

P. T. Narasimhan (1928–2013)

We record with profound sorrow the passing away of P. T. Narasimhan at Sunnyvale, California, USA on 3 May 2013.

Palliakaranai Thirumalai Narasimhan – PTN to his friends, students, colleagues and admirers in India, Jim to his colleagues in the West – was a phenomenon in the Indian academic and scientific research scene. Born on 28 July 1928 in Cuddalore (New Town), Tamil Nadu, PTN's early academic career was at Madras Christian College, where he obtained M Sc degree (by thesis) in 1951. He then joined the Indian Institute of Science (IISc) for his doctoral studies under the guidance of R. S. Krishnan. After obtaining his doctoral degree, he worked as an ICI postdoctoral fellow at IISc during 1955–1956. His research at IISc Physics Department included numerous investigations on molecular dipole moments of organic molecules, as well as a molecular orbital treatment of pyrazines. It is noteworthy that his work at IISc included studies on the temperature dependence of dielectric constants of ionic crystals and diamond; dealt with infra-red intensities and the chemical bond; and offered an extrapolation method for complex data. This body of work was published in 13 research papers in the *Journal of the Indian Institute of Science*, *Current Science*, the *Proceedings of the Physical Society*, etc. This was followed by postdoctoral years at USA, especially with Max T. Rogers at the Michigan State University. Rogers was keen on developing new experimental techniques to garner insights into molecular structure. The research work of Narasimhan and Rogers on nuclear magnetic resonance (NMR) was published in top-ranking journals including the *Journal of Chemical Physics*, the *Journal of the American Chemical Society* and the *Journal of Physical Chemistry*. Subsequently, between 1958 and 1961, PTN served as an Assistant Professor at Michigan State University, University of Illinois and Columbia University. While at Columbia, he had many fruitful discussions with Martin Karplus on the generalized valence bond theory of nuclear spin–spin couplings in molecules.

PTN returned to India in 1962 and joined as Assistant Professor in the Department of Physics at IIT Kanpur.

However, he soon moved to the Department of Chemistry – and the rest, as they say, is history. Joining the Department as Associate Professor, he became full Professor in 1965 and subsequently Senior Professor. It is here that the famous 'triumvirate' of Chemistry, P. T. Narasimhan, M. V. George and C. N. R. Rao, brought in a paradigm shift in the way chemistry was taught and practised in the country. In particular, physical chemistry was then dominated by research in electrochemistry, chemical thermodynamics and kinetics. Narasimhan and Rao brought in expertise in the field of magnetic resonance, solid state chemistry and theoretical chemistry. Fully supported by the founding Director of the Institute,



P. K. Kelkar, the three professors built the Chemistry Department at IIT Kanpur to national and international prominence. The culture and tone of the department resulted in chemistry flourishing at their hands, and at the hands of younger colleagues including D. Balasubramanian, A. Chakravorty, D. Devaprabhakara, G. Mehta and S. Ranganathan, to name but a few, who excelled both in teaching and research.

Narasimhan was passionate about magnetic resonance and theoretical chemistry. He brought to both these areas perspectives that have been unique on the Indian scene and made him a pioneer. In his experimental research, he believed in developing scientific instrumentation, while in his theoretical undertakings he never allowed mathematics to reach a point where it might distract from the physical perspective.

With his research group at IIT Kanpur, he pioneered the development in India of

dynamic nuclear polarization at X-band, both in terms of home-built instrumentation and chemical applications. Another important research area of his was nuclear quadrupole resonance (NQR) spectroscopy, culminating in home-built phase-locked super-regenerative oscillator-detectors and a home-built pulsed NQR double resonance system. The high resolution Nuclear Magnetic Resonance (NMR) of small molecules dissolved in liquid crystalline media, and the investigation of alternating line width effects in electron spin resonance (ESR) were other major undertakings of his group. PTN carried his fondness for working with scientific instruments to the point of reviving dead commercial spectrometers – the days spent reviving an A60D that had been given up being one example.

A considerable body of quantum chemical research also emerged from PTN's group. Much effort was focused on magnetic resonance (MR) parameters such as coupling constants in NMR, spin densities and relaxation models in ESR, and quadrupole coupling constants employing valence bond (VB) and molecular orbital (MO) theories. His group also worked on Sternheimer shielding and anti-shielding factors, using the Hartree–Fock–Slater approach, a precursor of density functional theory, as well as molecular electron momentum densities. His contributions to theoretical chemistry led to ushering in the era of computational chemistry in India, although he was a firm believer in gleaning physical insights through computational methods. A good deal of code development was undertaken by his group, both within semi-empirical and *ab initio* frameworks.

In PTN's thinking about science, the black box approach was clearly anathema! In his inspiring lectures throughout the country, PTN brought alive this magical sense of *doing* things – and *loving* it! Remarkably, PTN was at once the curious and childlike researcher, as well as the skeptic, 'so what?' scientist! He mentored over 20 Ph D students encouraging each one to be an independent researcher and published over 200 research papers during his 26-year stint at IIT Kanpur. In the classroom, he was a natural teacher, and his course on Chemical Binding at IIT Kanpur has

been the stuff of legend, fondly remembered to this day by acolytes across the country – themselves learned professors today.

