

demonstrably ignorant compared to their animal colleagues (the Cinderella effect?) are frequently pointed out and many chapters suggest where plant horizons could be broadened or at least examined more closely. According to Storey (Vol.2), none of the mitochondrial redox flavo-proteins has been characterized as an isolated enzyme. The contrast with the wealth of spectroscopic data available for plant mitochondria exemplifies the comparatively patchy sophistication of plant biochemistry. Similarly, the important enzyme thymidylate synthase, discussed by Cossins in Vol.2, has not been characterized from plant tissue. On a wider scale, the biochemistry of many basic physiological problems remains obscure, especially when they lie in the interstices of traditional major domains. For example, we have little detailed understanding of the differences in metabolite traffic, involved in energy supply and carbon skeleton provision, between chloroplasts, cytoplasm, mitochondria and peroxisomes in leaf cells in the light and the dark. Graham's chapter (Vol.2) on the effects of light on "dark" respiration addresses some of these questions. The excellent article on translocation of sucrose and oligosaccharides, by Giaquinta in Vol.3, combines a physiological and biochemical approach to highlight key problems such as the mechanism of sucrose unloading from phloem whose further elucidation could have agronomic and economic implications. It is important that plant biochemistry should, like mammalian biochemistry, be increasingly concerned with applying the burgeoning range of new techniques to essentially cellular problems.

As to omissions, I would have liked some treatment of the cytoskeleton in plants and also perhaps a chapter explicitly devoted to transport across the membranes of organelles. The virtual exclusion of growth substances from the consideration of cell wall dynamics and of seed reserve mobilization is also regrettable, although admittedly phytohormones are not within the plan of the treatise. Nevertheless, most topics that one would hope to find adumbrated by the volume titles are covered although the "metabolic" content of Vol.2 is largely carbohydrate; lipids, amino acids, proteins and nucleic acids, and secondary products being dealt with in Vols 4,5,6 and 7 respectively. Much of the contents of these three volumes and of the treatise as a whole are likely to remain valuable sources of reference and perspective for the rest of the decade. They are not expensive in today's terms for what they provide and the semi-autonomous nature of the volumes should enable a variety of permutations to serve the interests of different groups and individuals. The treatise is timely and, like Cinderella, the subject is of some promise. □

Philip Rubery is a Lecturer in Biochemistry at the University of Cambridge.

Muscle: from hypertension to erection

Andrew P. Somlyo

Smooth Muscle: An Assessment of Current Knowledge. Edited by E. Bülbring *et al.* Pp.576. ISBN 0-7131-4348-7/0-292-77569-5. (Edward Arnold/Texas University Press: 1981.) £45, \$95.

SMOOTH muscle cells in blood vessels, bladder, uterus, gastrointestinal tract and airways support and regulate, directly or indirectly, nearly all bodily functions. Nevertheless, physiologists, until recently, have shied away from studying these cells because of their small size, relatively poor ultrastructural organization and great individuality. Our knowledge of the cell physiology of smooth muscle, with a few notable exceptions, is largely due to studies conducted within the past 15 years and, thus, a timely subject for the stated aim of this book — "an assessment of current knowledge". The book is a "family affair"; the editors and contributors are Professor Bülbring of Oxford and her former pupils who, individually and in collaboration, have contributed vigorously to this field. Nevertheless, the volume is not parochial; geographically, the authors range from Oxford to continental Europe, including Russia, and through the United States to Australia and Japan. Intellectually, the contents extend to cover work from laboratories outside "the family" and successfully reconcile previously opposing views, such as the normal occurrence of graded changes in membrane potential in tonic smooth muscles and the existence of smooth muscle regulation by mechanisms independent of the membrane potential (pharmacomechanical coupling).

The major emphasis is on electrophysiology and ion transport, areas of research in which Professor Bülbring and her pupils have been most active. Of what is known about these subjects, the contributions by Brading, Casteels, Jones, Kuriyama and Tomita leave little uncovered. Jones, perhaps having planned successfully his chapter as the basis of a graduate course on smooth muscle, presents a particularly broad view, covering not only relevant aspects of the ultrastructure, electrophysiology and the ionic permeability of normal smooth muscle, but also the membrane properties of vascular smooth muscle altered by high blood pressure. Voltage clamping of smooth muscle is assessed with admirable caution by Bolton, Tomita and Vassort. The application of this technique to tissues having such complex geometries as smooth muscle is a terrain where most researchers fear to tread, and, therefore, the identification of the ionic currents responsible for action potentials in smooth muscles has been ambiguous. The task of identifying such currents is not made easier by the large variations among different smooth muscles in which the contributions of, respectively, sodium and calcium to

the early current are quite variable. Burnstock's contribution on smooth muscle development and innervation and Gabella's extensive discussion of the ultrastructure of smooth muscle successfully relate structure to function. Gabella, incidentally, also reflects the consensus of experienced electron microscopists that, in both relaxed and contracted smooth muscle, myosin is organized in thick filaments.

Given the highly individual properties of smooth muscle cells in different organs and the variety of their functions, the subjects to be covered are limited only by space and the authors' interests. These range from the aforementioned studies of vascular smooth muscle altered by hypertension to the role of penile blood vessels in erection. It may come as a surprise to some that erection is due to the relaxation of smooth muscle of the penile arteries, the flaccid state being the result of vasoconstriction.

The flaws of the book are minor, although the mistaken identification of one of the editors, a Professor of some years standing, as an Assistant Professor is certainly an editorial "bloop". There is considerable overlap between the various chapters covering electrophysiology and ion distribution, perhaps unavoidable in a multi-author volume that is the product of a single scientific "school", and also forgiveable in a book that boasts several thousand references dealing with this subject. It is not a textbook, since some important aspects of smooth muscle, including biochemistry, muscle mechanics and energetics did not fall within this group's research interests and are, therefore, discussed little or not at all. In this sense, this book and the recently published volume in the *Handbook of Physiology* series (*Vascular Smooth Muscle*; American Physiological Society, 1981), of which, I should confess, I am an editor, complement each other well; together they provide an encyclopaedic survey of the field.

Smooth Muscle: An Assessment of Current Knowledge brings us up to date with the use of electron probe analysis and ion selective electrodes, the latter in the laboratory of one of the editors, to verify the unusually high cytoplasmic concentration and activity of chloride in smooth muscle. Perhaps some of the more speculative aspects of this book, such as the postulated binding of calcium to the inner surface of smooth muscle plasma membrane, will eventually also be tested by direct methods.

The book is recommended to those with an interest in smooth muscle and to those wishing to learn about a cell system admirable in its infinite variety.

Andrew P. Somlyo is Professor of Physiology and Pathology and Director of the Pennsylvania Muscle Institute, University of Pennsylvania.