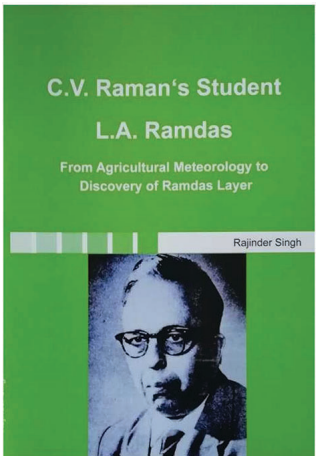

C.V. Raman's Student L.A. Ramdas: From Agricultural Meteorology to Discovery of Ramdas Layer. Rajinder Singh. Shaker Verlag, Düren, Germany. 2023. xx + 172 pages. Price: 23.90 Euro.

Rajinder Singh's journey in history of science started in 1995 at University of Oldenburg in Germany. He was awarded D.Sc. degree by University of Hamburg for his thesis 'Nobel laureate C. V. Raman's work and light scattering – historical contributions to a scientific biography'. In my opinion, he is not only an authority on C. V. Raman but also the best biographer of Raman's students at the Calcutta School of Physics. The book under review describes the achievements of L. A. Ramdas (LAR) as a student of Raman. Ramdas may be considered as the 'father of agricultural meteorology' in India.

N. Sathyamurthy, in the foreword, pays glowing tributes to LAR: 'He was a pioneer in agricultural meteorology in India and was instrumental in connecting various aspects of soil, climate and other factors that influence the agricultural production – the lifeline of India.' Arun K. Grover, in the prologue, traces the history of the Indian Meteorology Department (IMD) and its role in providing employment opportunities to Indian scientists like Ruchi Ram Sahni, K. R. Ramanathan and LAR. He writes: 'The teaching positions in the Universities and Post Graduate colleges were scarce for Ph.D. holders in India in the 1920s. Many Ph.Ds. in Physics had to be content with taking up jobs in the Department of Meteorology. LAR steered the Agriculture Meteorology agenda of IMD with great distinction.'

In the introduction, the author deplores that many eminent scientists who made fundamental contributions to the development of science in India have been ignored. He took up cudgels to write about their life and work. These lesser-known physicists include Sisir K. Mitra, Debendra M. Bose, Bidhu B. Ray, Kedareswar Banerjee, Sukumar C. Sirkar, Snehamoy Datta, Satish Ranjan Khastgir, Bibha Chowdhury and L. A. Ramdas.

Chapter 1 describes some aspects of LAR's life. He was born on 3 June 1900, in Palghat, Kerala. His father, L. K. Ananthakrishna Iyer, was an anthropologist and a professor at the University of Calcutta, where C.V. Raman was the Palit Professor of Physics. LAR did B.A. from Presidency College, Madras, in 1923 and joined the University of Calcutta for M.A. He was a Palit Research Scholar in Raman's group. He was awarded Ph.D. in 1927 for his work on the scattering of light and observing the 'Raman effect' in ether vapour. In 1926, Ramdas joined the IMD and became Assistant Meteorologist in Karachi. In 1930, he joined the Poona Meteorological Office, where he was promoted to Agricultural Meteorologist. He retired as the Deputy Director-General of Climatology and Geophysics Observatories of the IMD in 1956.

Chapters 2 and 3 describe LAR's cordial relation with C. V. Raman and his discovery of the Raman effect in vapours. He coined the term Raman effect in an article submitted to *Nature*, which was published on 14 July 1928. Raman also gave credit to LAR for establishing a relation between surface tension and surface-opalescence and tracing 'the transition from surface-opalescence to volume-opalescence which occurs at the critical temperature'. Raman changed the title of *Proceedings of the Indian Association for the Cultivation of Science* to the *Indian Journal of Physics* at the suggestion of LAR. In 1923, LAR attempted to verify Rayleigh's theory of scattering by spectrophotometry. He prepared potassium chlorate crystals and investigated the refractive index at different wavelengths.

