

major issues of developmental neurobiology and has grouped them according to several rather large subcategories of problems: morphogenesis, histogenesis, neuronal and glial differentiation, and the establishment of interneuronal connections. The success or failure of his efforts will vary depending upon the knowledge the reader brings to this book. It is not easy to read. The author's habit of defining specialized terms only after he has used them two or three times may frustrate novices, and the habit of describing the same experiments several times in different chapters could well create in the reader a "déjà vu" feeling and the erroneous impression that he has gained some familiarity with the literature of a very involved subject. Despite the obviously erudite and scholarly approach, the internal organization of the chapters and subsections often seems to be randomly determined and may well confuse those readers who expect their introductory reading to present material as an organized procession of hard data and softer interpretations. The chapters could probably be read in almost any order, as with Cortazar's *Hopscotch*. I found the last chapter, which contains Jacobson's own theory of neuronal specificity and a subtle statement of his motivations for studying development, to be a stimulating introduction to the analysis of this book.

These are stylistic points, however, and they will thwart the reader only momentarily. Perhaps more troublesome in potential damage to inexperienced neuroscientists are the author's assertions that the controversies over neurofilament-microtubule interconversions or the reality of axonal protein synthesis are now settled issues. They are not.

Nevertheless, anyone interested in the general problems of cellular differentiation and recognition will find both source material and theory relevant to the nervous system in this very useful book. Read with a dictionary close at hand, this book can be a rewarding and educational reading experience. One minor but noteworthy example (a possible warning for unwary reviewers?) is Jacobson's correct use of the name *Ambystoma* rather than the commonly used and erroneous "*Amblystoma*"; the latter term translates from its Greek roots as "stupid-mouth."

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## Translocation

**Phloem Transport in Plants.** ALDEN S. CRAFTS and CARL E. CRISP. Freeman, San Francisco, 1971. xxii, 482 pp., illus. \$12.50. A Series of Books in Biology.

The subject of translocation in plants is an old and difficult one. Both the tissues through which it occurs and the forces responsible for movement have been contested. The controversies have been lively.

Crafts's early conviction of the merits of the mass or pressure flow mechanism has shaped his scientific career. This book is best viewed as a monograph of his and his associates' work.

In justification, one should point out that the pressure flow mechanism is the only one for which a reasonably sound scheme of operation is readily evident. Its simplicity is beguiling, however, in view of the difficulties and uncertainties others have found in fitting it to all of the accumulated data.

The subject of phloem exudation, a phenomenon that could not be handled critically prior to the aphid-stylet technique, is belabored by the authors, in this reviewer's opinion. Also the importance to physiology of previous evidence for closed pores in the sieve plate is overemphasized. Physiological data have always indicated free movement through sieve tubes, and most physiologists have placed the burden of proof as to the open or closed status of the pores on the anatomists, who, although they originally believed the pores to be closed, now, on reexamination with the electron microscope, find them to be open. The consequences of this development are fully incorporated into the book.

If one approaches the book with these things in mind, together with a consciousness that the authors' aim was "to collect and interpret [italics mine] the experimental information available," one will find a useful compilation of literature and opinions dealing with each of the subtopics of translocation.

The strength of the book rests in the zest with which the authors have searched for and compiled most of the literature even remotely oriented toward a discussion of mechanisms. Some papers whose intent was data gathering, or merely a careful description of the phenomenon of translocation per se, are omitted; there is some carelessness in citing of authors.

A weakness of the book resides in the apparent urge to reinterpret data in a way foreign to the intent of the orig-

inal author. Reinterpretation is perhaps justified in some cases in the light of recent findings on sieve plate pores and is generally acknowledged by the authors, but it nevertheless does present a problem as to whose interpretation is best.

