Gupta's fossils may be Himalayan fakes, says GSI

The accusation of fraud against V. J. Gupta in the Himalayan fossil controversy has been jolted back into prominence by a recent investigation. The Geological Society of India (GSI) has carried out a detailed evaluation of papers published by V. J. Gupta in the *Journal of the Geological Society of India* between 1969 and 1988. GSI did this on a direction from its council. The evaluation was done with the help of stratigraphers and palaeontologists with experience in Himalayan geology. The report of the evaluation appears in the January 1991 issue of GSI's journal.

Gupta, of Panjab University's Centre for Advanced Study in Geology, was accused of giving false data, vague and misleading information about the location of his fossil finds, and plagiarism. According to the GSI report, the most glaring deficiency noticed in nearly all of Gupta's papers in the GSI's journal is the absence of precise locality information. Expressing concern that papers lacking essential locality and stratigraphic data were published, the report states that the fact that most of the papers were short, one-page or two-page notes may have made both referee and editor pass them for publication as preliminary notes. This phenomenon is, of course, not restricted to palaeontology or GSI's journal.

Gupta has thus far not answered the charges satisfactorily and has failed to confirm the genuineness of his fossil collections. 'It is obvious', says the report, 'that the fossil finds of V. J. Gupta are not reliable, that there are internal inconsistencies, that the data are incomplete, bordering on disinformation. The fossil records should, therefore, be ignored till such time when more reliable and reproducible evidence is forthcoming.'

The GSI's report gives assessments of 19 papers of Gupta. Most of the comments say that the papers must be viewed with suspicion. In several cases, other palaeontologists have asserted that Gupta has actually reported gifted or stolen specimens as Himalayan fossils.

The report was circulated among members of GSI's council and leading palaeontologists and stratigraphers, of whom only two did not express approval of the report's recommendation. It was even sent to Gupta himself before publication, to give him 'one more opportunity'. The report states that Gupta did not respond.

Meeting reveals changing face of organic chemistry in India

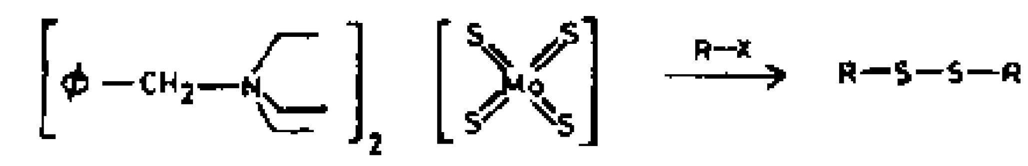
Scientists who have visited North America would be well aware of the Gordon Conferences, informal get-togethers of specialists, in secluded (but comfortable) locations. Not surprisingly, the concept of such meetings has become attractive here too. The National Organic Symposium Trust (NOST) conducted such a symposium in organic chemistry at Hassan in 1988, and has followed it up with a second NOST symposium at Aurangabad in December 1990.

The second symposi im was dedicated to the memory of Professor Biman Bihari Dey, of Presidency College, Madras (see accompanying biographical note)—a pioneer (whose birth centenary apparently went uncelebrated in 1989) who had trained trail-blazers like T. R. Seshadri, K. Venkataraman and T. R. Govindachari. A carefully chosen group of old and young chemists from various academic institutions in the country, as well as a few from industrial R&D establishments and representatives from CSIR and DST had been invited. There were 34 presentations in all, packed in morning and late evening sessions. The afternoons were left entirely free for personal exchange of ideas and for marvelling at our cultural heritage in Ajanta and Ellora. Chemistry was presumably conceived in the caves, even as the bard would like to see 'books in running brooks'.

