

## Kailasam Venkatesan (1932–2019)

It was four hours to tick for the arrival of the New Year 2020 when we heard the news that Prof. K. Venkatesan passed away peacefully at home. He is survived by his wife, Meenakshi, daughter Raji, son-in-law Dinakar and two grand children. Thus the year end marked the demise of an individual who possessed a polite unending charisma and simplicity par excellence. Crystallography (and crystallographers) has lost yet another significant teacher and a researcher from the old school which cared for rigour and precision. Venkatesan (KV for many in India, Seppli for the Zurich group and Ven for the rest of the world) was born on 29 April 1932 at Madras (now Chennai) in India. I wrote to Buergi about the demise of KV and asked him about the origin of the name Seppli? Here is what he wrote, ‘...the name “seppli” dates back to ven’s first stay in switzerland in the lab of jack dunitz, probably in the early sixties (before my time there). Apparently the then Ph D students had a bit of a problem with the unusual first and family names, so – for reasons unknown to me – they started to call ven “seppli”, which is the diminutive form of “sepp” which in turn is a swiss version of Josef. thus “seppli” was a kind of nickname with an undertone of endearment and “seppli” stuck with ven ever after...’

KV went to school in Tanjore (Thanjavuru in Tamil Nadu) since his family moved to that place (a place well known for Carnatic music) and he became a connoisseur of music. His father, Kailasam Iyer, a keen music lover himself was pious and respectful to people in general, a quality which got thoroughly imbibed in KV. After graduating in B Sc Physics from Annamalai University. He was married at the age of 18 in 1950 to Meenakshi who was 15 years of age, a norm in those days. He got admitted to the Ph D programme at the Physics Department in Indian Institute of Science in 1953 and joined S. Ramaseshan as his first doctoral student. He was later joined by M. A. Viswamitra and H. Manohar in subsequent years, the trio along with M. Vijayan who joined a few years later in IISc establishing a cherishing nexus which made a significant impact on crystallographic research in modern India.

KV made some noteworthy contributions to crystallography during his doctoral programme with Ramaseshan. Two seminal papers, one concerning the methodology and the other on the application stand out even to this day. The article, ‘Use of anomalous scattering without phase change in crystal structure analysis’ (*Curr. Sci.*, 1957, **26**, 352) in which it was suggested... ‘it should be possible to determine the phases in an acentric case by an analogue of Harker’s method by using three radiations, two of



which have wavelengths that are respectively scattered anomalously (without change of phase) by two kinds of atoms that occupy different sites in the structure’ heralding the basis of the key methodology employed to determine phases in the macromolecular structures in current day technology using synchrotron radiation. In fact, the method at that time was applied to determine the absolute structure of  $\text{KMnO}_4$  in the article ‘Use of anomalous scattering for the determination of crystal structures –  $\text{KMnO}_4$ ’ (*Proceedings of the Indian Academy of Sciences*, 1957, **A46**, 95). It must be mentioned that the experiments were performed using primitive rotational camera using photographic films, the first structure determination using anomalous dispersion in India! Indeed, these two articles not only stood the test of time but provided the basis for the determination of a large number of complex protein structures unambiguously.

The Ph D thesis submitted by KV was examined by two specialist crystallographers, Carlisle and Dunitz. In fact,

Dunitz apart from accepting the thesis, made an offer to KV to join him as a post-doctoral associate. The structure of cyclodecane HCl was determined by KV and Dunitz using the heavy atom method at this time and in fact it appeared on the first day cover of the stamp issued during the J. D. Dunitz Symposium in 1984. The structure was solved using a high speed computer of those days!

Dunitz was so impressed with KV that he recommended him to Dorothy Hodgkin for his second post-doctoral position. Sabesan (KV’s first student in India) wrote in his brief biographical sketch on KV marking his 80th birthday (Symposium on Crystallography held at IISc in 2012) that KV was also thinking of joining Lipscomb’s lab in MIT and Jack advised him to go to Oxford as he felt that KV would have a much better experience with Dorothy. After moving to Oxford in the early 60s, KV worked on the structure of ‘Vitamin B12-Factor VI a’ using the anomalous dispersion technique. The following is an excerpt from the classic paper of KV and the Nobel lecture given by Dorothy Crowfoot Hodgkin where she records Venkatesan’s contribution.