LAR studied light scattering from metal and liquid surfaces and concluded that the surface scattering in transparent liquids was due to molecular bombardment of the surface. In 1931, he studied the spectrum of glow-worm light and reported in *Nature* that the obtained spectrum consisted of a single band in the range 5290–5860 Å. He observed that when oil layer/film was spread over water surface, there was less evaporation. If oil layer is spread over a large surface area of seawater, it will drastically decrease evaporation. Consequently, there would be a decrease in rainfall around the globe. His idea was called by the editor of *Nature*, a 'novel suggestion'.

Chapter 4 presents LAR as the 'founder of the agricultural meteorology in India'. Agricultural meteorology is an interdisciplinary science, that covers fields like soil science, atmospheric science, micro-climatology, biology, etc. It is based on fundamental principles of radiation, surface aerodynamics and thermodynamics. He presented a paper: 'The influence of climate on agriculture' at Punjab Educational Conference and Exhibition, which was highly appreciated. A special unit of 'agricultural meteorology' was established within the IMD on 22 August 1932, under the direction of LAR with the aim: (i) to link meteorology and agriculture, and (ii) to provide research facilities for post-graduate students to investigate borderline problems like soil science, plant physiology and agricultural meteorology.

Chapters 5 and 6 sum up the scientific work of LAR at the Agricultural Meteorology Division of IMD. He started working on some of the important aspects of the micro-climatology, such as: 'role of solar radiation', 'surface conditions', 'soil conductivity', 'convection process and radiation from the earth's surface and adjacent air layers', 'wind movements', 'limits of surface climate', 'evaporation', 'the water vapour content in the atmosphere' and 'dew fall'. LAR fabricated instruments to undertake a study of different types of soils (black soil for cotton belt of then Bombay Presidency, alluvial soil of Trivandrum, and alkaline soil of Panjab), effect of moisture, percolation, evaporation and capillary action in soils. Wheat and sugarcane crop patterns were studied to introduce better agricultural practices in India.

LAR and his associates studied Monsoon and weather abnormalities, such as floods, droughts, cyclonic storms, thunderstorms, hailstorms, dust-storms, cold waves and frost hazards. They calculated the damage done by frost in the winter of 1933–34. LAR concluded from his experiments: (i) Punjab was most liable to frost hazard, and the hazard decreased rapidly as one moved southwards or eastwards and (ii) frost was caused by cold waves reaching India during winter in the wake of the winter depressions.

LAR was also a pioneer in the field of solar and wind energy in India. He proposed in 1941 Indian Science Congress utilization of solar energy. He summarized the data on the intensity and duration of sunshine in India. LAR and K. P. Ramakrishnan

gave a talk on 'Wind energy in India' in UNESCO's symposium on 'Solar energy and wind power' in the arid zones, New Delhi, 22–26 October 1954. They gave a short survey of the potentialities of wind energy in India.

The most prominent contribution of LAR is the discovery of Ramdas Layer/ Effect. It was reported in *Nature* (1938) that experiments done at Poona in winter established that the air temperature has a minimum, some distance above the ground. Until 1990, this phenomenon was known as 'lifted temperature minimum'. In 1991, Rodham Narasimha applied the term 'Ramdas Effect'. He tried to explain the effect by considering the surface emissivity and thermal conductivity of the soil. Narasimha and his co-workers gave a numerical model to explain the lifted temperature minimum. During 2016–17, evidence was found for the Ramdas layer using modern technology such as satellites and from high resolution temperature observations.

Chapter 7 describes the research work of LAR at the National Physical Laboratory, New Delhi, where he was employed (1956–61) as Assistant Director and Head of the Heat and Power Division after his retirement from IMD. During his stay in NPL, he wrote a book *Crops and weather in India*, which was published in 1960. This monograph was written for the students of agriculture to show the importance of weather science and weather forecast in agriculture.

LAR compiled a chart showing the frequency of floods and droughts from 1875 to 1950. To investigate the main abnormalities of monsoon in India, he considered the seasonal rainfall from 1875 onwards. Apart from the monsoon, he also briefly reviewed the phenomena which affected the rain, eastern- and western depressions, cyclonic storms, thunder- and hailstorms, artificial rain, and reduction of evaporation losses with chemical films on the water surface. In 1973, Ramdas discussed the significance of monsoon at global level. For India, he analysed the monsoon data for about 200 years.