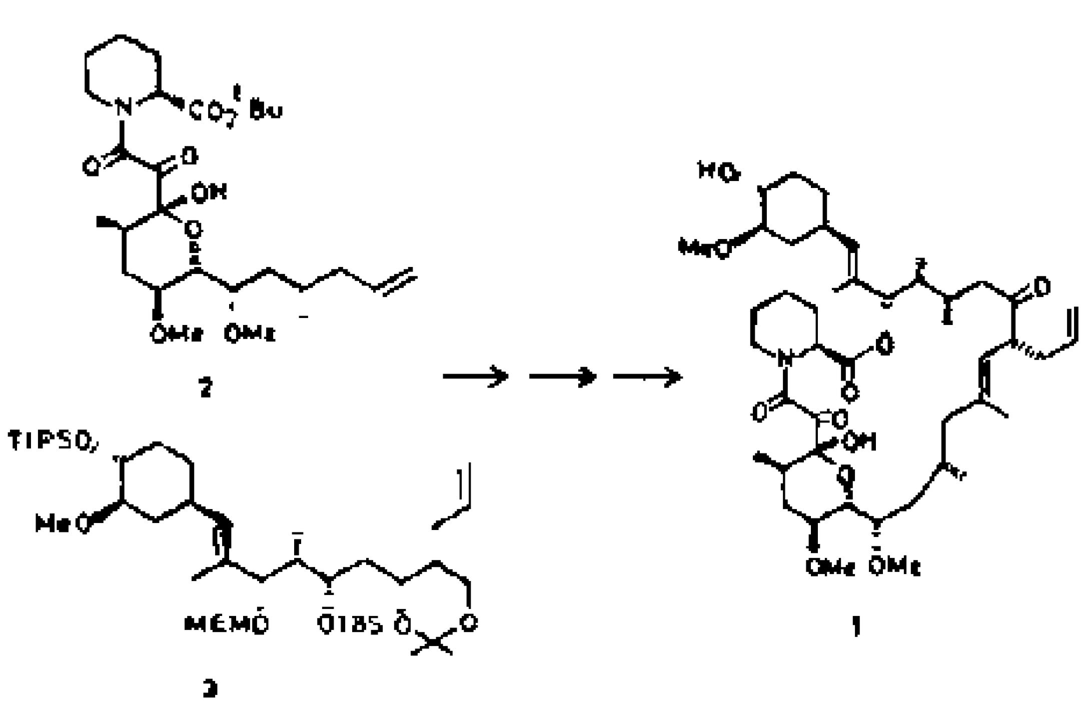
The Hassan meeting has asymmetric synthesis as its focal theme. At Aurangabad, the emphasis was on bio-organic chemistry. Full-length presentations reviewing the state of the art in this frontier area were impressive. The participants were exposed to the methodology of protein design and engineering, the use of abzymes, and to recent success stories across the world in the design of molecular receptors. A talk by M. Nagarajan (University of Hyderabad) on the mechanism of action of enediyne antitumour antibiotics (e.g. neocarzinostatin) aroused all-round interest, in terms of structure, postulated intermediates, biological activity, and targets for synthesis.

The review lectures were followed up with numerous presentations on work going on in India on various aspects of bio-organic chemistry. Talks ranged from the use of enzymes in synthesis to simulation of enzymatic action and biochemical cycles by means of simple molecules and reagents. A modest beginning seems to have been made in the area of host–guest chemistry, both in the design of specific receptors and in chemical applications. In line with the general trend of the symposium, a talk on classical synthetic approaches to oligosaccharides was placed in the context of the larger theme of synthesis of artificial antigens and leprosy vaccines.

The terminology, pace, enthusiasm and colour slides of the bio-organic chemists did have an intimidating effect on 'conventional' synthetic chemists, who routinely assume the spotlight in organic chemistry meetings. It was, however, evident that the latter continue to be a busy lot. The development and use of many new organic, inorganic, and organometallic reagents that do work in India were discussed. The periodic table was covered from hydrogen through boron, carbon, fluorine, sulphur, selenium and bismuth to titanium, cobalt, zinc, molybdenum and tungsten. Efficient syntheses of disulphides using molybdenum reagents (see below) were highlighted by S. Chandrasekaran (Indian Institute of Science, Bangalore). The targets for

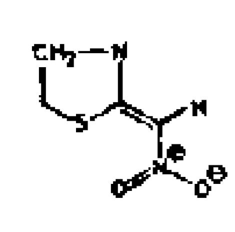


total synthesis were mostly of moderate complexity, perhaps sensibly so. Rather than the usual talk of art in synthesis, the emphasis was on plain hard work. A spectacular example was the progress reported (by T. K. Chakraborthy, Indian Institute of Chemical Technology, Hyderabad) towards the synthesis of the immunosuppressive agent FK-506, 1.



Key intermediates 2 and 3 were described. It was a pity that, apart from the relatively simple Alangium alkaloids and forskolin, there were no new complex Indian natural products as targets of total synthesis.

