

Tanjore Ramachandra Anantharaman (1927–2009)

Tanjore Ramachandra Anantharaman passed away on 18 June 2009 in USA.

He was born on 25 November 1927 in Tanjore, Tamil Nadu. His parents Tandagurai Appaswami Ramachandra Iyer and Saradambal had seven sons and one daughter. Anantharaman was the sixth child. His father, a Sanskrit scholar, was Principal of a Board school. Interestingly, five of his sons went to Indian Institute of Science (IISc), Bangalore for higher education.

Anantharaman had a brilliant academic career. He topped Madras University at every stage of his educational career. He obtained his BE in Metallurgy in 1950 from the very first batch of IISc. This stellar performance won for him the Rhodes scholarship and admission into Oxford University. His D Phil (1951–54) research concerned stacking faults and the hcp–fcc phase transformation in cobalt. It was carried out under the supervision of J. W. Christian in the Inorganic Chemistry Laboratory of which W. Hume-Rothery was head during a historic period when older metallurgy was giving way to new metallurgical science (cf. the riveting dialogue between the older metallurgist and the young scientist in Hume-Rothery's celebrated 1948 book *Electrons, Atoms, Metals and Alloys*). He spent two years at the Max Planck Institut für Metallforschung, Stuttgart in post-doctoral research on the determination of phase diagrams with Konrad Schubert and on precipitation reactions in aluminium alloys with Volkmar Gerold. The Institut then was led by venerable Werner Koester. Anantharaman returned to India in 1957 to take up a faculty position at the IISc. He moved to Banaras Hindu University (BHU) in 1962 to head India's first ever metallurgy department (established 1923). It is here that he found his métier.

With trivial sums of money by present day standards available for research, Anantharaman (TRA as he came to be known) launched his legendary effort to build one of India's finest research schools in metallurgical science. The discipline was witnessing yet another change at the time, metamorphosis into materials science. Thus began research in analysis of X-ray diffuse scattering from structural imperfections, liquid metal calorimetry, field ion microscopy, precipi-

itation hardening and spinodal decomposition in aluminium alloys, to name a few topics in which publications by TRA and his colleagues appeared in prestigious journals. Given his contacts overseas in the field of metallurgy and materials science, TRA pioneered international collaboration by establishing exchanges between his department and renowned centres in the UK (Sheffield, Cambridge and Oxford Universities) and Germany (Max Plank Institut für Metallforschung, Stuttgart; Max Plank Institut



für Eisenforschung, Dusseldorf and University of Erlangen). His extraordinary academic leadership of a fledgling team (at 35 years in 1962 Anantharaman was the oldest) had the infectious effect of spreading research culture beyond BHU to far-flung metallurgy and materials science schools in the country.

During his early years at BHU, Anantharaman grasped an opportunity to work at California Institute of Technology, Pasadena, with Pol Duwez. Duwez had just then invented a technique for splat quenching, a process that brought about dramatic non-equilibrium phase changes in metallic alloys. On his return, Anantharaman added the frontier field of rapid solidification with bountiful results to the impressive basket of research areas in his department.

Then dawned the era of funded research in India and TRA's heroic struggle was duly recognized: his department was declared the first ever Centre of Advanced Study in the country in a field of engineering. He enjoyed abundant goodwill among new science-funding agencies in the country. Consequently, a national electron microscopy facility was set up and a national project on metallic glasses was undertaken in the department with

substantial funding. The School of Materials Science and Technology was established in 1978 at Banaras Hindu University. It offered the first M Tech programme in Materials Science and Technology in India.

The discovery of quasi-crystals was announced in 1984. A paper published by the BHU group in 1978 was later recognized as one that had already dealt with a decagonal quasicrystalline phase. With his impressive record of work on non-equilibrium structures, once he was free from administrative responsibilities Anantharaman became engaged in this field of research. He also became involved in archeo-metallurgy. His penchant for detail is reflected in his prolific publications and in his books (*Metallic Glasses: Production, Properties and Applications*, 1984; *Rapidly Solidified Metals: A Technological Overview*, 1987 and *The Rustless Wonder: A Study of the Iron Pillar at New Delhi*, 1996).

Anantharaman was Fellow of all three Indian Academies of Science and of the Indian National Academy of Engineering. He also received numerous national honours. Among those from abroad, mention may be made of the Sorby Award of the International Metallographic Society, Honorary Memberships of the Deutsche Gesellschaft für Materialkunde, Corresponding Membership of the Royal Belgian Academy of Overseas Sciences and D Sc from Oxford University.

