

# Ranganathan S



## A SEARCH FOR STRUCTURE WITH TRAVELS IN SPACE AND TIME

Srinivasa Ranganathan aka Rangu

I was born on 24th January 1941 in Cuddalore (Tamil Nadu) as the youngest child of Srinivasa Iyengar and Satyabhama Ammal. My six siblings offered incredible support. My early schooling was in St Mary's School and St Joseph's School. Early memories are of the beaches of Cuddalore, Fort St David of Robert Clive from where he went on to lay the foundations of the British Empire in India. The proximity of Pondicherry, the French enclave, gave tantalizing hints of the international world. My date of birth was changed to January 10, 1941 so that I could be admitted to Loyola College in Chennai in 1955. This had momentous consequences in my journey through life. The discipline and dedication of the Jesuit fathers made a deep impression. Prof L Yeddanappalli was an outstanding researcher in catalysis. With limited facilities he brought a name to Loyola. I obtained my B.Sc. (Hons.) Degree in Chemistry with first rank from the University of Madras in 1960.

I applied for admission to the two year B.E., course in Metallurgy at the Indian Institute of Science following the trajectory of TR Anantharaman, a classmate of my brother S Krishnaswami. On arriving at the Institute I learned with pride that all University first rankers were offered automatic admissions. This turned into a mild shock soon, as I noted that my batch of 24 students had at least six such rank holders from Physics and Chemistry from the Universities in Karnataka, Kerala, Tamil Nadu and Orissa. It was refreshing that the class represented a microcosm of India - I made friends with Ahuja, Raheja, Mohanty, Joshi, Iyengar, Borle and others. Durai has been a friend from childhood through school and college



1962

The Department had a staff strength of 12. Its entire focus was on teaching the 2 year

course in an intensive fashion. We came to the Department at 9.00 a.m every day to learn and were not disappointed, If TR Anantharaman used colour chalks to separate alpha and beta brasses in Cu-Zn phase diagrams, KP Abraham taught us fugacity and activity and introduced us gently to the science of thermodynamics. P Rama Rao taught us the elements of electron theory of metals--this exposition left us spell bound.

The Department even then had an electron microscope - perhaps the first to India. We were not taught electron microscopy or the theory of dislocations-two major developments in the late fifties. Nevertheless a solid foundation in all branches of Metallurgy was given so that we could contribute to these new areas.

Four of us did a project on X-ray line shape analysis of filings under the guidance of TR Anantharaman and P Rama Rao. The latter liked our report so much that he had kept it with him. I was inspired to read papers on Structure by Cyril Stanley Smith. We were encouraged to give seminars. I spoke on the shape of grains. I believe that we assimilated a great deal in two years enough to stand us in good stead in several leading Universities in the West to which the graduating class flocked at that time.

I accepted the offer from Professor Alan Cottrell to start looking at grain boundaries in the field-ion microscope. TR Anantharaman gave his good wishes that I should make my mark though it may not be easy in a place

where Srinivasa Ramanujan, S Chandrasekhar and Homi Bhabha have set the standards!

The English winter of 1962-63 was one of the most severe

of seasons. The river Cam froze and water pipes burst. But I was fascinated by seeing the beautiful snowflakes falling on the lawns of Peterhouse. I had been welcomed by this College with a Research Studentship of GBP 485 per annum - a princely sum in those days. I had also received a travel grant from the J N Tata Endowment for the Higher Education of Indians. Then I saw with envy Fellows walking across the lawns. This turned into pride as two of them – Max Perutz and J F Kendrew won the Nobel Prizes for 1962. That I belonged to the same college, breathed the same air and dined in the same hall was an impression that transformed my life.

It was intellectually most exciting and rewarding to do research in the Department of Metallurgy in the early sixties. I was guided by David G Brandon during the first year. The group was pioneering in its' applications of field-ion microscopy to metallurgical problems. Mike Wald, Mike Southon, Brian Ralph, Kelvin Bowkett and MA Fortes all became close friends and taught me not just about metallurgy but to cope with the nuances of the British culture.



Rangu in 1966 at Berkeley Lab with Gareth Thomas

The ambience at Cambridge was incredible. The world's leading metallurgists came to Cambridge almost on pilgrimage. I could write to H S M Coxeter on compound tessellations, discuss crystal rotations with F C Frank and grain boundaries with Nevil Mott. The first paper of mine in *Acta Metallurgica*, coauthored with Brandon, Ralph and Wald – with the authors arranged in an alphabetical order after some arguments! - became a citation classic. To become the first Editor from India for *Acta Metallurgica* was memorable. My analysis of the geometry of grain boundaries lead to a generating function of coincidence site lattice known as the Ranganathan Generating Function. Prof Cottrell used two of my micrographs in his classic books. This made me more known across the globe than all my other endeavours. I received the Ph. D. degree from Cambridge University in 1965 .

