



**C. V. Raman's Student Sukumar Chandra Sirkar: Life and Science.** Rajinder Singh. University of Oldenburg, Germany, Shaker Verlag, Aachen, Germany. 2019, pp. 207, Price: 21.90 Euro.

Rajinder Singh, a well-established historian of science started his journey in this field by working on his Ph D thesis: 'Nobel Laureate CV Raman's work on Light Scattering'. Only the last two decades, he has published two dozen books on history of science dealing with Indian scientists, mostly belonging to Calcutta School. Rajinder has a knack of digging into archives in India and abroad to discover treasure troves of history of Indian science. This volume is dedicated to the life and science of one of Raman's brilliant students, Sukumar Chandra Sirkar (SCS), who was involved, along with K. S. Krishnan, in the experiments which led to the discovery of Raman Effect.

Kankan Bhattacharya, FNA, writes in his Foreword of this book: 'Dr Rajinder Singh for many years has been analyzing the history of Indian science quite dispassionately and has provided a balanced view. The present book is another commendable effort on an unsung hero, Professor S. C. Sirkar, a rather neglected associate of Raman. This book describes the struggle of Sirkar and his outstanding success.' Further he writes: 'I learnt from this book that Sirkar did not have a permanent job till the age of 44 though he was already a FNA and published nearly 50 papers.'

This book has 8 chapters preceded by a brief introduction and followed by an exhaustive bibliography of 28 pages. In his introduction to the volume, the author writes that SCS was the first Indian to measure the intensity of Raman lines in Raman spectra. India's renowned phys-

ist, R. S. Krishnan, called him the man whose 'work was the first indication of resonance Raman scattering which later on played an important part in the conformational analysis of biomolecules'.

Chapter 1 describes the biographical aspects: 'SCS was born on 18 April 1898, in the village Kullya (now in Bangladesh). Financially, the family was not well off. At one time, he started a small factory to manufacture match boxes but remained unsuccessful. SCS obtained his B Sc degree in Physics (Honours) in 1920 securing 2nd position in the first class from the University of Calcutta. SCS came in contact with C. V. Raman for the first time in 1920 as he used to visit IACS where Raman taught classes on electricity and magnetism.'

SC Sirkar's initial research was on the electric moment of chemicals, Kerr effect, and Laue photographs of crystals. Raman suggested that he work on Laue patterns produced by iridescent crystals of potassium chlorate. Later on, Raman told him to discontinue this work as it was already published by an American physicist. It seems that Raman and SCS did not have a cordial relationship after this episode. One of SCS's associates, G. S. Kastha, wrote: 'Prof. Raman did not encourage him and casually pointed out that only a scientist who was born as a genius could make any important fundamental discovery.' However, Sirkar was multitalented and a good instrument maker. He motivated his students to fabricate equipment required for their experiments.

Chapter 2 discusses the role played by SCS in the development of the department of Optics in the Indian Association for Cultivation of Sciences (IACS), Calcutta. In 1948, SCS was appointed as head of the Department of Optics at IACS. SCS and his associates carried on investigations on Raman spectra, ultraviolet absorption, depolarization of Rayleigh scattering in non-polar and polar molecules, absorption of ultra high frequency (UHF) radio waves in organic liquids, and structure of resonance lines of sodium. The Department of Optics, apart from the above mentioned topics, started working on the absorption of microwaves by organic liquids, and cosmic rays. SCS was appointed as M. L. Sirkar Professor of Physics at IACS. He remained on the post until his retirement in 1963, and even as an emeritus professor later on. The list of papers published and

students guided by SCS are tabulated in this chapter.

Chapter 3 describes the role played by SCS in the discovery of Raman Effect. He was one of the 29 students working under the supervision of Raman at IACS. Both KS Krishnan and SCS have recorded their observations about the discovery of Raman Effect in their respective diaries. According to SCS, the term 'Raman Effect' was coined by Peter Pringsheim of Germany in his paper published in *Naturwissenschaften*. Chapter 4 gives information about the early phase of SCS's work at IACS. Sirkar's work on the relative intensities of Raman lines was of high quality and international repute. For these investigations he was awarded a D.Sc. degree by the University of Calcutta. SCS also studied the influence of alternating electric current on the polarization of Raman lines in cyclohexane, chlorobenzene, benzene and toluene.

Chapter 5, 'S. C. Sirkar, C. V. Raman, and Diffuse Spots in Laue Photographs' is the most interesting chapter of this book. The author has provided an insight into the controversy of 'Diffuse spots' observed in the Laue pattern of diamond crystal after reflection of X-rays. This controversy pitted SCS against Raman and his supporters in IACS. In an article in *Science and Culture*, SCS questioned the nature of the diffuse spots observed by C. R. Bose, an associate of K. Banerjee, a staunch supporter of Raman. Many foreign experts were in favour of Born's theory and opposed Raman's theory (hypothesis?) based on quantum mechanics. However, Raman was adamant in defence of his proposed theory. The Born-Raman dispute was finally settled in 1962 after experiments gave the final proof for the correctness of Born's theory, which contained the cyclic boundary condition.

Chapter 6, 'Study of "Wings" and New Raman Lines' throws light on some unique contributions of SCS. In 1936, SCS studied the Raman spectra of four different compounds at different temperatures. In each case he observed new lines in the neighbourhood of the Rayleigh line. He found that with lowering of temperature, the intensities, widths, and frequency shifts of some of the Raman lines of single molecules changed. This was in agreement with Placzek's theory.

