Rangaswamy Narasimhan (1926–2007)

The father of Indian computer science research, Prof. Rangaswamy Narasimhan passed away on 3 September 2007, at the age of 80. In his blazing trail follows a rich tradition of research excellence and a pioneering spirit exemplified by the design of the TIFRAC – the first Indian digital computer, the setting up of CMC Ltd under challenging circumstances, the creation of National Centre for Software Development and Computing Techniques (NCSDCT) with a visionary zeal and the nucleation of the Computer Society of India (CSI) for nurturing the computer industry and the computer academicia.

Narasimhan was born on 17 April 1926 at Chennai. After obtaining a BE (Hons) degree in Telecommunication Engineering from Madras University in 1947, he received an MS in Electrical Engineering from California Institute of Technology and a Ph D in Mathematics from Indiana University.

Narasimhan returned to India in 1954 on the invitation of Homi Bhabha to join an elite group of scientists at the Tata Institute of Fundamental Research (TIFR), Mumbai. He was part of a team of seven researchers working with great dedication on the design and construction of India's first general-purpose digital computer. His expertise in logical and system design accelerated the tempo of the project and the development prototype computer became a functioning reality in 1959. In the year 1962, when Jawaharlal Nehru, the then Prime Minister, inaugurated the new building of the TIFR at Holiday Camp, Mumbai, this pioneering computer, India's pride, was formally inaugurated and named the Tata Institute of Fundamental Research Automatic Calculator (TIFRAC).

The innovation and quality culture of TIFR, where Narasimhan worked from 1954 till his retirement in 1990, left an indelible mark on him, spurring him to set up the National Centre for Software Development and Computing Techniques (NCSDCT) under the aegis of TIFR. That he succeeded in his cherished goal is obvious when NCSDCT (later renamed National Centre of Software Technology (NCST)) became the cradle for not only ERNET, the choice gateway of several academic and research institutions, but also the promotion of Internet domains in the country. NCST-certified courses in software, the epitome of quality education, were much sought after by the industry.

In the late sixties, as an offshoot of the recommendations of a three-man subcommittee, constituted under the Bhabha Committee, with Narasimhan as Chairman, it was recommended that a national company be set up to address computer

manufacture and maintenance in the country. The Electronics Commission, set up under M. G. K. Menon, gave priority to the setting up of a public sector company for the purpose. Narasimhan was drawn into these early efforts to set up the Computer Maintenance Corporation (later renamed CMC Ltd), and, as a natural choice was bestowed the honour of becoming its first Chairman, ably supported by Managing Director P. P. Gupta, who came with valuable private sector managerial experience, including the ICL. Narasimhan's contribution to the growth of CMC and its later foray into computer application engineering was so invaluable that he was requested to continue his association with CMC in various advisory capacities till his last days. This was so even after CMC Ltd was bought over by Tata Consultancy Services Ltd (TCS). In the words of S. Ramadorai, Chairman of CMC and CEO of TCS, 'He (Narasimhan) felt that with this change in ownership, CMC was in safe hands'.

Narasimhan assisted policy formulation for computer and software industry, often from behind the scenes. As pointed out by Ramadorai, 'Visionaries like Dr Naraimhan have been very important in building the industry and the entire IT community cherishes his contribution to computer science. Other than pure research, he was also keen on how IT could be deployed to serve the bulk of the population'.

Time and again, Narasimhan advocated 'self-help' as a means for growth, both to the industry and to the academicia. While he acknowledged the beneficial role of the Government, to the extent that it was catalytic and constructive, he cautioned against over dependence on the Government. In this spirit he encouraged the industry and the academicia to jointly set up a private society to evolve and articulate their stand on both industrial and academic aspects of design, manufacturing, services and applications of computers. His campaign resulted in the setting up of the Computer Society of India (CSI) in 1964. He served as the Founder President of CSI from 1964 to 1969.

A man of few words, every word he spoke was given great importance by all those who worked with him. He mentored without any mentee overtly feeling he was being mentored.

As much as he himself cherished the freedom to do what was best for him to do and the right for solitude for deep thinking, he respected the same in others. He was uncompromising, however, on integrity, high values, hard and dedicated work and larger national interests.

A personal vignette may amplify the observations. He mentored me at TIFR from 1966 to 1971. During this period I researched on and published papers in eight different subjects, including computers, OR, CAD of satellite launch vehicles, economics of PNE, and molecular biology. Once, hesitantly, I asked him how he felt about it. He calmly replied, 'Creativity knows no subjects', and encouragingly smiled.

