Evolution of Modern Chemical Sciences in India

Basudeb Barman

The history of modern chemical sciences in India is a part of the revival of the study of Sciences on modern lines in the country. And it may be said that scientific studies and research in modern Western lines were actually initiated by the Asiatic Society, founded by Sir William Jones in Calcutta in 1784, aims of which were clearly stated by the founder as under: "You will investigate whatever is rare in the stupendous fabric of nature; will correct the geography of Asia by new observations; will trace the annals and even the traditions of those nations who from time to time peopled and desolated it and will bring to light their various forms of government with their institutions, civil and religious; you will examine their improvement and methods in arithmetic and geometry, in trigonometry, in mensuration, mechanics and optics, astronomy and general physics, the system of morality, grammar, rhetoric and dialectic, their skill in Medicine and their advancement in Anatomy and Chemistry,"

All the branches of science in modern India owe their genesis to the Asiatic Society: its transactions and journals were the principal channels of communication for studies in various fields and also, it was only due to the initial activities of the Society, the foundation of various scientific bodies like the Survey of India, the Geological Survey of India, the Indian Museum, the Indian Meteorological Departmen, the Zoological Survey of India, the Botanical Survey of India, the Indian Science Congress Association, the School of Tropical Medicine, etc, could be possible. The Society acted as a melting pot where different branches of science could come into contact and thereby enriched one another.

We may rememeber that, for many years, there was no other organisation in India which could play this role. The Universities were yet to be born: the Universities of Calcutta, Bombay and Madras were established in 1857, to be followed by the Universities of Punjab (1882) and Allahabad (1887). The research institutions came much later. We may also note that many members of the Society were pioneers in various branches of learning, and the spirit of the

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Society percolated through them to these organisations. It may be said that the mind of India, long forgetful of its scientific traditions, awoke at last at the impulse of modern Western science.

The pursuit of study and research in chemistry in modern India began with its application in medicine. A group of research workers studied the active principles of Indian medicinal plants under Dr. W.B.O'Shaugnessey, Professor of Chemistry, Medical College, Calcutta, results of which were incorporated in Bengal Pharmacopoca (1840), and a few research papers were published in the Asiatick Researches of the Asiatick Society of Bengal.

Chemical Research in modern India may be said o have started in 1873 at the Presidency College, Calcutta, when Sir Alexander Pedler joined the institution. His first paper on Cobra venom, after joining the college, was published in the Proceedings of the Royal Society (London) The credit of developing teaching and research in all the branches of chemistry in India certainly goes to Acharyya Prafulla Chandra Ray who joined the Presidency College, Calcutta in 1889 after obtaining D.Sc. degree in chemistry in 1888 at the University of Edinburgh. His first paper was "On the Chemical Examination of certain Food Stuffs-Part I: Fats and Oils" (based on his work in the chemical laboratories of the Presidency College) published in the Journal of the Asiatick Society of Bengal in 1894. However, the epoch-making paper, "On Mercurous Nitrite" was published in the same journal in 1896. The journal *Nature* observed ; The Journal of Asiatic Society of Bengal is scarcely be said to have a place in our chemical libraries. The current number, however, contains a paper by Dr. P.C. Ray of Presidency College, Calcutta, on mercurous nitrite, that is worthy of note". In the same year, he published two papers, "Mercury hyponitrites" and "The interaction of mercurous nitrite and the alkyl iodides" in the Proceedings of Chemical Society (London), and one paper, " Uber Mercuronitrit" in the Journal of Zeit anorg.

Acharyya Ray published 160 papers (71 authored by him and 89 with collaborators, mostly his students) of which 12 were published in the Journal of the Asiatick Sociey of Bengal. The role of the Presidency College, Calcutta, should also be remembered in this connection: " It was the rooms of the chemical laboratory at the Presidency College, which, thanks to the acumen of Alexander Pedler and P. C. Ray, saw the dawn of chemical research in Bengal and in India.