Among other areas in organic chemistry, photochemistry did have token representation. Due (perhaps undue) respect was shown to theory; speaker after speaker revealed a touching faith in frontier orbitals or in computer-generated structures. Unfortunately, experimental physical-organic studies, structural chemistry, organic spectroscopy and organic materials science were not much in evidence at the symposium. Occasional reference to general electronic effects, such as the orientation-sensitive, intramolecular attraction between sulphur and oxygen quantified by S. Rajappa (National Chemical Laboratory, Pune) using NMR studies on carefully chosen models (4), did arouse considerable



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interest. There must be many similar unusual electronic effects that have gone unnoticed, simply because the evidence available has not been examined with sufficient interest.

What one perhaps missed were reports about the isolation and structure elucidation of new complex natural products from Indian sources with marked biological activity. However, it was heartening to learn privately that some new members of the azadirachtin family have been isolated from neem and their structures elucidated.

The genuine interest shown by the participants in hearing about other people's work sustained the intensity of the symposium. The personal contacts established at Aurangabad may be expected to provide constructive results in the long run. It is hoped that the gains from this compact symposium are shared with a larger audience.

K. Nagarajan, R&D Centre, Searle (India) Limited, Thane.
J. Chandrasekhar, Department of Organic Chemistry, Indian Institute of Science, Bangalore.

