

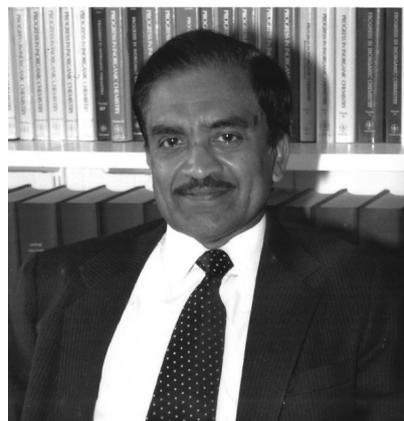
P. T. Manoharan (1935–2019)

Professor P. T. Manoharan, a distinguished chemist of international acclaim passed away on 6 March 2019. He was an excellent teacher, researcher, mentor and institution-builder. He was also highly independent, straightforward in approach and direct in every interaction. Dreaming big was his important characteristic.

Periakaruppan Thangiah Manoharan, popularly called PTM or PT by his close colleagues and friends, was born in Tirumangalam, Tamil Nadu on 12 June 1935 to K. P. Thangaiah and Sivabakiam. He obtained his B Sc in 1955 and M Sc in 1959 from Madras University and Ph D in 1966, working with Harry B. Gray at Columbia University, New York, USA. He had his postdoctoral training with Max T. Rogers at Michigan State University, USA during 1966–69. On his return to India in 1969, PTM joined the Indian Institute of Technology (IIT), Kanpur as an Assistant Professor. In 1972, he moved to the Department of Chemistry at IIT Madras as an Associate Professor and served as Professor of chemistry during 1973–95.

PTM was the founder of the first Regional Sophisticated Instrumentation Centre (RSIC) at IIT Madras, established in 1974, sponsored by the Department of Science and Technology, Government of India. RSICs were renamed as Sophisticated Analytical Instrument Facilities (SAIFs) subsequently, providing research/analytical services to scientists from all fields of research, a concept that has been appreciated worldwide. Today there are 18 SAIFs spread over the length and breadth of the country. PTM was the Head of RSIC at IIT Madras intermittently till 1995. He was the first Dean of students at IIT Madras and in 1995 he became an emeritus professor at IIT Madras. Later, he was appointed the Vice-Chancellor of University of Madras (1997–1999). In 2005, he took up the Raman Chair Professorship of Indira Gandhi National Open University, New Delhi (until 2007). Concurrently, he was a Raja Ramanna Fellow at IIT Madras and an Honorary Professor at the Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru. He was a Distinguished Fellow of Indian National Science Academy (INSA), New Delhi as well.

PTM is best known for his work in the field of electron paramagnetic resonance (EPR) spectroscopy and quantum mechanical calculations on transition metal complexes. He studied the magnetic and optical properties of such systems leading to a detailed understanding of their bonding and molecular structure. His other contributions include experimental analysis involving (a) EPR and optical spectroscopic studies using single crystals at various temperatures; (b) dynamic



NMR studies of complexes in solutions to examine their fluxional character; (c) Mössbauer and magnetic susceptibility studies down to 4.2 K, and (d) structural studies of molecular materials. PTM played a substantial role in filling the knowledge gap in the basic understanding of molecular electronic structure using various methods like semi-empirical WHMO, CNDO/INDO-MO, NDDO-MO and later $X\alpha$ calculations.

PTM's subsequent work involved studies on the construction of a microspectrophotometer to analyse the correct assignment of optical spectra in systems where it was not possible to measure the polarization due to unavailability of optically transparent materials, and dynamics in the NMR of some transition metal complexes. In later years, he was interested in artificial photosynthesis and alternate energy using nanostructures.