I left Cambridge to spend two years at the Lawrence Radiation Laboratory, Berkeley, California, USA with Prof Gareth Thomas building the FIM Laboratory. Inspired by Alan Moore I did computer simulation of field-ion images Here I reconnected with my classmates V C Kannan and N Duriaraghavan .

I returned to India in 1967 to join the faculty, at Banaras Hindu University – an act considered at that time as a foolhardy one. I was promoted as Professor in 1972. The fourteen years I spent at BHU was transformational. My teachers from my IISc days- T R Anantharaman, P Rama Rao and P M Prasad-were my colleagues. GMK Sarma, my classmate, D S Sarma, P Ramachandra Rao, V V Kutumba Rao and C Suryaranarayana- alumni from IISc

were my colleagues too. I served as Head of the department for six months. I served as founder coordinator of the School of Materials Science and Technology.

I then returned to the Indian Institute of Science in 1981 as Professor of Physical Metallurgy. I helped establish a research school at IISc as the leading research programme in structural metallurgy in India and recognized as world class. I served as Chairman of the Department from 1981-1988 and as Chairman of the Division of Mechanical Sciences from 1994-1999. I have enjoyed teaching different topics like alloy design. I was privileged to teach the first undergraduate course in Humanities at IISc. I chose Science and Civilization of India as the theme.

My significant contributions are to Materials Research, Materials Development, Materials Education, Materials History and Materials Policy over the last five decades. The studies on quasicrystals include the co-discovery of decagonal quasicrystals. Parenthetically Danny Shechtman, the discoverer of quasicrystals and I were both students of David Brandon and were born on the same date in 1941. My work on Bulk Metallic Glasses has drawn international attention. The research collaboration with Kamario Chattopadhyay was most stimulating.

My work has been widely and somewhat generously recognised as demonstrated by the numerous awards and distinctions conferred on me. The Distinguished Alumnus Award from IISc, Lifetime Achievement Award from IIM and the Distinguished Fellowship from RQ14 are particularly cherished.

I was elected as a fellow of several academies including the Academy of Sciences for the developing World. I was elected to the position of President, the Indian Institute of Metals . I had the privilege of guiding a number of brilliant students for Ph.D. and M.S. degrees and have published over 275 technical papers. I have coauthored two books on New Geometries for New Materials with Alan Mackay and Eric Lord and on the Legendary Wootz Steel with Sharada Srinivasan.

Currently I am Emeritus Professor at the Indian Institute of Science, Homi Bhabha Visiting Professor at the National Institute of Advanced Studies, Honorary International Chair Professor at the National Taipei University of Technology as well as Honorary Professor at the Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore. I am a Guest Professor at the Tokyo University of the Arts.

In 1964 I met Sucharita Desiraju who had come to do the Cambridge Mathematics Tripos. We married on June 20, 1968. She got her Ph D degree in mathematics from BHU and came to be known for her teaching. We have two sons. Satyajit did his BTech from IIT Kanpur and his MS from the University of California, Berkeley. He works for Oracle company in Seattle. He is married to Bratati Ghosh, an alumna of IIT Kanpur and IIM Ahmedabad. They have given us two lovely grandsons, Amartya and Ananta. They can both win chess games against me. Our younger son, Viswajit, got his B E degree from the National Institute of Engineering, Mysore, MS from Michigan Technological University and MBA from Cornell university.

He is married to Gopika Kannan, a management alumna of IISc. They both work in Connecticut .

The search for structure continues and I mainly rely on geometric intuition. I have travelled extensively. The many visits to Cambridge, Sendai, Varanasi and the visit to Kazakhstan left vivid impressions. In the study of quasicrystals I visited higher dimensional space. In archaeo-metallurgy I traveled back in time to distant lands in antiquity.



Rangu's family  
(Rangu and Sucharita with Satyajitm, Bratati, Amartya and Ananta) 2004



Israel Hampi: Rangu & Sucharita with David Brandon, Damy Shechtman & Wayne Kaplam with spouses on the 7th Festschayt for Danny prior to Nobel Gold medal 2011



With Viswajit & Gopika in London Olympics 2012