‘...The X-ray analysis was achieved by what still seems to me a remarkable operation. The crystals are monoclinic,  $P2_1$ , with two molecules in the unit cell, and X-ray photographs, taken of them with copper  $K\alpha$ -radiation show very markedly the effects of anomalous dispersion  $F_{hkl} \neq F_{-h-k-l}$ . The effects are due to a small phase change introduced by the scattering at the cobalt atom which has an absorption edge near the wavelength of copper. They make it possible to use yet another method of phase angle determination first suggested by Bijvoet, Ramachandran and others and illustrated in figure 6. By measuring the intensities of both  $F_{hkl}$  and  $F_{-h-k-l}$  reflections, Dale and Venkatesan were able to assign rather accurate phase angles to 1994 reflections – about half the total observed. The calculation requires a knowledge of the cobalt atom position, easily found from a Patterson synthesis...’

In fact Dorothy recommended KV strongly to G. N. Ramachandran for his appointment at the University of Madras.

I heard of an unprecedented event that occurred at this juncture. Ramaseshan was planning to work as a visiting fellow

at Dorothy's lab and KV was asked to write a recommendation letter in this context! KV began his research in India starting with a few students at Madras which brought out his real personality, dealing with students and training them in all aspects, a quality which was his own and hard to imitate. Crystallographic research in India blossomed with him moving to the Department of Organic Chemistry, Indian Institute of Science at Bangalore in 1971 and in the company of Viswamitra in the Physics Department, Manohar in the Department of Inorganic and Physical Chemistry and the newly joined faculty member in Physics, Vijayan (fresh from Dorothy's lab), the quartet took Indian crystallography to dizzying heights. With G. N. Ramachandran also moving to Bangalore the golden era for advances in crystallography began!

It is hard to find the difference between whether crystallography grew with KV or KV under crystallography. The advent of high speed computers and modern day technological advances did shake him a bit, but with immense patience and careful observation he got slowly but surely blended into the modern day advances, reading latest literature, discussing with experts and also students with equal respect, he kept informed on the advances even to his last days. When I visited him last month he wanted a reprint of my recent paper in *JPC Letters*! Keeping in view the developments in computational crystallography, KV arranged an International meeting under the aegis of IUCr in 1980 with an intention that crystallographers in India will be educated on the state of the art methodologies in modern crystallography.

The world's best crystallographers assembled in Bangalore for this meeting. In fact, I was working with P. Coppens as a post-doctoral associate at SUNY, Buffalo at that time and after his return from India, Coppens was happy with KV and his students and as a former student of KV his respect towards me increased several-fold!! KV was a fellow of all the science academies in India and got several other recognitions and awards, but never boasted about those, a quality which needs to be emulated by many scientists and academicians of the current generation.

KV is considered the best teacher in crystallographic science even to this day.

His course on symmetry was attended by a large group of students other than the crystallographers. I continued to teach the course after him by renaming it as 'Symmetry and structure in the solid state' and indeed a large number of students from various departments of the Institute attend this course even to this day. It needed a lot of courage and determination to take three physics students to the department of organic chemistry as students to begin his career in IISc, particularly with the department bustling with high level organic chemists who had contributed immensely to organic synthesis, reactivity and mechanisms arena. Structural chemistry was absolutely new to India and even though Manohar had made a beginning in the neighbouring department, KV was the one who took hard core organic chemistry problems like establishing the stereochemistry, conformation and crystal packing which assisted the organic chemist to closely evaluate the mechanisms with success. Assisted by the support KV received from D. K. Banerjee and the unusual combination of three students, Ramakumar, Murthy and myself who jelled well, crystallographic work became accepted and admired by the faculty and this culture spread slowly but surely across the country. The identity for structural chemistry in the solid state received further attention when C. N. R. Rao took over as the director of the Institute and with the arrival of

V. Ramamurthy. A generation of new students joined KV and with solid state chemistry in mind KV and VR produced excellent original research in the area of photo-dimerization, initially started by Gerhard Schmidt, marking the beginning of crystal engineering. This area soon became a common theme in the laboratory of KV and VR and excellent students emerged who now are in the limelight in the country and abroad. The beginning of the collaboration between KV and VR was heralded by the work on the photo-dimerization of 7-methoxy coumarin which lasted over a decade of immense activity with a large number of students graduating out of this programme on organic solid state chemistry. A comprehensive review on organic solid state reactions by KV and VR made a significant impact in the area of photochemical reactions. The partnership flourished with a significant number of publications and recognition worldwide. Dorothy visited Bangalore during this period and was appreciative of the efforts put in this collaboration.