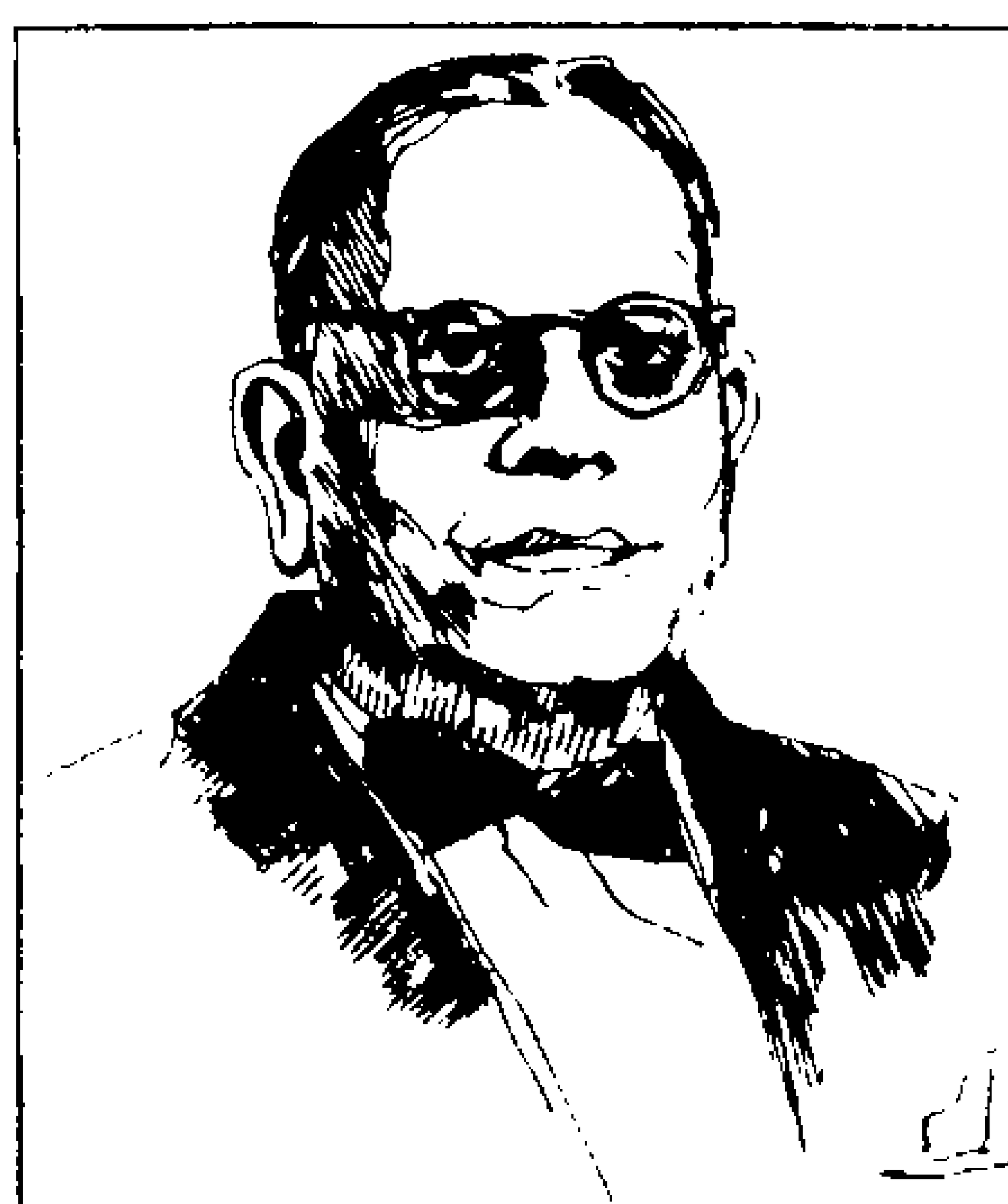
A great builder

A biographical memoir of Biman Bihari Dey

Biman Bihari Dey was born on 1 November 1889 in a small house in Sitaram Ghosh street in Calcutta. He was the youngest of a family of nine children. His father, Kedarnath Dey, had been employed in a lucrative post in the Northern Railways, but gave this up in 1871 in response to a great spiritual call, to become ordained as a missionary in the service of the *nava vidhan* or new dispensation. Kedarnath Dey was one of the most ardent disciples of the revered leader of the Brahmo Samaj, Acharya Keshab Chandra Sen, who gave him the epithet *santa sadhak* or sage of peace. Kedarnath should indeed have been a man of remarkable character, since he was not afraid of throwing away material comforts and courting a life of voluntary poverty to pursue his religious avocation. His decision plunged the family into privation and hardship, which were, however, cheerfully borne with a sense of perfect understanding.

When Biman Bihari Dey was only two years old, Kedarnath passed away, placing the family in even greater difficulties. But Kedarnath's wife was undaunted. She was certainly not in a position to give her children a comfortable life, but she did not fail to see that they all received a sound education or to mould their character on the right lines.

Biman Bihari Dey had his early education in the City Collegiate School, Calcutta, from where he passed the entrance examination (equivalent to



Reprinted with permission from *Biographical Memoirs of the Indian National Science Academy*, vol 1. A full bibliography of Dey appears in the *Biographical Memoirs*.

matriculation) in 1904. He passed the first examination in arts from the City College, Calcutta, in 1906. He secured the B Sc degree in 1908 from the Presidency College, Calcutta, with honours in chemistry and botany. In 1910 he passed the M Sc examination of the Calcutta University with inorganic chemistry as the special subject. His student career at the Presidency College was one of outstanding excellence and was fittingly climaxed by the award of the Mouatt medal and the coveted Premchand Roychand scholarship.

Dey studied at Presidency College when it was at the pinnacle of its glory. Sir P. C. Ray, the father of chemistry in India, was the professor of chemistry. The young Dey imbibed in full measure many of the noble qualities of his great teacher—fervent patriotism, hatred of ostentation, childlike simplicity, and consuming interest in research. Another professor at Presidency College who greatly impressed Dey was the professor of physics Sir Jagdish Chandra Bose, particularly by the importance the latter gave to experimental demonstration in illustrating his lectures. During this period the young Dey had the benefit of cultivating the intimate friendship of P. Ray and H. K. Sen. These friendships were a source of great strength to him in moments of triumph as well as tribulation throughout his life.

After completing his studies in the Presidency College, Dey became a lecturer in the Scottish Church College for a year. In August 1911 he proceeded to London and joined the Imperial College of Science and Technology, to work in the laboratories of Sir Jocelyn Field Thorpe. He obtained the diploma of the Imperial College (DIC) in 1912 and passed the examination for the associateship of the Institute of Chemistry (AIC) in 1913. On the basis of his thesis on 'Coumarin condensations' he was awarded the D Sc degree of the University of London in 1915. This was the first occasion on which an Indian (along with his intimate friend H K. Sen) was admitted to this high degree by the University of London

On his return to India in November 1915, Dey was engaged for some time with researches connected with the chemical industries in Calcutta. In November 1916 he was appointed to the Indian Educational Service in Presidency College in place of Sir P. C. Ray who had taken up the Palit professorship in chemistry at the University College of Science From here he published a number of papers in conjunction with his students in the *Journal of the Chemical Society*, London.

