

physiological responses to spectral changes and evolution of photosynthetic irradiance response by estimating effective absorption cross section. The physico-chemical response to the variations in spectral irradiance become observable in terms of net synthesis of LHC which has been evaluated along with the contributions of different physical factors to this process.

I feel that a short overview on the crystal structure of membrane proteins and of some selected antenna would have been within the scope of this volume. Also, addition of a chapter giving salient preparative methodology for characterizing LHS in different organisms would have been valuable since 'biodiversity' is a frontline research area in biology.

In my opinion, the new and most striking features of this book are (i) com-

prehensive overviews on all aspects from structure to evolution of all types of photosynthetic antenna; (ii) structural and functional beauties of these antenna; (iii) the regulatory roles that these light harvesting systems play in maintaining efficient light energy harvest and utilization by the organisms; and (iv) extremely attractive illustrations that give deep insights into the topics that could aid the subject teachers in the classrooms. An interesting new feature of the AIPH series is the inclusion of writeups on the Editors and the Series Editor. Such personal information will be of great interest to students.

In conclusion, this volume is a magnificent addition to the already successful AIPH series. The content of this book is sure to find its place in the courses in plant biophysics, biochemistry, micro-

biology and biotechnology. My major point of concern is how this important book shall be available to the students who need it the most because it is too expensive even for college libraries in India. We must explore means and methods to solve this problem because 'new biology' is becoming very attractive. Despite this, I recommend all biologists to read the interesting story of the golden green antenna that collects light for conversion into chemical energy that not only sustains life, but also makes our world worthy of living.

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## Sivaramakrishna Chandrasekhar

Sivaramakrishna Chandrasekhar, the well-known liquid-crystal physicist died on Monday, the 8 March 2004, after a brief illness. He was 73. He is survived by his wife, a son and a daughter.

Chandrasekhar was born on 6 August 1930 at Calcutta. He received his M Sc degree in physics with first rank from Nagpur University in 1951. Subsequently, he joined the Raman Research Institute (RRI), Bangalore to work for his doctoral degree in physics under the guidance of his maternal uncle, C. V. Raman. The main topic of his research was related to optical rotatory dispersion measurements on several crystals. He received the D Sc degree from Nagpur University in 1954.

In 1954 he went to the Cavendish Laboratory as an 1851 exhibition scholar and obtained a second doctorate degree from Cambridge University mainly for his work on the corrections for extinction in neutron and X-ray scattering from crystals. His subsequent postdoctoral work in the University College and the Royal Institution at London also dealt with crystallographic problems. He returned to India in 1961 as the first Head of the Department of Physics, which had just been started in the University of Mysore at Mysore. It was here that he turned his attention to

liquid crystals, a subject which at that time was just coming out of a long hibernation.



Liquid crystals made of rod-like molecules had been discovered in 1888, and many compounds had been synthesized in Halle in Germany in the 1920s and 30s. Some physical studies had been under-

taken by the German and Russian schools during that era, but the subject later languished till the mid-fifties. Starting in the late fifties, the systematic synthetic effort by Gray in the UK and the physical studies by Maier in Germany (including the well-known Maier-Saupe or MS theory) started a revival of the subject. Chandrasekhar and his co-workers made contributions to the application of the dynamical theory of reflections to study the fascinating optical properties of cholesteric liquid crystals which have a helical structure with a pitch which is usually  $\sim 0.5 \mu\text{m}$ , and to the extensions of the molecular theory of nematic liquid crystals beyond the MS model. (On a personal note, I could add that I joined him as the first Ph D student to work on liquid crystals towards the end of 1965.)

Chandrasekhar was invited to establish a liquid crystal laboratory in RRI after DST started supporting it in 1971. The move had a highly positive impact on his productivity. Along with a couple of former students who moved with him to RRI, he could, in a short time, develop a laboratory with all the essential facilities needed for research in the chosen area. Realizing that cutting-edge research would not be possible without an in-house capacity to produce new materials, a synthe-

tic organic chemistry laboratory was also added. Soon many new experimental and a few theoretical results emerged and the Liquid Crystal Laboratory at RRI became one of the leading centres of research in the world.

The twisted nematic liquid crystal display was invented in Europe in 1971 and recently, LCDs have displaced CRTs as commercially the most important displays. In cooperation with Chandrasekhar and his colleagues, the Bharat Electronics Ltd (BEL), Bangalore, developed indigenous know-how for the manufacture of simple LCDs for the domestic market.

The pinnacle in Chandrasekhar's scientific career came in 1977, when he and his co-workers discovered a new type of liquid crystal made of a new type of molecules. These molecules had the shape of discs rather than the well-studied rods. The discs exhibit columnar liquid crystals which have a two-dimensionally periodic order. The paper announcing the discovery of this type of liquid crystals was published in *Pramana*, and is one of the most highly cited papers in the field of liquid crystals. A few thousand compounds with disc-like molecules have been synthesized up to now. The columnar liquid crystals are being explored for their highly anisotropic conducting properties, which may be useful in some device applications. The year 1977 also saw the publication of Chandrasekhar's book on liquid crystals by the Cambridge University Press. The book is popular amongst workers in

the field, and has been translated into Russian and Japanese. An enlarged second edition of the book was published in 1992.

Chandrasekhar also organized several international conferences, including the one in 1973 on the occasion of the Silver Jubilee of the founding of the RRI. Many stalwarts in the field of liquid crystals like Brown, Gray, Saupe and de Gennes (who was to receive the Nobel Prize in 1991, partly for his work on liquid crystals) participated in this conference. Some major conferences he organized include the Ninth International Liquid Crystals Conference in 1982 and the Second Asia-Pacific Physics Conference in 1986.

After retiring from RRI in 1990, Chandrasekhar started the Centre for Liquid Crystal Research in a building made available by BEL.

Chandrasekhar's scientific achievements brought him many honours. He was elected Fellow of all the three academies in India, of the Royal Society, of the Institute of Physics (London) and of the Third World Academy of Sciences. He was a member of several international and national committees on science and education. He was the founder president of the International Liquid Crystal Society during 1990-92, and was an editor of the journal *Molecular Crystals and Liquid Crystals* for the past 20 years. He was the recipient of the Bhatnagar Prize (1972), Homi Bhabha (1987) and Meghnad Saha (1992) medals of INSA, C.V. Raman Centenary Medal of IACS (1988), the Royal Medal of Royal Society (1994), Niels

Bohr Gold Medal of UNESCO (1998), and the Fredericksz Medal of the Russian Liquid Crystal Society (2000) and several others. He was also the recipient of the Karnataka Rajyotsava Award (1986), Padma Bhushan Award (1998) and the entitlement 'Chevalier dans L' order des Palmes Academiques' of the French Government (1999).

Chandrasekhar was largely responsible for placing India on the international map in the field of liquid crystals. The subject has had yet another resurgence in 1996, when Japanese scientists discovered new types of liquid crystalline phases exhibited by compounds made of another new type of (banana-shaped) molecule having bent-cores. Many such compounds exhibit columnar liquid crystalline phases.

Chandrasekhar hailed from the most illustrious family of physicists of our country. His younger brother, S. Pancharatnam (of the Pancharatnam phase) died at a young age. His elder brother S. Ramaseshan, the well-known materials scientist and an editor of this journal, died a couple of months ago. In Chandrasekhar's passing away, the international liquid crystal community has lost one of its most vigorous practitioners and our country has lost a pioneering scientist.

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