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Pedler applied himself especially to problems connected with the action of light on phosphorous and chlorine acids and the explosions of sulpheur compounds. ... P. C. Ray in the years 1896-1900 carried out his celebrated work on the nitrites and hyponitrites of mercury. .... It was here that he completed his famous treatise on Hindu Chemistry; it was here again that he carried out his investigations on the organic snd inorganic nitrites and on mercaptans and other sulphur compounds. .... Great as P.C. Ray's own works are, the impetus he gave to scientific research in Bengal, and for that matter, in Indian was even greater.

He it was who laid the foundations of the study of Physical Chemistry in the Presidency College, and the experiments conducted here on vapour densities and conductivities of various substances were pioneering efforts in this country. ... The first doctorate in Science of the University of Calcutta was awarded for research in the Chemical Laboratory of the Presidency College, and some of P.C. Ray's latest pupils here have won international recognition for research in Physics and Chemistry. The spirit of the scientist was as great as the man,..." (Presidency College, Calcutta: Centenary Volume, 1955, P-20).

The history of evolution of modern chemical sciences in India is very much the history of teaching and research activities of Acharyya Prafulla Chandra Ray and his students at the Presidency College, Calcutta during 1889 to 1916, where he was Professor of Chemistry, and at the newly established College of Science, University of Calcutta during 1916 to 1936, where he was Palit Professor of Chemistry (he joined at the invitation of Sir Asutosh Mookerjee, the man who made the University of Calcutta worthy of its name); the Acharyya retired in 1936 at the age of 75 but continued to be the prime force for chemical researches in India till his death in 1944.

Here, it would be relevant to recollect the situation at the University particularly regarding the establishment of the University College of Science. Sir Asutosh was the Vice-Chancellor during 31 March 1906 to 30 March, 1914 (4 terms at a stretch) and again during 4 April, 1921 to 3 April, 1923. For five years beginning 1906, Asutosh had struggled hard to establish post-graduate teaching and research departments in a few disciplines of Humanities– mostly through appointment of professors of the Presidency College as University Lecturers in honorary capacity – in 1907; subsequently, chairs of Economics, of Mental and Moral Science, of Advanced

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Mathematics and of Ancient Indian History and Culture were established during 1907-1912, and, by the year 1912, regular University lectures at the post-graduate level and research in quite a few of subjects in Humanities and Mathematics could be arranged, and more than five hundred students were studying in English, Sanskrit, Pali, Arabic, Persian, Mental and Moral Philosophy, History, Economics and Mathematics. The University had no funds to think about establishing the departments of Science and Technology. There were men but there was no accommodation, no laboratory, no workshop, no museum and no equipment. In June,1912, the University was pleasantly surprised when Sir Tarak Nath Palit, an eminent barrister of Calcutta, made over to the University assets worth seven lakhs of rupees, for creating two Professorships, one in Chemistry and the other in Physics; the object of the donor was: "the promotion and diffusion of scientific and technical education and the cultivation and advance of science, pure and applied amongst his countrymen by and through indigenous agency. Such chairs shall always be filled by Indians to be nominated by a Governing Body." The duties of the professors were thus set forth: (1) to carry on original research with a view to extend the bounds of knowledge, (2) to arrange for adequate instruction of students for the degrees of Bachelor of Science, and (3) to stimulate and guide research by advanced students. The first holder of the Palit Chair of Chemistry was a great scientist and savant, Prafulla Chandra Ray; and the first occupant of the Palit Chair of Physics was C.V. Raman.

In October 1912, Taraknath made another contribution to the University, value of the endowment was around seven and half lakhs of rupees, and was for establishing and maintaining scholarships for advanced students in science to enable them to carry on research or investigation abroad. In August 1913, Sir Rashbehary Ghosh, an eminent jurist and scholar, made a munificent gift of ten lakhs of rupees, income out of which was utilised for establishment of four professorships: (a) Applied Mathematics, (b) Physics, (c) Chemistry and (d) Botany "for the promotion of scientific and technical education and for the cultivation and advancement of science, pure and applied, amongst my countrymen, by and through indigenous agency." The first occupants of the Sir Rashbehary Ghosh Chairs were, respectively: Ganesh Prasad, D.M. Bose, P.C. Mitter, and Shankar Purusottam Agharkar.