The authors have managed to encompass, judge, and classify most of the available data bearing on translocation mechanisms. The study of translocation benefits from such a book. Prior knowledge of the literature is necessary for the reader, since frequently the arguments require familiarity with papers and often even figures and plates of specific papers. As to its place among books about translocation, this one has no competitors in breadth and depth of coverage.

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## Nematode Worms

**Plant Parasitic Nematodes.** B. M. ZUCKERMAN, W. F. MAI, and R. A. ROHDE, Eds. Vol. 1, Morphology, Anatomy, Taxonomy, and Ecology. xiv, 346 pp., illus. Vol. 2, Cytogenetics, Host-Parasite Interactions, and Physiology. xviii, 348 pp., illus. Academic Press, New York, 1971. \$22 each volume; \$38 the set.

**The Structure of Nematodes.** ALAN F. BIRD. Academic Press, New York, 1971. xiv, 318 pp., illus. \$16.50.

Some of the most fundamental biological principles were established by the study of nematodes, but on the whole these animals are rather neglected by zoologists. With so much emphasis in zoological teaching on evolutionary theory and phylogenetic relationships, the fact that nobody really has much idea as to where they fit in has not exactly helped nematodes to get the attention they deserve. As parasites of man and domesticated animals they have, of course, been treated in courses on parasitology; and the growing realization of their importance as agricultural pests has led to their recognition in courses in plant pathology and, to underline the point, "entomology." But they continue to be neglected as animals in their own right; in my view, the development of the more applied fields of biology will be greatly impeded until this is remedied.

The recent demonstration that some nematodes are vectors of plant viruses has increased interest in them. The zo-

ologist who wishes to broaden his teaching about nematodes is, however, still handicapped by his ignorance. The appearance of the books under review should help him, as well as the specialist, considerably.

The first, a two-volume work devoted almost exclusively to the plant parasitic nematodes, is, in some ways, an up-to-date version of the collective work edited by Sasser and Jenkins in 1960. There are 27 chapters in the two volumes, grouped into sometimes arbitrary sections. The 12 chapters of volume 1 deal with morphology and anatomy, taxonomy, and ecology; the 15 chapters of volume 2 are grouped in three sections dealing with genetics and cytology, biochemistry and physiology, and host-parasite interactions; the last is the largest section and contains, in addition to usual aspects of interaction, chapters on resistant races, nematode enzymes, virus transmission, and culture methods. An indication of the growing strength of the subject is that all contributors except one are active workers in the field of plant nematology whereas in the previous collection some of the most important contributions were by workers on animal parasites.

To detail specific criticisms of the contents of the various chapters would be out of place; they are far outweighed by the debt owed to the contributors for making all this material so readily available.

Specialists will find the work most helpful, and so too will students and teachers of the subject. Its value to more general zoologists, for whom the work is apparently also intended, though considerable, could easily have been increased. For example, Hirschmann's excellent chapter on morphology, the first after the introduction, is general enough and assumes little, yet the reader encounters such terms as "Secernentea" and "Adenophorea" without any warning or explanation. A simple outline of the basis of the relations within the phylum would have greatly helped the excellent chapters dealing with the systematics of the nematode groups of major importance. I also think it would have been helpful if the editors had ensured that the various contributors were more aware of what their fellows were saying; there are numerous instances in which this does not appear to be the case.

One of the most ludicrous features of the nematology scene is the division between nematologists working on animal parasites and those working on free-

living and plant-parasitic forms. In fact, they even go by different names, the former being known as helminthologists. The book by Bird, dealing as it does with the structure of all nematodes, is therefore welcome, not only because it is a very useful volume indeed, but also because it is a major contribution to bridging this ridiculous and harmful gap.

After a discussion of techniques for light and electron microscopy, each tissue is described in turn as observed by means of both instruments, an impressive amount of the observation having been made by the author himself. Function is equated with structure "where possible"—and elsewhere too—and "structure" is interpreted very broadly indeed; for example, a detailed description of embryological development is included. The plates, well chosen, are beautifully reproduced, and the author has obviously gone out of his way to label his diagrams adequately, a welcome departure from an irritating nematology tradition.

