Krishnamurthy Ganapathi (1911–2004)

Krishnamurthy Ganapathi was born on 18 August 1911 in Tiruvarur, Madras. He graduated from St. Joseph's College in Trichinopoly, and received his MA degree in chemistry from Annamalai University, Chidambaram. He joined the Indian Institute of Science (IISc), Bangalore on a Lady Tata Memorial Fellowship, where he was awarded the Sudbury Medal for research in 1936. He received his D Sc degree from the University of Madras in 1941. He joined the Haffkine Institute, Bombay, at the invitation of General Sir Sahib Singh Sokhey, then Director, in 1941. Ganapathi discovered the crystallized form of the antidote to snake venom, which was a boon that helped save many lives during the War. He also discovered sulpha drugs that were crucial in the fight against plague. While at the Haffkine Institute, he established the first department of chemotherapy in India.

Ganapathi established, for the first time, the projection (conformational formula) of 3-dihydroxydecalins. He has made noteworthy contributions to chemistry of the thiazoles, synthesis and testing of derivatives of sulphanilamide, and also independent discovery of sulphathiazole, sulphaguanidine and sulphamethazine; the process for the manufacture of sulphathiazole, synthesis of potential antimalarials, and production of paludrine. His other important contributions concern the biosynthetic pathway for penicillin production by the mould, and biochemistry of *Penicillium chrysogenum*, and some pathogenic bacteria. Production of citric acid by submerged fermentation of *Aspergillus niger* is one of his major accomplishments.

Ganapathi had over 130 research publications and 20 patents on sulpha drugs to his credit. One of the sulpha drugs, sulfathiazole, is still being used in modern medicine. He was elected a Fellow of the Indian National Science Academy in 1946 and served on its Council. He travelled extensively to Canada, the United States, Europe, the former Soviet Union and Czechoslovakia.

Ganapathi produced the first project report for Indian Drugs and Pharmaceuticals Ltd. He conceived and pioneered the establishment of the first penicillin factory in India, Hindustan Antibiotics at Pimpri, where he was the Director Research and Works Manager from 1953 to 1959.

Ganapathi returned to the Haffkine Institute in 1959. In 1964, he became the Director of the Regional Research Laboratory, Jammu and Kashmir. There he modernized the laboratories, established pilot plants and set up a branch laboratory at Srinagar. Concurrently, he also acted as the director of the Central Indian Medicinal Plants Organization, Lucknow from 1964 to 1971. Ganapathi was a member of the Board of Governors of the Indian Institute of Technology, Kanpur, in the 1970s. He was elected Fellow of the Indian Academy of Sciences in 1951. He retired from active service in February 1972, but continued as a consultant to many firms.

Ganapathi was a scholar in every sense of the word. He read extensively and kept abreast of scientific research. His interests also included the history of science, biology, physics, Sanskrit, Tamil and English literature, history and philosophy. Above all, he was a connoisseur of classical carnatic music, whose extraordinary intricacies he studied with a truly scientific mind. He was at one time an honorary music critic for *The Hindu*. He led a quiet and simple life, devoting his time to reading until his death on 15 October 2004 in Bethesda, Maryland. He is survived by his son and two daughters.

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P. S. Goel (1930–2004)

Paramatma Saran Goel was born on 6 July 1930 at Dankaur, Bulandhshahr district, Uttar Pradesh. After his B Sc in 1952, Goel received his M Sc degree in physics from the Banaras Hindu University in 1954, MS (chemistry) and Ph D (chemistry) from the Carnegie Institute of Technology, Pittsburgh in 1960 and 1962 respectively. He was a postdoctoral fellow at the University of California, La Jolla during 1962–63. He joined IIT Kanpur as an assistant professor in 1964, and became a professor in 1972. Goel served as the Head of the Department of Chemistry at IIT during 1972–73 and again during 1986–89.

Before going to America in 1958, Goel worked in TIFR, Mumbai for four years with Bernard Peters, and was interested in the study of cosmic ray-induced radioactivity in nature. After returning to India in 1964, he was actively involved in teaching and research in nuclear cosmic chemistry and geochemistry. Some of the highlights of his work are mentioned below.

