



Kariamanikkam Srinivasa Krishnan: His Life and Work. D. C. V. Mallik and S. Chatterjee. Universities Press (India) Pvt Ltd, 3-6-747/1/A and 3-6-754/1, Himayatnagar, Hyderabad 500 029, 2011. xxiii + 461 pp. Price: Rs 895.

It was nearly two decades ago that I read the scintillating biography of C. V. Raman entitled *Journey into Light*, by G. Venkataraman. The story of Raman is in many ways the history of the beginning of organized science in India, which coincided with the emergence of revolutionary concepts like quantum theory and relativity in physics. It is well known that Raman had an outstanding collaborator in K. S. Krishnan in studies on scattering of light by liquids, which led to the discovery of the Raman effect. It is natural that Venkataraman, in his book on Raman, has given a gleam of the brilliant scientist in Krishnan. When I finished reading that book, my immediate feeling was that someone should write a similar account of Krishnan too. Therefore, it was such a delight when Krishnan's granddaughter Shantha Ramachandran gave me a copy of an authentic biography of K. S. Krishnan by Mallik and Chatterjee, immediately after it was released on 4 October 2011 in Bengaluru. The authors have taken enormous efforts to get access to the source materials for the book, much of which had remained in the custody of Krishnan's family. Mallik is well known for his several articles on the history of science.

After getting his Master's degree in physics from Christian College, Madras, Krishnan was a demonstrator in Chemistry in the same college for a brief time. He started his career as a research scholar with Raman in the Indian Asso-

ciation for the Cultivation of Science (IACS), Kolkata during 1923–28. In the next five years he worked as Reader in the University of Dacca, where S. N. Bose was the Head of the Department of Physics. Krishnan came back to IACS in 1933 and served as M. L. Sarcar Professor of Physics till 1942. Then he moved to the University of Allahabad to lead the physics department as a professor. In 1947, he became the first Director of the National Physical Laboratory (NPL), New Delhi.

The book under review clearly brings out many facets of Krishnan's life, both professional and personal. That Krishnan had an excellent aptitude for scientific research was evident even when he was a student. When he was a demonstrator in Christian College, he used to organize during the lunch hours informal discussion meetings with the students on variety of topics in physics, chemistry and mathematics, which attracted participants from other colleges too. The students gained more knowledge from these sessions than from regular classes in their colleges.

Though Krishnan's substantial contribution to Raman's work was recognized by Raman himself and others at IACS, Krishnan realized that he had to come out of Raman's orbit to establish his own reputation. There have been often controversial discussions on whether Krishnan was denied due credit for his crucial role in the discovery of the Raman effect. The authors have handled the topic well in this book without adding to the controversy. At the same time he gives a faithful picture of Krishnan's predicament in the months following the announcement of award of the Nobel Prize to Raman, leading to the decision of the former to quit IACS. But the relation between Raman and Krishnan always remained cordial.

In the context of his application to University of Dacca for the post of a Reader in Physics, Krishnan received from Raman a testimonial that any scientist would cherish to have, that too coming from a Nobel laureate. Raman wrote, 'Krishnan is in the laboratory an experimenter of rare skill and judgement, and in the library and seminar room, a mathematical physicist with a penetrating insight who can present a topic to the listeners with the utmost lucidity and verve. His real place in life is that of a teacher and a researcher in a university

and if he gets such a place, he will never stop climbing.'

It is amazing the way Krishnan switched his area of study. During the first five years that he worked in the University of Dacca with modest infrastructure, he produced 12 research papers and 10 brief notes in reputed journals, which formed part of his thesis for D Sc degree from University of Madras. The authors refers to the examiner's report from W. H. Bragg, 'The work Krishnan has done is notable both for its intrinsic value and for its indications of his great abilities and perseverance.'

Like many other eminent physicists Krishnan could make huge contributions to diverse fields: light scattering in liquids, crystal magnetism, electrical resistivity in metals, lattice oscillations in ionic crystals and thermionic properties of metals and semi-conductors.

Krishnan's innovative method of measuring anisotropy of magnetic susceptibility in crystals drew the attention of giants like Pauling and William Bragg. Not only was Krishnan an outstanding experimental physicist, he delved deep into the theoretical and mathematical aspects of the problem. Speaking on his work on band-limited functions, Bhabha and Lonsdale have observed 'Krishnan loved mathematical reasoning and his skill as a mathematician would have gained him international recognition even without his greater ability as an experimental physicist. He was deeply moved by a product of pure mathematical interest thrown up during a physical investigation.'

Krishnan chose the theme 'The place of fundamental research in industrial progress' for the Sri Krishnarajendra Silver Jubilee Lecture in 1941 at Mysore. His thought-provoking lecture was widely acclaimed and its message was so relevant for the nation at that juncture. As the authors have rightly observed, Krishnan's visits to Europe had considerably changed his perspective on science, in particular, its role in human life and progress. Here are a few extracts from the book.