In 1937, SCS and J. Gupta reported the observation of a new Raman line in solid

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carbon dioxide at  $-80^{\circ}\text{C}$ , which was at least twice as strong as the line  $1388\text{ cm}^{-1}$ . They attributed the line to the intermolecular oscillation in loosely polymerized groups at low temperature. Sirkar and S. N. Sen studied benzene, carbon tetrachloride, glycerine, acetone, and xylene with continuous radio waves in the range of wavelengths 55 to 100 cm. They found that different polar molecules in the liquid state exhibit anomalous absorption in different radiofrequency regions, and non-polar liquids do not show this phenomenon.

Chapter 7, 'Studying the Jute Fibre and Cosmic Rays' describes the ingenuity of SCS to study the quality of Jute fabric under the direction of Professor M. N. Saha, the Palit Professor of Physics at Calcutta university. The aim of the investigation was to find out how to improve the strength of high quality varieties of green jute fibre by treatment with chemicals. Under the guidance of Saha, SCS and his associates began their cosmic ray research. The American scientists, H. V. Neher and W. H. Pickering, helped them in constructing an apparatus (counter telescope) for this study during their visit to the University of Calcutta. SCS and S. K. Ghosh investigated the production of mesons by non-ionising agents in cosmic rays in lead absorbers using an anticoincidence circuit. They found that at sea level, about 2% of the total meson intensity was produced by non-ionising rays rather than photons in a lead absorber. Their results were not in accord with that of L. Janossy and G. Rochester, who performed experiments with similar instruments. SCS did not continue his work on high energy particles despite reasonably good results.

Chapter 8 is based on research publications of S. C. Sirkar. It includes 110 research papers, bulk of them published in Indian journals, 24 general articles and book reviews, and two books. He published his book *Cosmic Rays* in Bengali. It is a mere coincidence that when I ventured to prepare reading material in Punjabi language during my service in Punjabi University, Patiala, my first book was also on cosmic rays, titled *Brahmandi Kirna Di Kahani*. SCS proved to be one of the most widely published scientists of Calcutta School (IACS) amongst the students of CV Raman, who carried his legacy forward.

The author has published an exhaustive bibliography to augment the histori-

cal worth of his volume. It also shows the painstaking effort made by the author to prepare this monograph on S. C. Sirkar, who suffered neglect at the hands of his own countrymen. Despite the best efforts of the author, some minor mistakes of technical nature are visible in the text: on page 14, electric moment written as 'electric movement'; on page 107, precision misspelt as 'precession'; and on page 150, lead absorber written as 'lead observer'. Overall, one has to appreciate the hard work by the author to bring to light the rare quality of work done by S. C. Sirkar.

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### Annual Review of Nutrition, 2018.

Patrick J. Stover and Rudi Balling (eds). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, California 94303-0139, USA. Vol. 38. xii + 491 pages. Price: US\$ 112.

This issue of Annual Review of Nutrition (ARN) deals with many unusual nutrients as also with the complex interactions between nutrients. While the nutritional significance of fat-soluble vitamins is well-documented, most researchers tend to focus on the more popular areas, such as vitamin A and vision or vitamin D and bone health. Usually the other vitamins such as vitamin E and vitamin K get downplayed – and this issue of ARN attempts to bridge this gap. Shearer and Okano focus on vitamin K, which is classically known for its role in blood coagulation. The Vitamin K cycle involves its utilization as a cofactor for a microsomal enzyme,  $\gamma$ -carboxyglutamyl carboxylase (GGCX), and its subsequent regeneration by the enzyme Vit K epoxide reductase (VKOR). The article highlights novel predictive insights into specific mutations in these enzymes and their clinical phenotypes. Vitamin A and its derivatives belong to a group of organic compounds called apocarotenoids, which are cleavage products of parent carotenoids such as  $\beta$ -carotene. Interest in apoca-

rotenoids has spiked in recent years primarily due to their antioxidant properties, which can be attributed to the unique conjugated double bond system in their structure. The article by Harrison and Quadro describes many nonretinoid apocarotenoids, and attempts to elucidate the molecular mechanisms underlying the various beneficial effects they have on almost all organs in the human body. While many apocarotenoids regulate gene transcription by interacting directly with nuclear receptors, others also appear to have nongenomic activities. It is clear that further studies are needed to understand the bioavailability of these compounds, and if necessary, to define dietary requirements of the same. Studies suggest that there is high inter-individual variability in the bioavailability of all fat-soluble vitamins including apocarotenoids. Borel and Desmarchelier attempt to describe how this variability is mainly due to single nucleotide polymorphisms (SNPs) in or near genes involved in intestinal uptake or efflux of these compounds, and in genes involved in their metabolism and transport.

Over the last few years, the focus of papers in the ARN has been on obesity and its associated cardiovascular risks. In this issue, the focus is shifted to the other major global non-communicable disease, viz. cancer. High intake of carbohydrates has been implicated strongly in obesity and diseases such as CVD and type 2 diabetes, however the data on cancer is less obvious. It has long been speculated upon that sugars are the main source of energy for malignant cancer cells, but the review by Makarem indicates that the association between dietary sugars and cancer varies by the type of sugar, by cancer site and also by gender. The authors do provide a note of caution that there are a number of methodological issues with such studies, mainly with respect to self reporting of sugar intakes, and with extrapolation of such intake data over long periods of time. Nevertheless it does appear advisable to limit sugar intake, especially in the form of added sugars and sugar-sweetened beverages. One form of sugar, whose consumption has increased dramatically over the last 50 years is fructose, mainly due to the use of additives such as high fructose corn syrup. Ferraris *et al.* elucidate the process of absorption of fructose through the GLUT5 receptor, and discuss how high uptake of fructose could potentially