In December, 1913 Sir Rashbehary made another princely gift of eleven lakhs forty three thousand rupees to the University exclusively for the purpose of technological instruction and

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research: two new University Professorships, one in Applied Chemistry and the other in Applied Physics were established: Hemendra Kumar Sen and Phanindra Nath Ghosh, respectively, were the first occupants of these two chairs.

In 1919, Kumar Guruprasad Singh, Raja of Khaira, made a princely gift of eleven lakhs rupees to the University: five Professorships were instituted: one each in (i) Indian Fine Arts, (2) Phonetics (later changed to Indian Linguistics and Phonetics),(3) Physics, (4) Chemistry and (5) Agriculture; first Professors of these chairs were, respectively, (1) AbanindranathTagore, (2) Suniti Kumar Chatterjee, (3) Meghnad Saha, (4) Jnanendra Nath Mukherjee and (5) Nagendra Nah Ganguli.

The objective of establishing these chairs was 'to secure the growth of real learning among our own men' It must be remembered that it was Sir Asutosh Mookerjee, whether he held the office of the Vice-Chancellor or was a member of the Senate or any other authority of the University of Calcutta, but for whose untiring efforts the University would not have been converted from a mere examining body into an active centre of advanced teaching and research.

We would now proceed to see how the School of Chemistry in Calcutta grew up under the dynamic leadership of Acharyya Prafullachandra and gradually spread all over India in due course. We have already mentioned his work regarding preparation of mercurous nitrite in 1896; a good many investigations were completed on nitrites in thelaboratory of the Presidency College. A good many pupils now were working in his laboratory.

During this time, he was motivated by the famous French chemical scientist Berthelot's book *L' Alchimistes Grecs* (the Greek Alchemy) to write a book on Hindu Chemistry, and a very hard and sustained work on ancient manuscripts and books for more than five years resulted in the publication of the first volume of *A History of Hindu Chemistry* in June 1902. It was acclaimed to be a monumental work. The journals *Nature*, *Knowledge* and the *American Chemical Journal* reviewed it favourably. The book served to focous attention of the scientific world to the past contributions of India towards the progress of Chemistry. It raised new hopes in the minds of young India that, with diligence and perseverence, they would be able to enhance the world's stock of knowledge– a great step forward for the people who had been told time and again that theirs was only a back seat and they were not entitled to enter the superior educa-

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tional service. The second volume of the book was published in 1908, which was also highly acclaimed.

The preparation of the first volume entailed a great deal of hard labour and in consequence, Prafulla chandra's researches suffered a little. Inorganic chemistry received new impetus through the discovery of the rare gases of the atmosphere and the discovery of radio-activity. He had to catch up the advance that science had made; as a result some time elapsed before the second volume of the book was taken in hand. An unbroken series of papers on nitrites were published in the *Journal of Chemical Society,* London (19 papers during 1903 to 1907 of which 12 were on nitrites and were published in the JCS, London).

His work had now won recognition abroad. The Bengal Government founded some scholarships to encourage students to undertake research after their master's degree. Many of his students found ready employment in the new educational institutes that were coming up in different parts of the country or in some of the technical departments of the Imperial Government. One such research scholar, Atul Chandra Ghosh, was later appointed as the Professor of Chemistry at the Dayal Singh College Lahore (now in Pakistan), and thus took the Acharyya's waves of chemical research to far off Punjab. One of Ghosh's pupils was Shanti Swarup Bhatnagar (an eminent personality in Chemistry; the most coveted award in Science in India has been installed after his name, 'Bhatnagar Award') who often used to remind Acharyya Ray that although he was not a direct pupil of Acharyya Ray, he was his 'grand-pupil' A trio of brilliant young men appeared on the scene in 1909. Pupils of Acharyya Ray, Hemendra Kumar Sen, Biman Behari Dey and Priyadaranjan Ray were students of the same class. Sen worked in the laboratory of Professor J.F. Thorpe, London University, got his D.Sc; after a brief stint in industry in India and Burma, Sen, at the invitation of Sir Asutosh, took up the newly created post of Sir Rashbehary Ghosh Professor of Applied Chemistry of the University, leaving a fat salary and other perks in Rangoon and accepting a salary which was less than half of what he was getting and with no other parks, at his alma mater. As founder Professor of the Department of Applied Chemistry, he worked with vigour and spread his research activities in many directions, with great success, such us high-pressure reactions, glass technology, enzyme chemistry, thermodynamics, coal carbonization, etc. One of his students, Mahendra Nath Rudra, was Professor of Biochemistry in Patna. Another student, U.P. Basu was head of the research

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division of Bengal Immunity Co. Ltd. Calcutta. Sen was later Director of the Indian Lac Research Institute, Ranchi and Director of Industries, Bihar Government.