Well-versed in Sanskrit and German besides Tamil, Hindi and English, TRA was deeply interested in spirituality, religion and philosophy. He published two books in German, one on the *Bhagavad Gita* in 1961 and the other titled *Erkenntnis durch Meditation* (knowledge through meditation) in 1977. He naturally tended to interpret spiritual matters in terms of science. One outcome of such interpretation was his book *Ancient Yoga and Modern Science*, 1997. His two condensed versions of the Bhagavad Gita, titled *Gitasamgrah* (The abridged Gita) with 350 verses and *Gita Sarah* (Essence of the Gita) with 140 verses have been in private circulation.

A testimony to Anantharaman's personal stature is in the number of internationally renowned scientists who visited him and his department located in Varanasi, a city that was difficult to reach:

Cyril Stanley Smith, Pol Duwez, André Guinier, Werner Koester, Bruce Chalmers, Erwin Mueller, Morris Cohen, Robert Cahn, Bernard Ilschner, Robert Maddin, Severin Amelinckx and Sumio Iijima.

As I was closely associated with Anantharaman for five decades, recording a few of my personal recollections may not be out of place here. Ever since I joined TRA as a Ph D scholar, such was his inspirational influence that I thought only of remaining his associate in whatever he did. When he decided to move out of IISc and into BHU in the Department of Metallurgical Engineering, I did so too. And then there were several aspects of his unrelenting struggle to build, almost from scratch, a graduate school at BHU, in which I became engaged a willing deputy. Thus during the nearly two momentous decades (from 1960) I was witness to a transformation that was nothing short of a miracle. Despite lack of even rudimentary experimental or computing facilities, with his charismatic personality, one way or another TRA attracted student after talented student for his research programme and inducted quite a few bright young teachers. Over them all he held a magical sway that inspired them to develop into outstanding performers.

I must also mention some of his extraordinary personal feats: his eloquent extempore discourses on a range of subjects, some as abstruse as Sankhya Yoga, and his spellbinding recitation, in mellifluous voice and inimitable flair, of countless verses from *Bhagavad Gita* and Valmiki *Ramayana*. Many of his friends and relatives will always cherish the way he regaled them with his commentaries on sport, in particular cricket,

and on food, especially South Indian vegetarian dishes.

For a man who observed exemplary discipline in personal life, which was obvious from his immaculate attire and reflected in his radiant countenance, on the eve of his 80th birthday in November 2007 he surprisingly became quite ill. He could not attend the international conference on 'Metals and Alloys: Past, Present



and Future' organized at IIT, Kanpur in December 2007 specially to celebrate his 80th birthday. R. Balasubramanian, a former undergraduate student of TRA, spearheaded its organization with dedication. Many of TRA's former students and colleagues, who had travelled from within and outside India to attend the conference were sorely disappointed and depressed by TRA's absence. Yet, they presented serious technical papers as scheduled even as they feelingly reminisced on their association with TRA. This rendered the conference a truly memorable event. The papers presented at this conference have been published in a festschrift brought out in honour of TRA by the *Journal of Materials Science* (2009, volume 44).

Anantharaman never recovered from that bout of illness. The inevitable end

came after 20 troublesome months during which, sadly, he lost the very gifts for which he was widely admired, his memory and his speech. He left behind his wife Priyamvada, living in Gurgaon, two sons, Thomas Satya Prakash, a computer scientist who lives in USA, Martin Prem Prakash, a mechanical engineer who lives in Germany, and daughter Karuna, who is studying for a medical degree in USA.

This tribute by one who was fortunate to have been his first Ph D student is best summed up by saying that Anantharaman transcended the conventional notion of a professor. His impact on his students is lasting. His erudition, his gifted speech, his lucid discourses on arcane philosophical subjects and his intense commitment to physical metallurgy have left on the minds of his students an indelible imprint. They came to him as callow individuals and left to become acclaimed and mature professionals. Having spotted and nurtured talent with resolute determination, Anantharaman deserves the credit for his students' success. Some 35 became professors in Universities in India and abroad. Some occupied high offices like Directorship of National laboratories and Heads of Science Agencies and distinguished professional bodies. Anantharaman thus demonstrated that a sustainable way to realize a vision is by creating new leaders who in turn build new institutions.

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