In April 1920 Dey was transferred to Presidency College, Madras, to take the place of Sir John Lionel Simonsen, who was appointed to the Munitions Board. Here he continued as professor of chemistry (and towards the end as principal), until the normal age of retirement from government service, for nearly twenty-five years. Generations of students will remember fondly and recall with pride their student days in his department. This writer had the privilege of sitting in Dey's lectures during the years 1932–1935 and the memory of these years is still vivid. Dey took immense pains to see that his lectures were not only understood but also enjoyed. Half an hour before his lecture, an assistant would come in and arrange a whole series of lecture apparatus, stands stacked with clean test tubes, reagents and samples of organic chemicals, to be discussed in the course of the day's lecture These items occupied the entire length of the table, which stretched almost from wall to wall in the lecture theatre. Dey had a talent for selecting striking experiments to illustrate his lectures. He was a gifted story-teller and knew how to build up and sustain interest in the young student audience. No one could forget his thrilling account of W. H. Perkin's discovery of mauve and the birth of the dyestuff industry or his account of Ehrlich's work on chemotherapy. His English diction was excellent. He made a profound impression on his young students, and many among them who occupy high places in the profession of chemistry today undoubtedly owe their success to the spark kindled in them by the great teacher.

These years at Presidency College, Madras, were the most productive years of Dey as a research chemist. Sir J. L. Simonsen had earlier started research in organic chemistry in the chemistry department, but he did not stay long enough to create a strong school of chemistry. It was left to Dey to build up a vigorous tradition of research. During about thirty years in this department, he and his students produced a stream of publications, so that Presidency College, Madras, came to be recognized as a leading centre of research in organic chemistry in India.

Dey was fond of working with his own hands. He had his personal laboratory in the department, where, with the help of an assistant he would engage himself whenever he was free from his other duties. In one corner of the laboratory, he had a small cubicle, barely four feet square, where he did his reading and writing during the day. In the adjacent laboratory, the final year chemistry honours students and the research students carried out their work. Dey would stride into this laboratory every day in the morning and in the afternoon. He would stop at every student's table and find out what he or she was doing Very often he would demonstrate to the students how a particular test was to be done. He took a delight in carrying out crystallizations of the products obtained by the research students and derived a childlike pleasure in examining beautiful crystals of organic compounds. Some of the cleverer ones among his research students often succeeded in sending him away pleased by displaying nicely crystalline substances in watch glasses on their working table.

In the earlier years, Dey concentrated on the chemistry of coumarins. His work in this field has helped to add substantially to the knowledge of this ring system, as borne out by the many references to his work in the chapter on coumarins in the Elderfield series on heterocyclic compounds He also carried out in the early period a series of studies on the reactivity of the halogen atom on the aromatic nucleus in the presence of a variety of negative substituents.

This writer had the privilege of initiating Dey's studies on the isoquinoline ring system in 1934. During the next ten years, Dey and his students contributed more than fifteen papers on this interesting heterocyclic system, present in many alkaloids and biologically active compounds. His investigations on the chemistry of narcotine and cotarnine had commenced earlier than 1934, but extended for many years along with his synthetic work on isoquinolines.

The chemistry of plant products also had a fascination for Dey. Notable contributions in this field were the isolation of thevetin, a cardiac glycoside from *Thevetia nerifolia*, of the alkaloid heydotine from *Heydotis auricularia*, and of toddaline, toddalinine and toddalolactone from *Toddalia aculeata*. The structure of toddalolactone, a coumarin derivative, was fully elucidated. It must be remembered that all of Dey's work on plant constituents was carried out long before the introduction of physical methods and tools and of techniques like chromatography, which have revolutionized investigations in the field of natural products chemistry.

During 1927–1928, Dey was deputed to Germany to study biochemistry. He spent the time mostly in Berlin and Dahlem, working with Pringsheim, Warburg, Lindner and Weidenhagen. He also travelled in Europe extensively during this period, visiting many of the leading centres of research. One could trace his interest in biochemistry to the stimulus received during this period in Germany. Dey carried out some interesting work on peroxidases in collaboration with some of his students.