B. B. Dey also got his D.Sc, from London University and succeeded Acharyya Ray at the Presidency College, Calcutta, in 1916 and later worked at the Presidency College, Madras (new Chennai) where he developed three lines of investigations–synthetic chemistry, biochemistry and electrochemical reactions. His pupils T.R. Seshadri, K .Venkataraman and T.R. Govindachari are eminent personalities in the field of chemical science. Dey's electrochemical researches were highly acclaimed and he was appointed the first Director of the Electrochemical Research Institute at Karaikudi,. Tamil Nadu under the CSIR. We may say that another of Acharyya Ray's pupils was instrumental in initating and firmly planting chemical research in the southern part of our country.

Priyada Ranjan Ray, a pupil of immense potential of Acharyya Ray, was incapacitated through a disastrous explosion in the laboratory and had lost the sight of an eye and was out of the laboratory for about two years. He joined the University College of Science somewhat later as an assistant to Palit Professor of Inorganic Chemistry (Acharyya Ray), and began a spectacular career: his works in the fields of chemistry of co-ordination compounds, analytical chemistry and particularly on magneto-chemistry will find a permanent place in chemical literature. Pupils of P. Ray joined various academic and research institutions all over the country and made their mark. Ray also revised and re-edited Acharyya's famous book, *A History of Hindu Chemistry*, which has been published in 1956 by the Indian Chemical Society under the name, History of Chemistry in Ancient and Medieval India.

Nil Ratan Dhar, one of the most brilliant pupils of the Acharyya, D.Sc. from London and Paris (Sorboune) Universities, was the first person in India to work in the field of Physical Chemistry. Their joint paper on 'The vapour density of ammonium nitrite,' J.C.S., Vol 101, pp 1552-1557, 1912, was remarkable. He was appointed Professor, Indian Educational Service, and joined Muir Central College, Allahabad, and there he built up a thriving centre of chemical research– mainly in photochemistry, colloids and agricultural chemistry; he guided 142 candidates for their doctoral degrees and published nearly 600 papers– unbelievale achievement! Different universities received Dhar's pupils as Professors; K.C. Sen was Direcor of Dairy

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Research Institute at Bangalore; R.C. Mehrotra, Vice-Chancellor, Delhi University; Atma Ram, Director General of the CSIR; etc. He donated lakhs of rupees to different organisations including Allahabad University, Sriniketan and Chittaranjan Sevasadan. Calcutta University received a lump sum amount and instituted the 'Acharyya Prafullachandra Ray Professorship in Agricultural Chemistry.' Dr. Dhar joined the University of Calcutta in 1945 as Guruprasad Singh Professor of Agriculture.

Rasik Lal Dutta was the first D.Sc. of the University under new regulations (1910); he published around 60 research papers, registered a good number of patents and was an active partner of the Acharyya in promoting chemical industry. Among his students were Phuldeo Sahay Varma (B.H.U), Nihar Ranjan Chatterjee (School of Tropical Medicine,Calcutta) and Loke Nath Mishra (Ravenhaw College, Cuttack) . Bidhu Charan Chatterjee, another pupil of the Acharyya, was the industrial chemist of the Bengal Government and was instrumental in establishing a few industries in the State.