The section on techniques is a model of conciseness, although one might have been spared the detailed description of a stage micrometer and instructions on its use. Elsewhere the style is most discursive, and this makes the book very easy to read; but, evidently, the author was not troubled by shortage of space.

Bird is not afraid to speculate; sometimes, however, he is apparently prepared to back so many horses so many ways that it seems he is determined to be right. I am not too happy about his support for the view that the cuticle is bounded by a typical triple-layered membrane, and even less about his view that the eggshell may be bounded by one too. Though bold enough to propose different nomenclature for the shell layers when the facts demand it, he is, alas, not brave enough to call a pharynx a pharynx; his chapter on the gut is almost schizoid as a result of his mistakenly impartial use, synonymously, of "esophagus" and "pharynx," sometimes even in the same sentence.

The so-called "peripheral nervous system" is accepted in both works without question. This is particularly sad in the case of Bird's, for he underlines the nonspecific nature of staining techniques, and the claim, due to Croll and Maggenti, that a peripheral nervous system exists in nematodes is based solely on whole specimens treated with silver nitrate, which, of course, can be reduced by many things in addition to nerve. Smith and Stephenson, in my

laboratory, by careful examination of sectioned material by light and electron microscope, show that Retzius, in fact, was right; the structures Croll and Maggenti revealed are a system of hypodermal membranes (*Nematologica*, 1971).

Both works are remarkably up to date, and a tribute to the publishers and all concerned. But because the subject is advancing so rapidly, the books will also become very rapidly out of date. One wonders, therefore, about a policy which produces such works so lavishly and expensively.

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## Books Received

**Advances in Cytopharmacology.** Vol 1. A symposium, Venice, Italy, July 1969. F. Clementi and B. Ceccarelli, Eds. Raven, New York, 1971. xviii, 476 pp., illus. \$32.50.

**Advances in Microwaves.** Vol. 6. Leo Young, Ed. Academic Press, New York, 1971. xvi, 270 pp., illus. \$16.50.

**Affinity and Matter.** Elements of Chemical Philosophy, 1800–1865. Trevor H. Levere. Clarendon (Oxford University Press), New York, 1971. xviii, 230 pp. + plates. \$14.50.

**Agricultural Development.** An International Perspective. Yujiro Hayami and Vernon W. Ruttan. Johns Hopkins Press, Baltimore, Md., 1971. xvi, 368 pp., illus. \$10.

**Air Tracks and Experiments.** Allen Anway. Koch, Superior, Wis., 1971 (available from Wisconsin State University Bookstore, Superior). iii, 89 pp., illus. \$3.35.

**American Medicine and the Public Interest.** Rosemary Stevens. Yale University Press, New Haven, Conn., 1971. xiv, 572 pp. \$18.50.

**An Analysis of Complexity.** M. H. Van Emden. Mathematisch Centrum, Amsterdam, 1971. xii, 86 pp. Paper, \$3.

**Atomic Safeguards.** A Study in International Verification. Allan McKnight. United Nations Institute for Training and Research, New York, 1971. xxii, 302 pp., illus. Paper, \$6.50.

**Biochemistry of Antimicrobial Action.** T. J. Franklin and G. A. Snow. Academic Press, New York, 1971. xii, 164 pp., illus. \$7.

**Biological Control Programmes against Insects and Weeds in Canada, 1959–1968.** Commonwealth Institute of Biological Control. Commonwealth Agricultural Bureaux, Slough, England, 1971. x, 266 pp., illus. £2.50. Commonwealth Institute of Biological Control Technical Communication No. 4.

**Biological Principles.** Burton S. Guttman. Benjamin, New York, 1971. xxvi, 742 pp., illus. \$12.95.

**Biomembranes.** Vol. 1. Lionel A. Man-

(Continued on page 743)