A notable contribution during his service as professor of chemistry was the production of the book *A Laboratory Manual of Organic Chemistry* in collaboration with his friend and colleague, Professor M. V. Sitaraman. This book is even today rated highly as a textbook for instruction in practical organic chemistry in most Indian universities and received high praise from several leading international journals.

His early association with Sir P. C. Ray had given Dey a strong practical outlook. He did not believe that study and research in chemistry had fulfilled their purpose if they provided intellectual amusement. He fervently desired that chemistry should be applied to practical ends in India as in the advanced, Western countries. He received ample scope for giving a practical outlet to his knowledge of chemistry during the years of the Second World War. He supplied scores of stains for use in biological analysis to the army, by carrying out the purification of commercial dyes to the requisite extent. He supplied tens of thousands of ampuoles of pituitrin to hospitals, by processing pituitary glands obtained from the slaughterhouse in Madras.

During the years 1940–1953, Dey had two important schemes operating under his supervision in the laboratory of Presidency College, Madras, under the auspices of the Council of Scientific and Industrial Research. One of these was on gland products, under which processes were developed for the production of insulin, thyoxine, adrenaline and pituitrin from slaughterhouse wastes. Another was on the electrolytic reduction of nitro compounds, which led to the development of electrolytic processes for the production of important dyestuff intermediates like benzidine, toluidine, dianisidine, *p*-aminophenol, 2,4-diaminophenol, etc.

Dey officiated as principal of Presidency College, Madras, in 1938 and as permanent principal of the college during 1943–1944, and his talents as an administrator received full scope. He saw the great difficulty experienced by women students from mofussil towns in finding suitable accommodation in Madras city. As a result of his efforts, the Madras Government sanctioned the construction of a hostel. A magnificent structure, costing over fourteen lakhs and capable of housing two hundred women students, was opened by President Rajendra Prasad, and Dey, though not in service at the time, had the satisfaction of being a witness to the realization of his plans.

In 1944 Dey retired from government service but was reappointed for two years as Director of Public Instruction of Madras State. He instituted many reforms in the educational system of the state, whose beneficial effects are felt even now. His work as Director of Public Instruction was appreciated by his colleagues for its vigour, generous impulses and absolute fair play.

Even after retirement from government service in 1946, Dey's services were fully utilized. He served as director of the biochemistry department of Madras University during 1948–1950. In 1953 he was appointed the first director of the Central Electrochemical Research Institute at Karaikudi. He held this post till 1957. During this difficult formative period, his zeal and pioneering spirit enabled him to surmount many odds and build up the institute as a fine centre for electrochemical research in India.

It is relevant to mention some details about Dey's personal life and characteristics. He married in May 1920, Miss Amiya Ghosh, daughter of J. C. Ghosh, an advocate in Nagpur. Mrs Dey was a lady of great charm, gentle disposition and extreme kindliness. Of their four children, the youngest, a daughter, passed away in 1942, causing the parents great mental anguish. Dey was very fond of his children, but he was also very strict. He disliked ostentation and extravagance of every type and expected his children to live up to his high ideals of simple living and high thinking. He had a great love of literature and philosophy and was widely read in the classics both in English and in Sanskrit. The death of his wife, a most noble lady and a true companion to him in every sense, in 1948, was a grievous blow from which he never recovered.

Dey had a personality that commanded respect and awe from his colleagues and students. He was not afraid of acting strictly according to his lights, even if it meant losing popularity. He did not have any talent for concealing his emotions and pleasure or displeasure would show up in his face, according to circumstances, almost as in a child. He hated all types of manoeuvring and was never afraid of speaking out his mind even if this meant losing the favours of the powers that be. In spite of this, many honours came his way throughout his life. Dey was a fellow of the Royal Institute of Chemistry and a member of its advisory board. He was a foundation fellow of the National Institute of Sciences of India and a member of its council for several terms. He presided over the chemistry section of the Indian Science Congress in 1926. He was a member of the Council of Scientific and Industrial Research and chairman of its chemical research committee for several years. He was also chairman of the heavy chemicals and dyestuffs committee of CSIR. During the Second World War, he was adviser to the Government of Madras and the South Indian states for anti-gas warfare.

