

properties offer a new range of display devices. The temperature-sensitive colours of some liquid-crystal phases offer a direct form of thermography. Lyotropic liquid crystals offer an understanding of the state of membranes in living systems as well as explaining the properties of commercial surfactants and foams. In short the subject has something to offer virtually everybody.

The pace and diversity of the subject makes frequent reappraisal desirable and the proceedings of the series of international meetings have provided a valuable and necessary record. This volume is amply fitted to stand beside its predecessors. It contains both state-of-the-art surveys and original research papers. There are papers dealing with almost every conceivable physical approach: hydrodynamics, light scattering, electrical, magnetic and electro-optical properties, phase-diagram investigations, thermodynamic properties, surface-tension measurement, circular dichroism and a variety of spectroscopic techniques. A single biological paper by Professor Ambrose of the Chester Beatty Research Institute on the organizational role of liquid crystals in living systems appears to point to an awakening of interest in liquid crystals in molecular biology also.

There are two classic papers of special interest to crystallographers. Both deal with thermotropic phases. The one by de Vries is very much the sort of paper one has come to expect from this author. It gives a survey of the contemporary structural knowledge of thermotropic phases, discusses the interrelations between different phase types and argues in favour of the scheme of nomenclature proposed by the author. The other paper by Vainshtein & Chistyakov is complementary in character. It relates the X-ray diffraction patterns of nematic and smectic phases to the statistical distribution functions describing the molecular arrangement. The relevant calculations are described and the concepts are elegantly illustrated by a series of optical diffraction patterns. It is a pity that an account of the third X-ray paper presented at the conference did not materialize in this volume. In dealing with the lyotropic phases it would have completed the structural survey of mesophase types.

The book is well presented and adequately illustrated with black and white photographs and line drawings. Although the 570 pages of the volume make it appear of daunting size, the individual papers are all concise and readable, and the uniformity of style in the presentation makes one suspect a good deal of effort has been expended by the editor to achieve this.

This is an interesting and useful reference volume. It is available at reasonable cost and can be warmly recommended both to those with an interest in liquid crystals and those on the periphery of the subject.

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**NMR basic principles and progress. Vol. 9. Lyotropic liquid crystals.** By C. L. KHETRAPAL, A. C. KUNWAR, A. S. TRACEY and P. DIEHL. Pp. 11+85, Figs. 18, Tables 5. Springer-Verlag, 1975. Price \$15.60.

In this short monograph the authors give a concise yet comprehensible survey of the literature on NMR studies of

lyotropic liquid crystals up to 1974. Following a short introduction, the review is divided into two sections: the first describes investigations of the structures of the mesophases themselves, while the second is concerned with studies of the geometry of molecular and ionic species dissolved in the so-called 'nematic' mesophases which may be macroscopically orientated in magnetic fields to provide an ordering matrix for the solute. This latter subject reflects the research interests of the authors and will be of little interest to those concerned with the properties of liquid crystals as discussed in the first section. Each section is appended with a useful, referenced table of the systems reported.

The book should be particularly useful as a source of references for NMR spectroscopists working in either of the fields described, but has little to offer the general reader with an interest in liquid crystals.

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**Advances in liquid crystals. Vol. 1.** Edited by GLEN H. BROWN. Pp. xi + 320, Figs. 243, Tables 19. Academic Press, 1975. Price \$31.50.

We are at present witnessing an intensive, multidisciplinary attack on the properties of liquid crystals, albeit their discovery by Reinitzer and Lehmann dates back to 1888. The combination of molecular order and fluidity confer on these materials fascinating properties which find a diversity of applications ranging from their use in electro-optic devices to their role in the lipid membranes of biological structures. The introduction of this new series is therefore timely and will be welcomed by research workers in the field.

There are five chapters in this first volume; all authoritatively written and beautifully illustrated. The first, by Per Ekwall, is by far the most substantial (142 pages, 140 figs., 7 tables, 134 references); it is an exhaustive review of the composition, properties and structures of aqueous lyotropic liquid crystalline phases formed by amphiphilic compounds. The collection of phase equilibrium diagrams for binary and ternary systems will be particularly useful to workers in this field. In Chap. 2 (23 pages, 14 figs., 2 tables, 65 references), Christyakov describes the structure of thermotropic liquid crystals as derived from X-ray diffraction studies. Next Skoulios gives an intelligible account (19 pages, 14 figs., 53 references) of how block copolymers may form mesomorphic phases with structures similar to those exhibited by soap-water mixtures. Smith, in Chap. 4 (77 pages, 37 figs., 9 tables, 320 references) discusses the complementary nature of the disorder in plastic and liquid crystals and their significance for the melting of molecular crystals; this article should interest the general reader. In the final chapter (44 pages, 38 figs., 1 table, 45 references), Kleman gives a lucid account of the structural defects encountered in liquid crystals.

These articles are written for the specialist and as they cover a diverse range of topics it is doubtful if they would all interest a single reader. The series is, therefore, more likely