

the smectic state, the long molecules lie parallel to one another, with matched ends, and form sheets; in the nematic state, they lie parallel without matched ends; apparently the cholesteric state is not well enough defined for the author to describe it succinctly.

Properties of the three kinds of mesophases are described in chapter 3. The smectic state is characterized by the so-called focal-conic texture, which is not very clearly described. The nematic state can assume several textures; the cholesteric state is related to the nematic state, but the reader is not given a clear impression of its exact characteristics. Identification of the various kinds of mesophases is discussed in chapter 3. In this work a polarizing microscope equipped with a heating stage is the chief experimental tool.

Chapter 4 is devoted to proposed views of the molecular arrangement in the nematic state, specifically to Bose's "swarm theory" and Zocher's "distortion hypothesis." The study of the mesomorphic states by various physical experiments is described in chapter 5. X-ray diffraction studies have been made by several well-known crystallographers, including Friedel, Hermann, Bernal, and Crowfoot. The last two demonstrated that crystals which, when heated, transform to a smectic mesophase have layer structures in which the molecules are transverse to the layers. Thus, transformation from the crystal to the smectic state consists essentially of rotational disorder of the molecules in the layers as well as of shear disorder between the layers. Physical properties such as viscosity, dielectric constant, transition properties, refractive index, light scattering, and surface tension are discussed in chapter 6.

Chapters 7 and 8 are chiefly concerned with the molecular structures of materials capable of forming mesomorphic phases. The chapters are intended partly to rationalize the occurrence of mesophases in terms of molecular structure.

This book, which is written from the point of view of the organic chemist, is heavily documented and has an extensive coverage of chemical examples.

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## Research Adventures

**Design and Function at the Threshold of Life: The Viruses.** Heinz Fraenkel-Conrat. Academic Press, New York, 1962. vii + 117 pp. Illus. Plates. Paper, \$1.95.

This little book is a labor of love. It deals with the intimate laboratory adventures that have led to one of the great and dramatic achievements of modern biology: The elucidation of the nature and function of viruses in the genetic processes of living things. But it is more than that. Its central theme is concerned not so much with the significance of this particular area of investigation as it is with insight into the process of doing research. And the protagonist is the research scientist, his motivating curiosity, his long, arduous, and often disappointing labors, his embarrassment about errors of judgment, his skepticism in the face of established views, his puzzlement over unexpected results, and sometimes his exalted joy when the challenge has been successfully overcome.

There have been many attempts to explain scientific research to the intelligent layman. The necessarily witless pedantry of much of the significant scientific literature of our time has placed it beyond the layman's reach and understanding. In its stead, an incredible proliferation of popularized research reports (not to mention advertisements) have abused the term *scientific research* to the point of meaninglessness. Fraenkel-Conrat has written one of the very few authoritative books that can bridge the gulf between the scientist and the humanist with depth and substance. This gulf, however, will not be easily traversed by a casual reader. Though the style is lucid and the explanations frequent, even a practising scientist may find it necessary to read the book with unusual care and attention.

Perhaps this is because the author took too much for granted and left a considerable number of key technical terms undefined. Thus, it is questionable whether this book "will be readily understood by laymen," as its jacket suggests. But there can be little doubt that many students will find this work a source of information and inspiration.

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## Botany in India

**Summer School of Botany, 1960 (Darjeeling).** *Proceedings.* P. Maheshwari, B. M. Johri, and I. K. Vasil, Eds. Ministry of Scientific Research and Cultural Affairs, New Delhi, 1962. viii + 522 pp. Illus. Rs. 25.

A review of these proceedings necessarily brings into consideration the merits of the school itself. Unlike the summer institutes organized in recent years by the Botanical Society of America, the Darjeeling program brought together a group of persons who participated both as lecturers and as discussants. Another difference, this one in favor of the American format, was the lack of laboratory sessions to augment and clarify the lectures.

Almost all papers have been published *in extenso*. The variations in subject matter, treatment, and qualification of authors is so great that evaluation of the book as a whole is difficult. I assume that my bewilderment was not shared by the participants, who undoubtedly were stimulated and carried along by personal contact. That the various contributions exhibit varying degrees of competency is to be expected. Papers by such authorities as T. V. Desikachary (electron microscope studies on algae), P. Maheshwari (contacts between embryology, physiology, and genetics), V. Puri (morphology of the flower), and A. K. Sharma (chromosome structure) are understandably noteworthy. It is puzzling, however, to discover that some papers are not reviews of current concepts and methods, such as would be appropriate for a summer school, but are reports of original research. While the inclusion of these papers probably was not a drawback to the sessions themselves, the resulting heterogeneity narrows the usefulness of the proceedings. The value of this collection of papers would seem to be chiefly historical: it furnishes an excellent transect of Indian botanical research in 1960.

The report of a discussion on the "Promotion of teaching and research in botany" is especially interesting in that it gives insight into the problems and limitations faced by Indian botanists. There is no doubt that the Darjeeling summer school substantially aided the Indians in achieving their worthy goals.

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