In 1909, Satyendra Nath Bose, Manik Lal Dey, Jnanendra Chandra Ghosh, Jnanendra Nath Mukherjee and Pulin Behari Sarkar joined the Presidency College. Meghnad Saha joined them after tewo years in the B.Sc. class. Nil Ratan Dhar and Rasik Lal Datta were senior to them by a couple of years. Soon these young men of somewhat different age groups formed a close friendship among themselves. Acharyya Ray came to know of this group and started nurturing and mentoring them in a very subtle way as if he was one of them as a friend. He often visited those who were residents of the Hindu Hostel. These promising young men in the formative stage of their career received full measure of daily contact with the great master. We may say that a good deal of their future success and promotion of science in India could be traced to this personal contact and guidance.

In 1912, Acharyya Ray attended the first session of the Congress of Universities in London as a delegate of the University of Calcutta, when he also attended meetings at the Chemical Society and the Royal Society where the work of Calcutta School of Chemistry was highly appreciated. While in London, Sir Asutosh offered him the chair of chemistry (Palit Professorship) of the University to be founded soon. In reply, Dr. Ray wrote, " I look upon the proposed College of Science as the realization of the dream of my life and it will not only be

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my duty but a source of gratification to me to join it and place my humble service at its disposal."

On his return to India, Dr. Ray, however, resumed his duties at the Presidency College as the University College of Science was yet to built. Prafulla Chandra Mitter, a former student of Dr. Ray and who did his Ph.D. at the Berlin University, was appointed Rashbehary Ghosh Professor of Chemistry and on him delved the task of organising the new college, and under the guiding spirit of the Acharyya, he did the job magnificently. Dr. Mitter's discipline was organic chemistry and he was one of the longest serving Professors of the University, 1914 to 1946.

The work carried out by Professor Ray and his pupils were now referred to as the work of the Calcutta School of Chemistry, and this was a great satisfaction to the Acharyya as he felt hat one of his missions had been fulfilled. Nature in its issue of March 23, 1916 observed: "In connection with the University of Calcutta, 'extension lectures' are being delivered and that on January 10, by Dr. P.C. Ray, the Dean of the Faculty of Science of the University, is before us. The lecture consists of a brief resume of original researches carried out in Bengal in the last twenty years, and as an appendix a list of 126 papers contributed to various societies such as Chemical Society, Journal of the American Chemical Society and others, is given. Some of these papers are of very considerable value and interest, and indicate enthusiastic work on the part of this newly created school, which is mainly due to the example and work of Professor himself."

Here, it will be proper to mention that Dacca, through the efforts of Professor E.R. Watson, chemical research was developing steadily since 1908. Anukul Chandra Sarkar, one of his pupils, made significant contribution on the relationship between colour and constitution. Some of the students who became eminent later were Prafulla Chandra Ghosh who later on became famous in the political field, B.N. Ghosh, S. Ghosh, Kumud Bihari Sen, Sikhi Bhusan Dutta, later on Professor of Chemistry, Delhi University; B.K. Singh, who joined Dacca College as Watson's assistant professor, did good work on asymmetric nitrogen compounds and on the rotation of camphor derivatives.

In 1897, Prafullachandra was offered the principalship of Rajshahi College by the Bengal

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Government, which he, at the age of 36, respectfully declined as did not want to sacrifice his interest in research and advanced study in chemistry for the sake of pelf and position. We cannot imagine what would have happened to Indian Chemistry and chemical industry had the decision been otherwise.

Dr.Ray joined the University College of Science in 1916 as Palit Professor of Chemistry on retirement from the Presidency College at the age of 55. The building 92 Upper Circular Road (now 92 Acharyya Prafullachandra Road) was ready but on account of the first World War, the problem arose of properly equipping it. Sir Asutosh could obtain as gifts some equipment from Raja Manindra chandra of Baharampur and some from Bengal Engineering College, Sibpur. With Dr. Ray came, J.C. Ghosh, and J.N. Mukherjee R.L. Datta joined as Assistant Palit Professor (Satyandra Nath Bose and Meghnad Saha joined as Lecturers in Physics). There was a lamentable lack of apparatus and chemicals for want of funds. After a lot of negotiation, only an annual grant of Rs. 12,000 for the College of Science comprising chemistry, physics, botany, applied mathematics, etc., could be secured. However, Sir, Ashutosh could get a second endowment from Sir Rashbehari Ghosh and a handsome donation from Kumar Guruprasad Singh, Raja of Khaira, which set the departments going.