Rajinder Singh concludes the biography of LAR with a ten-point agenda. He calls L. A. Ramdas an 'innovative scientist'. To justify this statement, we may quote K. R. Ramanathan, who called him one of Raman's students who 'discovered' the light scattering at the surface of pure liquids. His article in *Nature* on 'Oil contamination as a climatic factor' is a sterling contribution to science. In it, he proved that the minor organic layer of oil could hinder evaporation and, consequently, decrease the rainfall at global level.

L. A. Ramdas was a prolific writer and contributor to research journals. He published 148 research papers, mostly in the field of Agricultural Meteorology. Rajinder Singh deserves our appreciation for bringing into limelight another brilliant student of CV Raman. I congratulate him for his effort in establishing the legacy of L. A. Ramdas as 'father of agricultural meteorology' in India.

HARDEV SINGH VIRK

Sri Guru Granth Sahib World University, Fatehgarh Sahib 140 406, India
e-mail: hardevsingh.virk@gmail.com

Annual Review of Plant Biology, 2023. Sabeeha S. Merchant, Wilhelm Gruissem and Donald R. Ort (eds). Annual Reviews, 1875, S. Grant Street, Suite 700, San Mateo, California 94402, USA. Vol. 74. xii + 801 pages. Price: US$ 122.00. ISBN: 978-0-8243-0674-8.

The *Annual Review of Plant Biology* serves as a guiding light illuminating the most recent discoveries, innovations and insights that contribute to our evolving comprehension of plant biology. Navigating through the 801 pages of the 2023 edition, we embark on a thrilling journey through the complex mechanisms, ground-breaking research and transformative ideas delineating the forefront areas of plant biology. Twenty eight chapters were grouped, wherever possible, to maintain the continuity of going through this book.

Of the articles related to RNAs, 'An RNA World' by David C. Baulcombe, an eminence in this field narrates his research journey aimed at unravelling plant gene regulation. Eventually, his focus shifted to plant viruses, RNA silencing, epigenetics, genome evolution, the arms race concept of disease resistance, and addressing Darwin's enigmatic 'abominable mystery'. In his youth, he aspired to become a saxophonist, yet he eventually emerged as a pioneering scientist with a visionary outlook, albeit he humorously refers to himself as a 'beachcomber'. Zhan *et al*. reviewed the recent discoveries regarding small RNAs in plants, providing insights into their biogenesis mechanisms, targets, modes of action, mobility, and functions across various plant species, including economically significant crops, with a particular focus on Arabidopsis. The details of RNA modifications such as methylation of the bases, methylation of the ribose sugar, or more complex reactions such as the oxidation of methylated bases that bring functional, regulatory, and structural complexity to gene expression regulation are discussed by Sharma *et al*. under a relatively new field, Epitranscriptome.

Further, Elizabeth *et al*. explain the establishment, maintenance and removal of epigenetic modifications that provide an additional layer of gene regulation controlling developmental processes and response to the environment. Patterning of epigenetic modifications can be heritable inter-generationally or maintained intra-individually with resetting between generations. The significance of epigenetic regulation in development has become evident through certain regulators, such as the polycomb repressive complex 2, cytosine–guanine (CG) methylation, and heat-activated transposable elements. The emerging area of research in this field is to understand how epigenetic resetting between generations occurs during normal development and in response to environmental stress. Regulation of transcription, replication and DNA repair by chromatin remodelling is described by Bieluszewski *et al*. Switch deficient sucrose nonfermenting (SWI/SNF) class of chromatin remodelling complexes enhance the accessibility of proteins to genomic DNA, either sliding the histone octamer along the DNA or ejecting it from the DNA altogether. Different subtypes of SWI/SNF complexes are critical for cell fate reprogramming, responses to environmental challenges and disease resistance.

Genomic blueprints that ensure the spatiotemporal patterning of gene expression necessary for appropriate development and responses to the environment are mainly governed by *cis*-regulatory elements. These DNA sequence motifs are often found clustered together in *cis*-regulatory modules that are targeted by sequence-specific transcription factors. Marand *et al.* explain transcriptional regulation through *cis*-regulatory sequences by employing chromatin accessibility profiling, functional assays, and genetic perturbations to untangle genetic and epigenetic variations. A recent study suggests that *cis*-regulatory regions are extremely robust to mutagenesis and can