He detected cosmic-ray produced S^{35} in rains and showed that it was present in amounts expected due to its production in the atmosphere by cosmic-ray particles. This discovery was made in 1955, when only a few cosmic-ray produced isotopes were known. He made the first measurements of cosmogenic C^{14} in meteorites and showed that it is possible to precisely determine the time of all of stone meteorites,

which fell in the last 50,000 years. This is one of the patent methods of dating the time of fall of stone meteorites; the other method developed subsequently is based on the isotope Be^{10}. In collaboration with his student B. M. P. Trivedi, Goel made the first measurements of production of Na^{22} and H^3 in silicate targets with a view to interpret cosmogenic effects in meteorites. This work, which he completed in 1973, is considered as a reference for determining cosmic-ray production rates as a function of depth in meteorites. He was the principal investigator for lunar sample studies from the time of *Apollo 14* mission. He developed and applied the neutron activation method for measurement of nitrogen content of lunar samples and meteorites. These measurements are extremely difficult, but the creditability and usefulness of his measurements have been recognized. Last but not least, he was actively engaged in conducting hydrological work of national importance. He was considered an expert by the International Atomic Energy Agency (IAEA) in this field. He was deputed by IAEA to Sri Lanka to investigate the use of radio isotopes on hydrology and was deeply involved in the study of meteorites and isotopic anomalies therein. Goel was elected a Fellow of the Indian Academy of Sciences in 1977 and of the Meteoritical Society in 1966.

Goel was suffering from prostate cancer before he breathed his last on 9 August 2004 in Lucknow. He is survived by his wife, a son and two daughters.

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RECOLLECTIONS

Science and Music: Truth and Beauty

I read with interest the editorial on the above subject[1]. Right from my school days I have been a fan of M.S. and one of her songs which I liked to hear often was 'Needu Charanamule' in the raga 'Simhendramadhyamam'. This song seemed to have impressed Rabindranath Tagore so much that he composed a Rabindrasangeet piece in the same tune and the words of this begins with 'Baje Karuna Shure'.

There is an interesting background to the origin of this song. Some years back I met one Michael Nixon in Chennai and he was then doing research on Carnatic music guided by Savithri Rajan, a renowned veena player and musicologist. She and Michael Nixon founded the 'Sampradaya' group for research on old traditions in Carnatic music. Michael told me that 'Needu Charanamule' was not composed by Thyagaraja though it has his 'mudra'. It was actually composed by Krishnamachariar, brother of the famous Tiger Varadhachariar. Krishnamachariar was an accomplished musician, but was not as well known as his illustrious brother. Krishnamachariar realized that Thyagaraja surprisingly had not composed any song in the raga 'Simmendramadhyamam' and so wanted to rectify this lacuna by composing 'Needu Charanamule' and inserting Thyagaraja's 'mudra'.

Chandrasekhar, about whose essays on Truth and Beauty the editorial mentions, was not only fond of Carnatic music but also of classical western music as well as art and literature. He gave an interesting lecture on 'Newton and Michaelangelo' at the meeting of Nobel Laureates in Lindau[2]. When my wife and I visited him at his apartment in Chicago he played for us two of his favourite records, one 'Music of the Minstrels' and the other, the recording of the rehearsal of the 36th Symphony (also called the Linz Symphony) of Mozart conducted by Bruno Walter. Bruno Walter was a friend of Chandrasekhar and the Professor told us that during one of his dinners with Bruno Walter, the Professor talked to him with his usual high intensity on Newton and hearing this the conductor asked him whether Newton was to Science what Bach was to Music and Chandrasekhar quipped 'This is the only comparison I shall tolerate'.

Apart from many honours in his lifetime, Chandrasekhar's contribution to astrophysics was also recognized by the launching of the X-ray observatory 'Chandra' in 1998 named after him. At that time, *Chicago Sun-Times*[3] had a column which said 'In all his years on the University of Chicago faculty from 1937 until his death in 1995, India-born Subrahmanyan Chandrasekhar never sought public attention for his work and the astonishing insights that gave him rank with Albert Einstein and Stephen Hawking among the greatest physicists of this century'. The paper also quoted British Astronomer Martin Reiss's comment on Chandrasekhar which said 'he probably thought longer and deeper about our Universe than anyone since Einstein'.

Both M.S. and Chandrasekhar were known for their kindness, humility and simplicity. A friend of mine who was an amateur singer in Carnatic music and had some training in vocal singing used to tell me that her lifetime ambition was to sing a song with M.S. accompanying her on the tanpura. Believe it or not, when she went to M.S.'s residence and told her about her ambition, M.S. immediately played on the tanpura to my friend's singing!

My wife and I had seen off Chandrasekhar and his wife many times at Bombay airport after their stay in India. Every time he told me that I should not tell anyone at the counter about him as he did not want any special treatment which he used to call as 'fall-outs'.

During one of his visits to India, my wife and I had a conversation on Einstein and to my remark that I had heard that Einstein was a very humble person, Chandrasekhar referred to a comment made by Bernard Shaw on Mahatma Gandhi namely 'Gandhi is a humble man, but he knows he is Gandhi alright' and said similarly Einstein knew that he was Einstein alright. Needless to say, the same applied to M.S. and Chandrasekhar as well.

1. Balaram, P., *Curr. Sci.*, 2004, **87**, 1639–1640.
2. Lecture given at the 44th meeting of Nobel Laureates in Lindau, on 28 June 1994.
3. *Chicago Sun-Times*, 23 December 1998.

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