However, this lack of facilities pushed the young minds to theoretical work. Ghosh put forward an equation for the conductivity of strong electrolytes and Saha's work on the pressure of light and high-temperature ionisation attracted considerable notice. Bose was studing deeply the newly propounded theory of relativity.

J.C. Ghosh on return from Europe was appointed a Professor at the newly founded Dacca University, where he developed researches in photochemistry, catalytic reactions and a variety of others. His pupils held important positions in India. Ghosh moved to Bangalore as Director of the Indian Institute of Science and established an active centre of research. Later, he became successively the Director General of Industry and Supplies, Government of India; Director of the Indian Institute of Technology, Kharagpur (where he installed a Fischer- Tropsch Pilot plant for systhesis of hydrocarbons using coal as the raw material); Vice-Chancellor of the Calcutta University and a member of the Planning Commission.

J.N. Mukherjee joined the College of Science in 1921 as Guruprasad Singh Professor of

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Chemistry (popularly known as Khaira Professor) and developed the theory of electrical double layer and worked mostly on colloids. S.P. Roy Chowdhury, R.P. Mitra, B. Chatterjee, and B.N. Ghosh were some of his students who made their own independent contributions. Mukherjee later joined as the Director of the Indian Agricultural Research Institute and subsequently the Central Building Research Institute under the CSIR for some time as its Director, J.N. Ray., J.C. Bardhan and Pulin Behari Sarkar joined the Science College from the Presidency College: J.N. Ray worked on alkaloids and held the chair of Organic Chemistry at Lahore University; he also developed biochemical work and founded the first microchemical laboratory in India. He became the Deputy Director-General of Industry and was later on Industrial Advisor to the Government of India. Among his students, mention may be made of Colonel N.N. Chopra, K.S. Narang, M.L. Dhar and K.N. Gaind. J.C.Bardhan held the Khaira Professorship in chemistry at the Science College since 1946 and he and his co-workers made significant contribution in synthesizing polynuclear hydrocarbons. P.K. Bose did extensive work in plant chemistry and became the Director, Lac Research Institute at Ranchi; among his students was Professor (Mrs.) Asima Chatterjee who made signal contributions to the chemistry of natural products and synthetic organic chemistry. P.C.Guha was Professor in Chemistry in the Indian Institute of Science, Bangalore, where he worked on a variety of subjects including terpenes, M.N. Goswami, a pupil of B.B.Dey, worked on oils and fats, and was a faculty in the Dept. of Applied Chemistry. P.B. Sarkar held the Rashbehary Ghosh Professorship in Chemistry at the Science College since 1946 and his main field of investigation related to the chemistry of rare earths and allied elements. Among the researchers of the later period the names of Monmohan Sen, D.K. Banerjee, R.N. Chakraborty, P.C. Datta, R.N. Sen, S.S. Guha Sarkar, Qudrat-i-Khuda, and D. Chakrabarti may be mentioned. Bires Chandra Guha, a direct pupil of Acharyya Ray, specialized in biochemistry. His researches on the vitamins particularly vitamin C earned him great reputation, and was appointed Sir Rashbehari Ghose Professor in Applied Chemistry in 1936. It was through his initiative that the Department of Biochemistry was established in the University College of Science in 1957, the first such department to be established in India. Students of Guha held important positions in different academic and research organisations all over the country.

The activities in the chemical field in India were not confined only to the academic insti-