It is not that KV did not come across difficulties in the departmental issues. The contemporary classical organic chemists in the department did keep treating him as an odd man out, but KV remained an embodiment of patience and perseverance. He was silent, but at the same time stuck to his principles and never deviated, a feature which hall marks his immense superiority over others.



KV with Dorothy and VR during her visit to Bangalore.

KV's 60th birthday was very special and unique and probably the first of its kind for any professor at IISc, blended with simplicity and affection. It was a picnic with families of his students over the years and it combined business with pleasure. Almost all students of KV who are scattered in different parts of the country attended the celebration at their own cost and presented their current work and future aspirations.

After his retirement, KV continued his interest in both crystallography and spirituality. Being a voracious reader he kept himself abreast with the current advances in the area and many students from various groups at IISc frequented his house to discuss their work and get some guidance after his visits to the laboratories in IISc got curtailed due to his illness. I am given to understand that he gave several

important directions to students that helped them to publish their work in leading journals. Effectively, he was retired only on paper (as per the rules of the Institute) which happens unfortunately to many scientists in India who remain active and vibrant and particularly in cases like that of KV. The students along with the Department of Organic Chemistry arranged a special symposium to mark his 80th birthday on 28 April 2012. A booklet brought out on this occasion had a biographical sketch on KV and his life written by his first student Sabesan which brought out not just KV's scientific career but an account of his personal life, simplicity and humbleness personified with glory and dignity.

KV with all this was indeed a novice when it came to day-to-day life and in this aspect the support he received from

his wife Meenakshi is unmatched. She singlehandedly managed the entire household and particularly during the last few years of KV where he was physically dependent on her. They made an ideal couple and I must say KV was fortunate in this context.

Venkatesan will carry a message for all scientists from the past, present and future, that is to lead a life with honesty, simplicity and respect for all at the same time being firm and decisive and judgmental.

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## R. Jayaraman (1937–2019)

Prof. R. Jayaraman, a scientist and teacher *par excellence* passed away on 13 April 2019. He was an inspiring teacher and an exemplary researcher, a humble human being and a great friend. He always wished Indian science and scientists to be in forefront of world science and worked for the same throughout his life.

Ramamirtha Jayaraman, affectionately called as RJ by his friends and colleagues is perhaps the first one to start *Escherichia coli* genetics laboratory in a State University setup in India. He was born in Burma (now called Myanmar) on 10 October 1937 to Ramamirtham Ayyar and Bragath Kujambaal. He did his schooling in Thiruvavur and obtained B Sc (Chemistry) degree from Kumbakonam Arts and Science College (then affiliated to Madras University). Later, he joined as a research student in the Biology Division of Atomic Energy Establishment, Trombay (now BARC) and earned M Sc (Biochemistry) degree by research from Mumbai University. Subsequently, after spending a brief time at CIBA Research Centre, Mumbai and Maulana Azad Medical College (as a demonstrator) in Delhi, he joined Tufts University, School of Medicine, Boston, USA and carried out his Ph D work

under the guidance of Edward Goldberg (1965–1970). Later, he moved to Harvard Biological Laboratories, Cambridge, MA, USA as a Damon Runyon Memorial Post-doctoral fellow and worked under the supervision of the Nobel Laureate James D. Watson (1970–1972). He then joined Tata Institute of



Fundamental Research (TIFR), Bombay and worked as a Fellow during 1972–1974. Later, he joined as a Reader in the Department of Molecular Biology, School of Biological Sciences (SBS), Madurai Kamaraj University (MKU) upon invitation by the then Co-ordinator

S. Krishnaswamy. He retired from service as Professor and Head in Molecular Biology and Chairperson of School of Biological Sciences in 1988 and continued his research work in the same institution in various capacities. He was an INSA Senior Scientist and INSA Honorary Scientist at MKU till 2003 and Guest Faculty at IIT-Madras (2006–2007).

Jayaraman's research was mainly on transcription and its regulation in *E. coli*. At Tufts, he developed a genetic assay for gene-specific mRNAs of Bacteriophage T4 which was well applauded and quoted in the text books and monographs of that period. At Harvard, he demonstrated that some genes of phage T4 could be expressed by read-through mechanism and some others require specific initiation factor(s). At TIFR, his studies revealed that *E. coli* RNA polymerase exist in heterogeneous forms *in vivo* by associating with different proteins (different forms exhibit different physical and catalytic properties). He was perhaps the earliest to show the role of accessory transcription factors in *E. coli*. Though most of his work prior to coming to School of Biological Sciences was related to biochemical studies pertaining to transcription regulation in T4 phage infected cells of *E. coli*, after joining SBS,