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.

The chapter concerning mitochondrial biogenesis in HeLa cells, by Giuseppe Attardi *et al.*, must be singled out as especially readable.

The treatment of the genetics of chloroplasts is less thorough, although plastid variegation in higher plants is covered exceptionally well by R. A. E. Tilney-Bassett. The coverage of chloroplast biogenesis is very spotty, consisting only of a chapter by J. Kenneth Hoober and W. J. Stegeman, in which they discuss primarily their own work.

Included in this collection are two papers that will be of interest to those outside the field of plastid genetics. The discussion of the evolution of ferredoxin and fraction I protein in the genus *Nicotiana* by S. G. Wildman *et al.* demonstrates the use of biochemical probes to study the evolution of higher plants and deserves the attention of population geneticists and persons interested in plant evolution. A paper by John R. Laughnan and Susan J. Gabay is concerned with instability of S cytoplasmic male sterility in corn. One wonders about the inclusion of such a topic in this collection, since very little is known about the molecular or cellular basis for cytoplasmic male sterility. Perhaps presentation of the subject in this context, where it will receive the attention of persons unfamiliar with this system, will provide stimulus for investigation on the cellular and molecular levels.

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Plant Physiology

Phloem Transport. Papers from a NATO Advanced Study Institute, Banff, Alberta, Canada, Aug. 1974. S. ARONOFF, J. DAINTY, P. R. GORHAM, L. M. SRIVASTAVA, and C. A. SWANSON, Eds. Plenum, New York, 1975. x, 626 pp., illus. $48. NATO Advanced Study Institutes Series A, vol. 4.

The conference of which this book is the proceedings assembled 73 active workers on phloem transport to discuss one of the last great puzzles of plant physiology: how plants distribute their organic food materials. It was one of the aims of the conference to provide ample time for discussion, and a third of the book is taken up with question-and-answer exchanges on the topics of the presented papers. These provide a particularly lively view of the more debatable areas in this controversial field and of the personalities of the more vocal participants, their insights and prejudices.

The first of the three sections is devoted to phloem anatomy. An avowed intention of this was to bring about "a dialogue between the anatomists and physiologists, because it was clear that a great gap . . . exists between the two." This seems to be an unfair description of workers in the field. No phloem anatomist fails to be drawn by the fascination of the sugar transport problem into study and speculation about the function of the cells he studies; nor does any physiologist neglect the descriptive papers that might show structures that would help his thinking on function. Half the contributors to the symposium would be difficult to classify under either heading, and those who are clearly in one category are found ably discussing the papers of those in the other. So the fruitful integration of views that emerges from these pages was strengthened and extended, but not initiated, by this conference.

In the anatomical section there are wide-ranging reviews of phloem and sieve tubes and similar structures in angiosperms, gymnosperms, and lower plants, and concentrated discussion of the topical subjects of P-protein and transfer cells. There is, strikingly, no account of the light microscopy of living phloem, to which much effort has been devoted.

The second part of the book, Physiology of Translocation, is concentrated on loading, tracer kinetics, the effects of external factors, bidirectional transport, and phloem exudates. These are among the "facts" of the process from which an understanding of how it may work must be derived. The balanced surveys of published and novel work and the dialogue of the discussions will give the reader unacquainted with the difficulties a clear view of how these facts can fade away when approached by experimenters with opposing viewpoints or different techniques.

The third part, headed Biophysics of Phloem Transport, is in fact concerned mostly with the hypothesized models. The reader who has not kept up with the arguments about mechanism will find here the wide range of tenable views, the assertions and contrary facts, the acts of faith, and the selections of assumptions that make this a fascinating game, and he will retire bewildered that so little progress has been made since he last tried to follow it all.

Much of the appeal of the book is in its topicality and in the diversity of the observations that are brought out for consideration in both the papers and the discussions. One may expect much of this to go out of date quite quickly. Nevertheless, there are half a dozen critical and deeply researched reviews that will become part of the permanent literature of the subject and should earn the book a place on the shelves of all serious botanical libraries.

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Books Received

Administration Behavior. A Study of Decision-Making Processes in Administrative Organization. Herbert A. Simon. Free Press, New York, and Collier Macmillan, London, ed. 3, 1976. lii, 364 pp. Cloth, $12.95; paper, $5.95.

Advances in Clinical Chemistry. Vol. 18. Oscar Bodansky and A. L. Latner, Eds. Academic Press, New York, 1976. x, 342 pp., illus. $31.50.

Advances in Sleep Research. Vol. 2. Elliot D. Weitzman, Ed. Spectrum, New York (distributor, Halsted [Wiley], New York). xii, 236 pp., illus. $20.

Algebra for College Students. Max A. Sobel and Norbert Lerner. Prentice-Hall, Englewood Cliffs, N.J., 1976. xiv, 544 pp., illus. $11.95.

Anesthesia for the Uninterested. Alexander A. Birch and John D. Tolmie. University Park Press, Baltimore, 1976. x, 188 pp., illus. Paper, $7.50.

Antiviral Drugs. Mode of Action and Chemotherapy of Viral Infections of Man. Yechiel Becker. Karger, Basel, 1976. xiv, 130 pp., illus. Paper, $30.50. Monographs in Virology, vol. 11.

Applications de la Thermodynamique du Non-Equibre. Bases d'Energétique Pratique. Pierre Chartier, Maurice Gross, and K. S. Spiegler. Hermann, Paris, 1975. 192 pp., illus. Paper, 78 F. Actualités Scientifiques et Industrielles, 1363.

Atomic Energy Levels and Grotrian Diagrams. Vol. 1, Hydrogen I—Phosphorus XV. Stanley Bashkin and John O. Stoner, Jr. North-Holland, Amsterdam, and Elsevier, New York, 1975. xx, 616 pp. $59.95.

Auditory Competence in Early Life. The Roots of Communicative Behavior. Rita B. Eisenberg. University Park Press, Baltimore, 1976. xxviii, 314 pp., illus. $18.50.

Beyond Economic Man. A New Foundation for Microeconomics. Harvey Leibenstein. Harvard University Press, Cambridge, Mass., 1976. xiv, 298 pp., illus. $15.

Biology. Richard A. Goldsby in collaboration with C. Ritchie Bell and seventeen others. Harper and Row, New York, 1976. xxiv, 862 pp., illus. + plates. $14.95.

Butterflies in My Stomach. Or: Insects in Human Nutrition. Ronald L. Taylor. Illustrated by John Gregory Tweed. Woodbridge Press, Santa Barbara, Calif., 1975. 224 pp. $8.95.