It follows naturally that PTN built an awesome reputation and received a series of accolades from the Indian science establishment, including the Shanti Swarup Bhatnagar Prize, Fellowships of the Indian National Science Academy, New Delhi; the Indian Academy of Sciences, Bangalore; and the National Academy of Sciences of India, Allahabad. He served in several positions, such as Founder Member and secretary of the Association of Magnetic Resonance Spectroscopists (AMRS) of India, and Member of the first Editorial Board of *PRAMANA – a Journal of Physics*, published by the Indian Academy of Sciences, Bangalore. PTN also served as a Council Member of the International Society of Magnetic Resonance, Chicago. He received the Sir C. V. Raman Award and Hari Om Ashram Trust Award established by the University Grants Commission. PTN was the moving force behind the establishment of one of the earliest magnetic resonance imaging (MRI) facilities in India, at the Institute of Nuclear Medicine and Allied Sciences, New Delhi. His reputation was by no means confined to the shores of India. He had close working relationships with the leading magnetic resonance researchers and theoretical chemists of continental Europe, UK, USSR and USA. Indeed, despite not being given to *seeking* visibility, he unfailingly attracted a fan following wherever in the world he lectured or researched – or gave his Carnatic music concerts!

To the surprise of many, he chose to resume his research in the USA after his ‘retirement’ from IIT Kanpur in July 1988. He continued his work at the Huntington Medical Research Institute in Pasadena, California on novel applications of magnetic resonance in biology. Subsequently, in 1993, he moved to the Biological Imaging Center of the Beckman Institute at California Institute of Technology, from where he contributed significantly to biomedical NMR and to NMR microimaging. A list of publications in his ‘second innings’ of research

includes development of methods for small animal brain mapping, as well as several applications. He formally retired from the Beckman Institute in 2009, after being engaged in research in the USA for about 21 years after ‘retirement’ from IIT Kanpur. In August 2011, IIT Kanpur honoured themselves by making him an Institute Fellow, in recognition of his lasting contributions to the institute.

Music was always close to PTN’s heart. He was an accomplished violinist and flutist who gave recitals in India as well as several performances abroad, especially in the USA after 1988. In addition, he played host to top classical musicians and dancers during their visit to Kanpur. Many of us fondly remember the performances of Bhimsen Joshi, Lalgudi Jayaraman, Ustad Amjad Ali Khan and several SPIC-MACAY programmes. Many a time, there were dinner outings to the Kwaliti Restaurant at the Mall Road in Kanpur and also dinner meetings at his residence.

In his personal life, Narasimhan was supported devotedly by his wife Leena Narasimhan for over 50 years. His children Nalini, Vikram and Nandini are all doing very well in their chosen careers.

PTN was very pleasant and gentle in his approach to his students, well aware of their limitations. Smilingly and steadfastly, however, he insisted all along that the student should develop scientific prowess on his – or her – own, be it in magnetic resonance, or theoretical chemistry, or both. In time, this approach greatly helped his students find their feet quickly as independent researchers in their chosen areas of work. At a personal level, his handwritten letters to each one of us at least once a year, long after our graduation, remain cherished.

Having been diagnosed with lung cancer by September 2012, he had elected not to pursue any major medical treatment and expressed a desire to say his goodbye to the people who were an important part of his life. Many of his close associates talked to him on the phone. His voice, though feeble, was calm. He made enquiries about our work and families. As those who visited him in person during his last couple of months attest:

‘He was weak, but the same energetic glowing gentleman’ (private communication from Russell Jacobs, as conveyed to S. Sendhil Velan, and thence to one of us). If one were to employ the jargon of his favourite science, here is an unusual case where the ‘lifetime’ T_1 was regrettably shorter than the ‘coherence time’ T_2 !

Though we knew the end was near, it is difficult to accept that he is no more. PTN had been a brave fighter all along, whether fighting for an academic cause, maintaining high standards in scientific research or in his illness. To his Ph D students, he was much more: a friend, philosopher and guide.

His students feel privileged to have been associated with PTN, a scientist and an artist, a man with great personal charm and ready wit. He will be remembered for his outstanding contributions to teaching, to the development of scientific instrumentation and to insightful researches into magnetic resonance and theoretical chemistry, with chemical and biomedical applications. It is our privilege to salute a rare person: a stellar performer and a true connoisseur!

ACKNOWLEDGEMENTS. The authors acknowledge with pleasure inputs from Professor M. S. Gopinathan, IISER Thiruvananthapuram, and from Nalini Murdter (née Narasimhan) and Vikram Narasimhan, USA. We also acknowledge the kind permission of the Editors of *ARKIVOC* to use portions of our write-up on PTN which appeared in the issue of *ARKIVOC* in his honour (2004 (viii), 1–3).

N. CHANDRAKUMAR¹
J. SUBRAMANIAN²
SHRIDHAR R. GADRE^{3,*}

¹*MRI-MRS Centre,
Department of Chemistry,
Indian Institute of Technology – Madras,
Chennai 600 036, India*

²*Central Leather Research Institute,
Adayar,
Chennai 600 020, India*

³*Department of Chemistry,
Indian Institute of Technology – Kanpur,
Kanpur 208 016, India*

**e-mail: gadre@iitk.ac.in*