'In order that the results of fundamental research may reach industries, we naturally need a large group of scientific men, fully equipped with the available knowledge of fundamental sciences, who will apply them for industrial purposes – that is ad hoc researchers, who will take up problems that are of importance to the

industries and tackle them. These ad hoc researchers serve a very useful purpose, and it is to them that we owe much of the gradual filtration of the results of fundamental research into the industries, and also the ultimate spreading of the fruits of science to the various spheres of human activity. Particularly in India, which is industrially so backward, we need many more of such ad hoc researchers... it is to science that most civilized countries owe their standards of living....'

'We need in India more and more of the ad hoc type of research intended to help the industries. Its usefulness to the industries, its importance and its caliber will ultimately depend on the strength of the fundamental science behind it.'

It is this view of Krishnan which became a sort of a motto for NPL, of which he was the first Director.

When Bhabha came into India in 1939 for his annual holidays, he could not go back due to the outbreak of war in Europe. He was asked to give a series of lectures at the Institute of Science in Bangalore in the beginning of 1940. That was the time Krishnan was organizing the Annual Meeting of the Science Congress at Chennai, as President of the Congress. Bhabha was keen to meet Krishnan and other scientists, and secured his participation in the meeting of the Congress. Later, when the Atomic Energy Commission was first constituted in 1948 with Bhabha as Chairman, Krishnan was a natural choice to serve the Commission as a member along with Bhatnagar.

It is well known that Bhabha and Meghnad Saha had divergent views on the way the atomic energy programme was sought to be developed in the beginning. While Bhabha's plans were centred around the creation of a Government Department of Atomic Energy and a high-powered Atomic Energy Commission, Saha opposed such a move and preferred a university-centric growth of atomic energy in the country. It was in this context that a National Symposium on Atomic Energy was organized at the instance of the Prime Minister, Jawaharlal Nehru during 26–27 November 1954 at NPL. The meeting was attended by more than hundred participants, including Nehru, his cabinet colleagues, MPs, defence officials, representatives from industries and a large number of eminent scientists and engineers. Bhabha made a detailed presentation of the blue-print

prepared by the department for harnessing the atomic energy for the benefit of the country. While Nehru was quite impressed by the presentation made by Bhabha and his colleagues, the proceedings were marked by some acrimonious debate. It was Krishnan, the host at the venue, who with his characteristic and charming style brought the curtain down on the proceedings with a fervent appeal to the scientists to embark on the research work instead of engaging in endless debates.

Years later it was Krishnan who gave the name *Apsara* to India's first reactor, a swimming-pool type, which went critical on 4 August 1956.

Krishnan was an important member of the Indian delegation to the Second International Conference on Peaceful Uses of Atomic Energy held in Geneva in 1958. Krishnan and P. C. Mahalanobis were official delegates from India to the first Pugwash Conference held in Austria.

Like in Venkataraman's book, one gets in this book too some interesting accounts of history of Indian science during that period. The book deals with at some lengths the bitter battle that accompanied the formation of Indian Academy of Sciences and the National Institute of Science of India (NIS), which later on became the Indian National Science Academy (INSA). Yet another snippet of the book which makes interesting reading is the brief profile of Swami Jnanananda, the fascinating saint-scientist who served as Assistant Director in NPL. The book also refers to many instances when Chandrasekhar often consulted Krishnan rather than Raman on many matters.

Krishnan is an astonishingly multifaceted personality. In spite of his intense research and academic activities, Krishnan devoted enough time to pursue his keen interests in philosophy, literature and classical music. He had read a large number of works in English literature. He was well versed in Sanskrit and Tamil literature too. He wrote regularly scholarly articles in Tamil and often gave discourses on the Vishishtadvaita philosophy. He drew the admiration of eminent personalities like Sarvapalli Radhakrishnan and C. Rajagopalachari. He loved to play tennis, football and bridge, and enjoyed travelling as well. Krishnan's personality was marked by modesty and humility about his own merit and

achievement, in contrast to that of his mentor, Raman.

Nehru said on one occasion: 'Krishnan was something more than a scientist, he was a perfect citizen, a whole man with an integrated personality'. Nehru also said on another occasion: 'I don't remember meeting Krishnan on any occasion when he did not tell me a new story...Krishnan a man of so many facets, was particularly blessed, not because he had great success, but because he has got something inside him for the possession of which we sometimes envy him.'

Krishnan received numerous awards, including fellowships of several national and international science academies, Knighthood of the British Government, the first S. S. Bhatnagar Award, and Padma Bhusan. But interestingly the book mentions that Bhabha, Bhatnagar, Krishnan and J. C. Ghosh got Padma Vibhushan Dusra Varg. However, according to the list of Padma Awardees in 1954 given in the website of the Ministry of Home Affairs, GoI, they all are all recipients of Padma Bhusan.

This book clearly is an absorbing chronicle of a great man's journey starting as a brilliant child in Watrap, a remote town near Madurai, Tamil Nadu, and ending up as an outstanding researcher and science administrator of India. As Mallik himself is a hardcore physicist, this book on Krishnan is equally about the man and his work. I immensely enjoyed reading this book as much as I did reading K. C. Wali's story of Chandra and Venkataraman's biography of Raman.

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