" (mother).

Late Dr Madhuri R. Shah, Former Chairman, University Grants Commission, in one of her letters to Professor Chatterjee's daughter wrote "Her selfless devotion inspires and gives strength to people like me and renews my faith in the goodness of human nature".

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