Some of his important contributions were concerned with oxygen uptake in haemoglobin and haemocyanin; bio-inorganic chemistry of haemoglobin and hemeoporpherins to understand the mechanism of haemoglobin in biology; study of Jahn–Teller interactions and

exchange interactions in solid-state materials; exchange interactions in one-dimensional systems, biradicals and exchange coupled systems involving two or more centres; magneto-chemistry and EPR of exchange coupled systems mainly involving copper and nickel complexes, and interaction of nitric oxide with Vitamin B12 in the presence and absence of biomolecules like glutathione. PTM's work on layered materials involving extended interactions has a bearing on the production of semiconductors, giving an insight into the binding within individual molecules and between different molecules in solid state.

Starting with his doctoral research on transition metal coordination chemistry, PTM earned international acclaim as one of the most distinguished authority in the field of structural bio-inorganic chemistry, exploring haemoglobin and reconstituted haemoglobins, reversible oxygen uptake in metallo-enzymes, exchange interactions in copper complexes, their magnetism, etc. One of the unique features of his research is balanced and thorough application of all available spectroscopic, scattering and diffraction techniques, namely EPR, NMR, ESCA, Mössbauer, EXAFS, IR, Raman, UV/Vis and XRD as well as theoretical computations, at the state-of-the-art level.

PTM published close to 200 papers in journals of international repute. He guided 36 students for their Ph D and trained 24 postdoctoral fellows, all of whom are well-placed either in academia or corporate research. In IIT Madras, he used to love teaching undergraduate students. He was instrumental in improving the curriculum for M Sc and Ph D chemistry degrees in theoretical chemistry and spectroscopy. He was a meticulous organizer of academic conferences, symposia and workshops. He conducted more than a score of summer and winter schools on a variety of spectroscopic topics, often coordinating and preparing excellent teaching materials which have helped many research scholars and teachers in universities and colleges.

Honours received by PTM include Fulbright–Smith Mundt Fellow to the US; Visiting scientist at NIH/NIA (Bethesda). He visited several universities on sabbatical and exchange visitor assignments

including Europe, USA, Japan and Australia. He was an editorial board member of *Proceedings of the Indian Academy of Sciences* (Chemical Sciences, 1980–89) and *Indian Journal of Chemistry* (1985–89). He was the recipient of INSA Rangadhama Rao Lecture award (1987), S. R. Palit Memorial Award in Physical Chemistry by IACS (1989), Award in the field of Physical Sciences including Mathematics (1989); Morris Travers Lecture Award, IISc (1995); K.S.G. Doss Memorial Lecture, CECRI (1995); Sadhan Basu Memorial Award, INSA (1996); Professor Govindarajulu Endowment Lecture Award, University of Madras (2003); Professor Baliah Endowment Lecture, Annamalai University (2004); Mahatma Gandhi University Decennium Commemoration Lecture Award and Medal (2005); Lifetime Achievement Award in EPR Spectroscopy by the EPR 2005 Conference held at Ohio State

University. Positions occupied by him include, Vice-Chancellor, University of Madras (1997–99), Research Council Chairman, CSIR-RRRL, Thiruvananthapuram, Secretary, INSA (1997–1999), Treasurer and Vice President, Chemical Research Society of India and Founder of Green Canopy, an environmental organization at IIT Madras.

PTM was a Fellow of INSA (New Delhi), Indian Academy of Sciences (Bengaluru), Third World Academy of Sciences (Trieste, Italy) and World Innovation Foundation. He was also a member of several advisory and executive boards and committees of DST, CSIR and UGC, IACS, IISc and JNCASR.

He was a distinguished scientist and a pioneer in the field of spectroscopy. With his demise we have lost a good academician, able administrator, excellent leader and a strong motivating force in the field of education. He was and will

remain a role-model for many generations to come.

Professor Manoharan will be remembered as the champion of providing easy access to sophisticated scientific instrumentation for the needy, through the concept of RSICs, now known as SAIFs funded by the Department of Science and Technology, a vision that seeded and encouraged experimental chemical research in institutions across the country.

He leaves behind his wife, a son and a daughter.

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