He played an important part in the affairs of Madras University, being a member of the academic council and the senate for many years and also of its syndicate for a time. As chairman of the Board of Studies in Chemistry of Madras University, he played an important part in improving standards of teaching and examination in the university. Many of the leading universities in India had the privilege of receiving his advice and help. He served as a member of the enquiry committee of Calcutta University in 1954 and also as chairman of the Secondary Education Commission of the West Bengal Government in the same year. He was a founder-member and president of the Bengali Association of Madras, and also president of the South Indian Brahmo Samaj over a period of many years. He was elected president of the Indian Chemical Society during 1943–1944 and took a keen interest in its activities throughout his life.

Dey passed away peacefully on the night of 18 January 1959, deeply mourned by all who had the privilege of knowing him. No one can deny that he had made a profound impact on chemistry in India. He was one of the great pioneers who established and cultivated the tradition of research in Indian universities. He ranks high among the great builders of modern India by his inspiring work as a teacher and his contributions as a research scientist of the highest calibre.

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RESEARCH NEWS

Large atoms in interstellar space

K. R. Anantharamaiah

In interstellar space atoms spend most of their time in the ground state. However, under suitable conditions it is possible to find some atoms in highly excited states with large principal quantum numbers ($n > 500$). During a recent visit to the Raman Research Institute, A. A. Konovalenko described his observations of carbon atoms in interstellar space with principal quantum numbers as large as 768! The 'classical radius' of such atoms is $\sim 5\,\mu m$ and they can be considered as the largest atoms yet observed in either a terrestrial laboratory or an astronomical object. These atoms are observed through their characteristic absorption spectrum when the atom jumps from the excited state $n = 768$ to $n = 769$ by absorbing radiation from a background astronomical source. The frequency of this absorption line is near 14.5 MHz (wavelength ~ 20 metres!) and requires, for its measurement, a radio telescope operating at this frequency. Such a radio telescope, known as UTR-2, is located near Kharkov in the USSR and is operated by the Institute of Radio Astronomy of the Ukrainian Academy of Sciences where Konovalenko works. The first observations of an absorption line at 26.13 MHz, in the direction of the strong radio source Cassiopeia A, was made using this telescope by Konovalenko and Sodin in 1980 (ref. 1). This absorption line was correctly identified by Blake, Crutcher and Watson[2] as due to excited carbon atoms with principal quantum number of 631. The UTR-2 radio telescope used for these observations is a 'T'-shaped array of 'fat' dipoles stretching about 2 km along the north–south direction and 1 km along the east–west and operates over a frequency range of 12 to 30 MHz. In this frequency range the telescope can be used to observe excited carbon atoms with principal quantum numbers ranging from 600 to 800 or so. The 'T'-shaped radio telescope at Gauribidanur near Bangalore, which was constructed jointly by the Raman Research Institute and the Indian Institute of Astrophysics, is somewhat similar to the UTR-2 telescope, but operates over a narrow band of frequencies around 34.5 MHz (see accompanying article on 34.5-MHz sky survey, p. 144). This telescope has also been used recently to observe carbon atoms excited to $n = 579$ in the direction of Cassiopeia A (ref. 3).

In the decade since their first discovery, Konovalenko and collaborators have observed excited carbon atoms in several regions of interstellar space using the UTR-2 radio telescope[4]. In the direction of Cassiopeia A, carbon atoms with principal quantum numbers ranging from 600 to 768 have been observed. These are difficult observations requiring anywhere from ten to several hundred hours of integration per detection since the lines are extremely weak ($\sim 10^{-3}$ of the sky background at these frequencies). In addition man-made interference is severe in these bands, which means even longer observations to obtain the required integration after careful editing of the data. Observations of these lines, apart from the novelty of being the lowest frequency spectral lines, tell us something about the nature of the interstellar medium. Carbon atoms in these highly excited states are produced through the process of ionization and recombination. These atoms reside in gaseous clouds containing mostly neutral hydrogen. There is approximately one carbon atom for every 2500 hydrogen atoms in these clouds. The carbon atoms are ionized by the background ultraviolet photons with energies greater than 11.26 eV, which is the ionization potential of carbon. Hydrogen in these clouds is mostly neutral since there are not many background UV photons with energies greater than the 13.6 eV required to ionize hydrogen. The process of ionization is balanced by an equal number of recombinations in which a carbon ion captures a free electron to become neutral again. The process of recombination can leave the electron in a highly