Narasimhan was on a sustained quest, over two decades, of developing a metatheory of behaviour. This led him to deep research in the areas of computational modelling of behaviour, modelling language behaviour, first language acquisition, and Artificial Intelligence (AI) in the study of agentive behaviour among others. This covered a wide range of subjects from picture processing to natural language theory to linguistics to behavioural sciences to formal mathematics. He was the first to discover an analogy between formal grammars of natural languages and the formal structures underly-

ing picture processing. His work on syntactic pattern recognition at Illinois University between 1961 and 1964 was path-breaking in this field. Following up on this, at TIFR, he developed a meta-theory and approach to the study of language behaviour that takes pragmatics as the point of departure rather than syntax or semantics. He logically argued that, from an evolutionary point of view, behaviour must have evolved to be put to specific uses, and therefore, use must define structure and mechanism and not the other way round. This line of investigation culminated in his epoch-making book, *Modeling Language Behaviour* that opened an alternative concept to the earlier works of Chomsky. Apart from a number of widely acclaimed research papers, he authored four books published by Springer Verlag in 1981, SAGE in 1998 and 2004, and Tata McGraw Hill in 2004.

To give a creative direction to early education of children, Narasimhan investigated the language behaviour environment that a child is exposed to in the very early stages (9 months to 3 years) of first language acquisition. This led to an important ethological study of language acquisition behaviour. Such first language acquisition was found to have close links to the orality–literacy contrast. He showed that pre-literate oral language behaviour differs from literate language behaviour and that the former, and not the latter, has correlations with genetically prewired behaviour.

Further, he showed that language acquisition in the two cases bears an analogy to the differences between connectionist AI and rule-based AI, the former defined to include non-literate modes of functioning which cannot be reduced to a 'puzzle-solving' mode. He wrote a thought-provoking book on this at the age of 77.

These studies have revealed new paradigms for nursery and primary education of children.

In the 60s and early 70s, Narasimhan was among the early workers in the area of computational modelling of visual behaviour and advocated structural models and a 'grammar' to analyse and describe what is in the visually given image. For this he was instrumental in the development of a special language called 'PAX'. A group at Illinois, of which he was a part, was putting massive effort to realize a retinal image processing hardware based on PAX and other principles. The project was far ahead of time, at least by four decades, and therefore was subsequently abandoned.

No largesse of conferment of awards and rewards like Fellowships of INSA, IASc, NAS, CSI or the Padmashree (1976), Homi Bhabha Award (1976), Om Prakash Bhasin Award (1988), Dataquest Life Time Achievement Award (1994) can do full justice to this great mind, which saw possibilities far ahead of time.

Now, with tremendous strides being made in nanoelectronics and nanocomputing, these nodal ideas of Narasimhan, which are still basic and valid, can be resurrected. The time is appropriate to begin the development of a nano-hardware with the concept behind PAX among others to design and build retinal image processing hardware. This would be a fitting tribute to Narasimhan.

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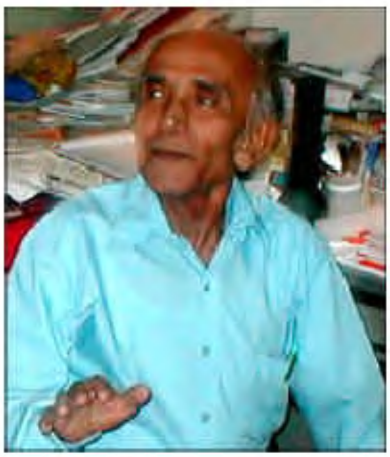
P. K. Maitra (1932–2007)

Pabitra Kumar Maitra (fondly known as PKM to his students and friends), a pioneer in the field of yeast biochemical genetics, passed away after a brain haemorrhage in a Kolkata nursing home on 4 September 2007. PKM retired as a Professor at the Department of Biological Sciences (earlier Molecular Biology Unit), Tata Institute of Fundamental Research (TIFR), Mumbai. Some of his later years of research were spent at IIT, Mumbai and Agharkar Research Institute, Pune.

PKM was born in 1932 in Mazda, a small town in Nadia District, West Bengal and attended school in Krishnagar in the same district. He obtained his Bachelor's, Master's and Ph D degrees from Calcutta University during the period from 1952 to 1960. His doctoral research, under the guidance of S. C. Roy at the Department of Applied Chemistry, dealt mainly with the biochemical regulation of certain metabolic pathways of *Streptomyces olivaceous*. PKM then joined the Johnson Foundation, University of Pennsylvania, USA where he worked with Britton Chance and Ronald Estabrook on the bioenergetics and regulation of cellular metabolic pathways, with particular



focus on baker's yeast, *Saccharomyces cerevisiae* as a model system. During this period he developed sensitive fluorometric assays for the enzymes and intermediates of the glycolytic pathway. These assays have since been used widely to monitor glycolytic reactions and their rates *in vivo*. A noteworthy outcome of these studies was the discovery of oscillations in this pathway.

After his return to India, PKM joined the Molecular Biology Unit at TIFR, as one of its first members in 1964. Here, he and his colleagues, notably Zita Lobo (whom he later married in 1997), worked on the biochemical genetics of *Escherichia coli* and *S. cerevisiae*. In an early investigation on the effect of ribosomal mutations on the fidelity of translation in *E. coli*, PKM discovered changes in the structure and kinetic properties of enzymes synthesized on mutant ribosomes. A lifelong obsession for PKM concerned the question of how metabolic flux was regulated and homeostasis maintained in cells when crucial enzymes in biochemical pathways such as glycolysis were greatly reduced or increased. PKM decided very early on to take an approach, which used