

## PERSONAL NEWS

*Transactions of the Indian Institute of Metals*. He was also President of the Indian Institute of Metals, and of the Indian Nuclear Society. For his outstanding scientific and technological achievements, the Government of India honoured Sundaram with the Sanjay Gandhi Award for Science and Technology in the field of energy (1985) and Padma Bhushan (1986). He was awarded the honorary degree of Doctor of Science by the Banaras Hindu University and Distinguished Material Scientist Award by the Materials Research Society of India.

Sundaram was a man with a brilliant mind, a man of science with a voracious appetite for knowledge and truth, and an avid reader who felt at home surrounded by a variety of books. His knowledge and scholarship, diligence and patience, temperance and charity, and above all his para-

mount devotion to duty and virtue have made a lasting impression on all those who came in close contact with him. Sundaram pursued his career as an opportunity to serve the nation using science and in the process found satisfaction. He was profoundly influenced by Homi Jehangir Bhabha, Brahm Prakash and Raja Ramanna. Sundaram was also inspired by the spiritual thinking and simple living of great leaders like Swami Vivekananda and Mahatma Gandhi. He was erudite in Sanskrit and translated *Sivandalahari* into English published by Bharathiya Vidya Bhavan. He was also known for his deep understanding and ardent love for classical music. Sundaram was a compassionate human being, and an articulate speaker and writer. He was always keen to foster talent and develop new scientific leaders for the future. He

had his entire education and training in India, where he also did most of his research. He had genuine pride in things that are Indian and was keen to push forward the frontiers of science and technology in India. In his passing away, India has lost one of her worthy sons, who was a true leader in science and technology and more importantly, a human being par excellence.

Sundaram will be fondly remembered by his family members, peers, collaborators and a large number of colleagues, admirers and friends.

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## K. Joseph Thomas (1935–2008)

K. Joseph Thomas was born on 20 March 1935 in Kerala. He obtained his PhD in botany from Bombay University in 1962, followed by a postdoctoral stint at Prague, Czechoslovakia, working on mass cultivation of algae. Thomas (better known as Joe Thomas to most) joined the Biology and Agriculture Division, Bhabha Atomic Research Centre (BARC), Mumbai in 1966. Here, Joe spent the prime of his research career to make several outstanding and original contributions to cyanobacterial/rhizobial nitrogen fixation research in India.

Using absorption microspectrophotometry, he was the first to show that photosystem II pigments were absent in heterocysts of *Anabaena*. This *in situ* study implicated the mysterious heterocysts as the possible sites for localization of oxygen-sensitive nitrogen fixation in *Anabaena*. He followed this up by demonstrating nitrotetrazolium blue reduction in heterocysts *in vivo*, to establish the required reducing atmosphere inside these specialized cells. Both these discoveries were published in *Nature*. Thomas and his colleagues isolated new cyanobacterial strains from Trombay, devised a new culture medium (cyanophycean medium) for cyanobacteria, and developed meth-

ods for their mass cultivation. They also identified physiological and biochemical factors regulating the formation of heterocysts and spores in *Anabaena*, and characterized the response of *Anabaena* strains to UV light.



The first-ever demonstration of conformational changes in nitrogenase *in vivo* came from his laboratory in 1978. Long-term preincubation with acetylene was found to enhance nitrogenase activity in several organisms, including cyanobacteria, resulting in over-estimates of their diazotrophic potential. This revelation led to the development of an improved acetylene reduction assay technique

for analysis of hundreds of field samples per day. In the late 1970s and early 1980s, Thomas and his colleagues discovered an unusual and novel requirement of sodium for cyanobacterial growth and metabolism. Mechanisms underlying salinity stress tolerance in *Anabaena* were elucidated and the myth behind the well-known reclamation of saline soils using cyanobacteria was unravelled.

Thomas visited the laboratory of C. Peter Wolk, Michigan State University, East Lansing in 1975–76, to pioneer work on ammonia assimilation pathway in cyanobacteria using the short-lived radioisotope,  $^{13}\text{N}$ . This outstanding research work established exclusive aerobic fixation of nitrogen in heterocysts, transport of fixed nitrogen to vegetative cells as glutamine and its assimilation there as glutamate. Subsequent to his return to BARC, his laboratory extensively characterized the major ammonia assimilatory enzyme glutamine synthetase from *Anabaena* and from rice, and described its regulation. Thomas also used stable isotope of nitrogen ( $^{15}\text{N}$ ) to obtain reliable estimates of nitrogen fixation by cyanobacterial biofertilizers and their contribution to rice yields. Efficient strains of *Anabaena* and *Nostoc* were de-

veloped and evaluated as N biofertilizers in paddy cultivation.

Thomas also made some original contributions to the area of legume–rhizobium interactions. His laboratory identified factors in legume root exudates which induce corresponding rhizobia to initiate nodulation, and also demonstrated the role of rhizobial exo/lipopolysaccharides in extending the nodulation process further.

Thomas joined SPIC Science Foundation in 1987, where he established and strengthened a Centre for Biotechnology and rose to be one of its Vice-Presidents. He was elected fellow of all the national science academies, including the Indian National Science Academy (INSA), Indian

Academy of Sciences, National Academy of Sciences, and National Academy of Agricultural Sciences. He served twice as a member of the INSA Council in 1993–94 and in 2000–02. He was a recipient of the FICCI Award and an elected member of the prestigious Guha Research Conference. Thomas was a member of the Governing Body of the Council of Scientific and Industrial Research, and Research Council of the Centre for Cellular and Molecular Biology, Hyderabad and of the International Advisory Committee on Biological Nitrogen Fixation.

Thomas will be remembered by his students and colleagues as a meticulous task-master, and an excellent teacher and

mentor. He guided several students working at BARC for their PhD under the University of Mumbai; M.S. University, Baroda; S. V. University, Tirupati, etc. His last major assignment was as adviser to the Indian Institute of Technology, Chennai, where he was instrumental in establishing a strong School of Biotechnology. He passed away on 30 January 2008 at Chennai after a short illness.

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