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tutions, again, mainly due to the initiative and hard work of the Acharyya and some of his colleagues who were anxious to apply the principles of chemisry for industrial production of different materials in the country as well as to utilise, in the language of the Acharyya, "the resoursefulness in our youths, that go to the making of a businessman or an entrepreneur or a captain of industry. ... These thoughts were weighing heavy on me at the very threshold of my career at the Presidency College. How to utilize the thousand and one products which Nature in her bounty has scattered broadcast in Bengal? How to bring bread to the mouths of the ill-fed, famished young men of the middle class?" He started preparing common pharmaceutical products for the market in his house from the locally available raw materials. But his resources were very limited, savings from his meagre salary supplying the capital for his enterprise. He had to put an up-hill fight from the beginning to push his products in the market against the competition of imported foreign drugs. He was, however, undaunted and decided upon starting a regular pharmaceutical works. A locally made sulphuric acid chamber plant and was operated :Chandrabhusan Bhadhuri who had considerable experienceof dealing with probelems related to chemical engineering, his brother Kulabhusan, a very distinguished scholar in chemistry, Satis Chandra Sinha, Dr. Amulya Charan Bose, a renowned medical practitioner,and at some later stage, Rajsekhar Bose (Parashuram) and Satis Chandra Dasgupta came forward in this venture of Prafullachandra, and in 1901, the 'works' was converted into a limited liability company with Prafullachandra and a few of his friends and colleagues as Founder Directors, and the Bengal Chemical and Pharmaceutical Works Ltd. was born. Besides this enterprise of his own, he was associated with a large number of industrial and business concerns either as a Promoter, Director or Patron, which included cotton mills, soap works, sugar works, pottery and porcelain, steam navigation, publishing of books, etc.

The birth of the Indian Chemical Society: In 1921, while J.C. Ghosh, J.N. Mukherjee and S.S. Bhatnagar were doing research in the laboratory of Professor Donnan at London, Acharyya Ray happened to meet them there; during informal meet of these four persons, the subject of publication of research papers by Indian scientists for which no facility existed in India, came for discussion, and the need for a journal from India for publication of research results in the field of chemistry was keenly felt. On return of Ghosh, Mukherjee and Bhatnagar to India, steps were taken to establish the Society: The Indian Chemical Society was founded and registered

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on May 9, 1924 with P.C. Ray as the Founder-President and J.N. Mukherjee as its Secretary; Vice-Presidents J.L. Simonsen and G.J. Fowler; P.C. Mitter Treasurer; Honorary Editors: E.R. Watson and N.R. Dhar; among the members were J.C. Ghosh, S.S. Bhatnagar, B.B. Dey, B.H. Wilson, K.G. Naik, B.K. Singh, A.N. Meldrum, R.N. Sen, H.C. Annatt snd A.R. Normand.

Funds presented a problem. The University of Calcutta generously agreed to print 1000 pages of the journal per annum free of cost–it was again Sir Asutosh who came to the rescue. A small annual grant was received from Dacca (Rs. 200/-) Allahabad (Rs. 200/-) and Punjab (Rs. 100/-) universities. Acharyya Ray made a handsome donation of Rs. 10,000/- to the University of Calcutta for building two large rooms with a verandah and side room in a portion of the Palit Building of the University College of Science, for housing the Society. The whole space was rented to the Society at a token rent of one rupee per month. The Society is still housed here.

The quarterly journal of the Society was published in November, 1924, fulfilling the hope and aspiration of the Indian Chemical Scientists. The Society received compliments from the Nature under caption 'Chemistry in India' : "... The new journal is a welcome illustration of the development which has taken place in Indian Chemistry during recent years. There are thirteen papers and only one of these is published by Indians... Four of these emanate from the College of Science, Calcutta and this is as it should be, because for many years past this institution has been the backbone of chemical research in India, The other communications came from Allahabad, Baroda, Dacca, Cuttack, Banaras and Madras and constitute a series of which the organising committee and the editor have every reason to be proud." Congratulatory telegrams were received from the Council and the President of the Chemical Society, London. Papers continued to pour in from all over India and in spite of extreme financial hardships the journal was elevated to a bimonthly one by 1928 and to a monthly one by 1930, which is continuing most successfully till to-day. The Society has now grown with several branches. India was partitioned into two countries and three regions in 1947, and the hinterland of the Society dwindled, Different publishing organisations are bringing out specialized journals with some eminent scientists as editors.Learned societies all over the world are suffering for one such reason or the other, and the Indian Chemical Society is no exception. However, in spite

