Protons, Electrons, Phosphorylation and Active Transport: R. N. ROBERTSON. Cambridge University Press, 1968. 32s.

THE HYPOTHESIS that ATP synthesis involves charge separation across membranes of subcellular particles, which was proposed some years ago by Mitchell, is now gaining increasing acceptance following the demonstration by Jagendorf and his colleagues of acid-bath phosphorylation by isolated chloroplasts. In this book, which is based on a series of lectures given at Imperial College in 1967, Professor Robertson postulates that the Mitchell chemi-osmotic scheme can be used to explain many different types of ion transport, particularly in plants.

In the first chapter the early history of the association between ion transport across cellular membranes and respiratory processes and the later association with the cytochrome system is outlined. This leads into the second chapter which mainly comprises an explanation of the Mitchell chemi-osmotic hypothesis. Chapter 3 contains a review of the work of Jagendorf and his associates on the interrelationship of proton uptake and phosphorylation in isolated chloroplasts and a review of recent experiments on proton extrusion by mitochondria and the ATP formation which occurs when mitochondria are transferred from alkaline to acidic media. The chapter concludes with a rebuttal of criticisms of the chemiosmostic theory as an explanation of phosphorylation mechanisms.

There is an extremely good review of recent work on ion movements and shrinking and swelling of isolated chloroplasts and mitochondria in Chapter 4. The results are all explained by assuming that the primary ionic movement is a separation of protons and hydroxyl ions as required by the chemi-osmotic hypothesis and that all other effects such as anion and cation movements and either shrinking or swelling follow as a consequence of the proton transport.

Active transport of anions and cations across plant cell membranes is discussed in Chapter 5. There is much less evidence here that proton translocation is a general primary process; however, a convincing explanation is put forward for chloride accumulation which involves separation of protons and hydroxyl ions at membranes of the endoplasmic reticulum and that the separation is maintained by mitochondria which undergo successive cycles of hydrogen-ion extrusion and hydroxyl leakage; as the mitochondria are moving rapidly around the cell these cycles will occur when they are in contact with different parts of the cytoplasm. The schemes for charge separation are summarized in the final chapter together with some comments on future developments.

The book is well written and reads easily. It contains useful summaries of recent important work in this field which in many cases is explained much better than in the original papers. Even though there seems to be little concession to explanations of the phenomena of ion transport other than those based on the chemi-osmotic hypothesis, the book can be highly recommended as an excellent introduction to this extremely important area of plant physiology.

J. FRIEND