undergraduates. Nevertheless, this is a very worthwhile contribution to a little-known aspect of an important area of chemical theory, which should be read by anyone with a serious interest in ligand-field theory. The book is well produced, with extremely few typographical errors.

G. DAVIDSON

Bioengineer's dreams

Phloem Translocation. By M. J. Canny. Pp. x+301. (Cambridge University: London, November 1973.) £7.50; $22.50.

THE question of how cells in phloem tissue transport organic foodstuffs, viruses and other material from one end of a plant to the other, remains, tantalisingly, open. The nature of the movement and the force which drives it are still unknown. It is not even agreed about where in the pipelines any forces might be applied.

The reasons for this ripe state of affairs, and suggestions for improving it, are set out in this lively book by Martin J. Canny, Professor of Botany at Monash University.

It is now ten years since Professor Canny first proposed his own hypothesis or model to explain translocation. In the very first sentence of the preface he warns "This book is less a review of a field of plant physiology than a lengthy statement of a point of view about that field which, in the course of the argument involves the review of most of the work". His point of view is that translocation behaves like diffusion but is faster.

The angle of view in part one of the book ("The Experimental Facts", 211 pages) is wide. It gives an interesting, though sometimes closely argued account of the ups and downs of research into translocation; of the quantities translocated; of how the channel of movement was identified; of how patterns and rates of movement and gradients of concentration were studied; of the effects of temperature; of the nature of phloem exudates; of why functioning sieve elements are so difficult to examine and experiment with; and of what is known or controversial about their structure. In particular Professor Canny discusses very fully how the distribution of radioisotopic tracers and their concentration profiles in the transport channels are related to various patterns of flow proposed to occur through sieve tubes.

Part two (52 pages) is divided from part one by a group of 23 plates which contains 45 micrographs and photographs and two line drawings. These are well chosen to illustrate the text and beautifully reproduced.

In part two ("Towards a Mechanism") Professor Canny outlines briefly various mechanisms which have been proposed to explain translocation, and discusses their drawbacks. He then describes his own model as he first based it, in 1962, on hypothetical membranes round transcellular strands proposed by Dr R. Thaine. But he goes on to say that "The prime objection to the model is that the strand structures it uses seem not in fact to be there, nor any such tonoplast-type membranes as were originally imagined as separating them from the sap". Filaments, perhaps gathered together in bundles are all that appear in the electron microscope to warrant his highly sophisticated calculations, which have been criticised[1,2]. He now seems to suggest that "accelerated diffusion" might be caused by flow within (and of?) 250Å diameter tubular filaments, or within "small aggregates of them", and driven by "mechanicochemical means". I find flow through such filaments hard to believe; their resistance would surely be enormous[3]. Far-fetched models have an irritant value which provides much of the spark for research into translocation. But they can become an entanglement.

There are numerous useful tables, graphs, and drawings in the text. These provide essential information from many different sources for those who wish to make their own calculations about translocation, or try their hand at model building. The book has author and subject indexes, and a bibliography with more than 330 references. There are four short appendices.

I found this a stimulating and thought-provoking book. It should be read by anyone who wishes to know more about translocation. It demonstrates vividly how enthusiastic speculation stimulates the search for hard facts.

RICHARD JOHNSON

1 MacRobbie, E. A. C., *Biol. Rev.*, **46**, 429–481 (1971).

2 Crafts, A. S., and Crisp, C. E., *Phloem Transport in Plants*, **277** (Freeman, San Francisco, 1971).

3 Weatherley, P., *Physiol. Vég.*, **10(4)**, 731–742 (1972).

Bacterial envelopes

Bacterial Membranes and Walls. Edited by Loretta Leive. Pp. xv+495. (Microbiology Series.) (Dekker: New York, December 1973.) $38.

IT is fashionable in some quarters to pretend that the prokaryotes are a spent force as research models in biology. This collection of essays, all written by distinguished experts, might be read with great profit by those who promulgate or accept such views. Chapters such as those by Mindich on membranes, by Kaback on transport, by Luria on the colicins, by Tomasz on the uptake of DNA, by Pardee, Wu and Zusman on bacterial division and, despite its specialised title, certainly that by Ghuysen and Shockman on the biosynthesis of peptidoglycan (mucopeptide, murein) all embody principles of general biological importance. In particular the necessary confluence of those interested in DNA replication and nuclear segregation with those interested in cell envelopes, to tackle the fundamental biological problem of cell division, is illuminating.

Although the subject of cell division is mentioned in the title of only one chapter, five out of the total of nine essays deal at lesser or greater length with it. Indeed, it might have been profitable to put together a separate section of the book on this subject, taking and expanding the relevant sections from some of the other chapters. For example, the part of Ghuysen and Shockman's article called "Relationship to Morphogenesis and Division" could well have stood on its own in such a section. This section would also have included the stimulating but maverick article by Henning and Schwarz which points its didactic finger in almost the opposite direction to several of the other chapters, as well as the thoughtful and cautious article of Pardee with its epilogue. This is not to criticise either the book or the editor who has persuaded her distinguished soloists to perform with such crystal clarity of tone, even though she did not integrate them into a consonant orchestra, had this been desirable. It is rather meant to emphasise unsatisfied intellectual hunger stimulated from the brief remarks often made almost as asides by some of the authors.

The generality of the title is a little misleading since some considerable lacunae exist. There are, for example, no serious considerations of energy metabolism, despite the siting of important parts of the electron transport chain in membranes, no general or detailed ultrastructural studies, no biophysical studies, nothing on the export of macromolecules other than DNA, and no serious study of the transport of ions. The latter might have allowed the supporters of the chemiosmotic hypothesis a fair chance to reply to Dr Kaback's strictures on them. A brief mention of the L-forms of Gram-positive bacteria such as *B. subtilis* or *Streptococcus haemolyticus* might have given pause for thought to Henning and Schwarz in their considerations of the determinants of cell shape for, to adopt their style—if membrane, not mucopeptide formation, is alone shape determining how is it that unstable L-forms of Gram-positive bacteria totally without regular shape or division and without mucopeptide