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of all these, the Society grew on and on with the advancement of chemical sciences and expansion of chemical industries in India. Among other publications of the Society, most notable one was *History of Chemistry in Ancient and Medieval India,* which was a revised edition of the two volumes of Acharyya Ray's 'History of Hindu chemistry', edited by P. Ray and published in 1956. Special issues of the Journal are exclusively based on papers presented on occasions of birthday celebrations of the Society's senior and eminent Fellows from all over India and more than twenty such issues have so far been published. In addition, over twenty five memorial lectures, medals and awards have been instituted by the Society starting with the Acharyya P.C.Ray Birthday Commemoration Medal (1932) Three publications on the occasions of the Silver Jubilee (1948), the Golden Jubilee (1973) and the Diamond Jubilee Celebrations of the Society were brought out, which provided the Fellows of the Society and other scholars concerned with the development of Chemical Sciences in India. excellent opportunities to assess the success and failure of the organisation , judge its achievement and suggest how things could be done in an improved manner.

Since 1963, the Society has been organising, in collaboration with the Council of Scientific and Industrial Research, the Instiution of Chemists (India), and the Society of Biological Chemists (India) an annual 'Convention of Chemists',which provides for serious and dedicated deliberations; the conventions are usually divided into six parallel sessions: Inorganic, Organic, Physical, Analytical, Industrial and Biochemistry. Apart from presentation of papers, each session arranges symposium under the leadership of one of the Fellows. It may be said that convention of Chemists gives annually an opportunity for introspection as well as acquainting oneself with the progress of Chemical Science in the country.

Indian Science Congress Association was inaugurated in Calcutta in 1913 with Sir Asutosh Mukherjee as the first President and the first session of the Indian Science Congress was organised by and held in the premises of the Asiatic Society during January 15-17, 1914: the Congress had six sections –Chemistry, Physics, Geology, Botany, Zoology and Ethnography and thirty five papers were presented, of which eight were in chemistry. Through the decades following tremendous expansion in research activities in all branches of science including chemistry has taken place and several hundred papers are presented in the Congress held annually in different parts of the country. However, there is no reason to feel complacent, as

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we have got much beway to make up in order to reach the standard of the advanced countries. May the sustained efforts of our scientists and technologists help India to take a seat of pride in the scientific comity of nations of the world.

Since the inauguration of the Indian Science Congress in 1914, there had been a steady progress of research activities in most of the branches of science in India, but more so in chemistry. This has been particularly conspicuous after the attainment of indepedence in 1947, stimulated undoubtedly by the generous and encouraging support by the nation. The establishment of quite a number of new Universities and naional and regional laboratories with modern equipment and facilities for research in chemistry and pressing demand for rapid industrialisation of our country, have been the important contributory factors in the promotion of chemical research.

The stride is on: thousands of chemical scientists, technologists and engineers are doing commendable work. The leading Research and Development institutions in this regard are: (1) Council of Scientific and Industrial Research; (2) Indian Council of Agricultural Research; (3) Defence Research and Development Organisation; (4) Indian Council of Medical Research and (5) Department of Biotechnology. Also, significant research is being done in chemistry and related fields in institutions which include: Universities including Indian Institutes of Technology; Indian Institute of Science, Bangalore; Indian Association for the Cultivation of Science, Calcutta; National Chemical Laboratory, Pune; Bose Institute, Calcutta; Indian Institute of Chemical Biology, Calcutta; Indian Institute of Petroleum , Dehradun; Bhabha Atomic Research Centre, Trombay; Tata Institute of Fundamental Research, Mumbai; Indian Agricultural Research Institute, New Delhi; Saha Institute of Nuclear Physics, Calcutta; Central Glass and Ceramic Research Institute, Calcutta; Indian Institute of Chemical Technology, Hyderabad; Central Drug Laboratory, Calcutta; National Metallurgical Laboratory, Jamshedpur; Central Eletrochemical Research Institute, Karaikudi; Central Forensic Science Laboratory, Calcutta; Central Food Laboratory, Calcutta; Central Drug Research Laoratory, Lucknow and a host of others in the public as well as private sectors. The standard of research and development work in chemical sciences and related fields is often comparable to that of international institutes and organisations, for which all of us may feel proud. It may also be noted that these endeavours underscore the need to secure for the people of the country all the benefits that can accrue from

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the acquisition and application of knowledge of chemical sciences and related disciplines.

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