provided a wealth of interpretation and 125 pages of bibliography and notes. Anthropologists, historians, biologists, and physicians will all find much that is interesting. This is a book that is a pleasure to read and to own.

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The Integument in Arthropoda

Biology of the Arthropod Cuticle. ANTHONY C. NEVILLE. Springer-Verlag, New York, 1975. xvi, 450 pp., illus. $62.40. Zoophysiology and Ecology, vol. 4/5.

Studies of the integument, that is, the cuticle and the single layer of epidermal cells that secrete it, are of fundamental importance in arthropod biology. Arthropods are epidermal organisms in the sense that vertebrates are mesodermal organisms. All their obvious and most of their characteristic features depend upon the epidermis, just as the obvious features of vertebrates depend upon the mesoderm. The cuticle is skin, skeleton, and food reserve. Arthropod biologists will therefore welcome Neville's successful attempt to draw together current cuticle research from many disciplines into a readable book. There is no longer any excuse for failing to give a detailed treatment of the cuticle in advanced biology courses.

Neville describes the general structure of cuticle, particularly the fibrous components, and illustrates the description with numerous electron micrographs and some diagrams. The components of cuticles of all sorts are now well known and we may expect that this description will last, although there is still much to be learned about the composition of the epicuticle and the cell components concerned in cuticle secretion. Structural macromolecules (chitin, proteins, lipids, pigments) are reviewed, and good diagrams and useful tables are included. If the list of some 20 cuticular enzymes reminds us that we still have much to learn about the way the cuticle functions as an extracellular reaction vessel, the discussion of cross-linking shows us how far we have come. Numerous linking mechanisms in addition to quinone tanning are now known.

Separate sections of the book deal with the phylogeny, physical properties (including mechanical and optical properties), and physiology of cuticle. Interest in electrical properties is increasing, but the permeability studies that used to be so popular seem to be on the wane. The physiology section is a mixed bag. There is a need for a more detailed treatment of the sequences that result in cuticle deposition and their control, while subjects such as water relations belong with permeability and the control of chitin orientation relates to microfibrillar architecture. In the final chapter Neville lists outstanding cuticle problems remaining to be solved. The chapter includes useful discussion points for students, but the author has missed an opportunity. Most of the topics are details of interest to the specialist, but some are destined to illuminate pathways in the mainstream of biology and these should have been singled out.

Neville is at his best in discussing supermolecular architecture and the orientation of microfibrils. Cuticles may have regions in which the fibers have preferred orientations, but most commonly the cuticle is made up of laminae of parallel microfibrils that change orientation slightly from layer to layer in an anticlockwise helicoid. This helicoidal fibril arrangement has general relevance in biology and may be found in chromosomes, cholesteric liquid crystals, egg shell proteins, and tunicate cellulose, as well as in the chitin-protein complexes of cuticle. Neville explores all aspects of helicoidal architecture and makes a case for the self-assembly of cuticle helicoids from liquid crystals.

Neville keeps a balance between presenting his personal view and reviewing the literature, coverage of which is up to date through 1973, with some 1974 and 1975 references. Occasionally Neville sits unnecessarily and precariously on a fence of his own erecting. In discussing the source of cuticular proteins, for example, he refers to growing evidence suggesting that cuticular proteins are not synthesized by the epidermis but are transported across it from the blood. He does not evaluate this evidence, which indeed is largely contradicted by the knowledge that the epidermis can secrete cuticle in tissue culture.

If the book has weaknesses they are probably a reflection of the present state of research. There is a lack of information about the epidermal cell itself and about its role in the precisely timed sequential secretion by which cuticle is made and the way the sequence is controlled. There is also a lack of consideration of growth and the forces that model the shape of arthropods both at the cellular and at the macroscopic level. In view of the importance of the epicuticle as the primary barrier to the environment, surprisingly little is said about it, and it is not illustrated in any electron micrographs or detailed diagrams.

These are minor criticisms. The care in preparation, the quality of production, and its author's interdisciplinary sweep combine to make this book a sensible addition to the libraries of most biologists. Nearly all the workers on arthropod cuticle are still alive and active, and I am sure that they hope the author will keep up with their new work for a second edition, which will no doubt be needed after the stimulus given to the field by the first.

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Organelle Genetics

Genetics and Biogenesis of Mitochondria and Chloroplasts. Papers from a colloquium, Columbus, Ohio, Sept. 1974. C. WILLIAM BIRKY, JR., PHILIP S. PERLMAN, and THOMAS J. BYERS, Eds. Ohio State University Press, Columbus, 1976. x, 362 pp., illus. $15. Ohio State University Biosciences Colloquia.

This collection of papers is devoted principally to reviews of organelle genetics in higher plants, mammalian cells, and lower eukaryotes. It will serve scientists in this field as a fairly comprehensive update of Sager's 1972 review of the field, *Cytoplasmic Genes and Organelles*. The papers are for the most part also general enough to interest people whose concern with the field is more casual. In several instances, however, recent significant work is not mentioned, owing to the fact that the papers were prepared more than 18 months ago.

Mitochondria are especially well treated in the book; the coverage is largely limited to mammalian cells and yeast, however. A noteworthy exception is the chapter on mitochondrial genetics by C. William Birky, Jr., which includes a thorough discussion of recent advances in ciliates, *Aspergillus*, and *Neurospora*, as well as yeast. Philip S. Perlman has written an excellent review of the genetic analysis and molecular biology of cytoplasmic petite mutants of yeast. His discussion of ethidium bromide mutagenesis, together with a section in the chapter by Henry R. Mahler *et al.*, will be particularly useful, as will the chapter by David E. Griffiths on the selection of mutants resistant to specific inhibitors of the adenosine triphosphatase complex.