I would therefore like to recommend this handbook to all researchers and graduates in botany, phytochemistry, pharmacology, pharmacognosy, agronomy, and also for anyone interested in learning about medicinal plants.

Yoshinori Asakawa
Faculty of Pharmaceutical Sciences
Tokushima Bunri University, Yamashiro-cho
Tokushima 770-8514, Japan
E-mail address: asakawa@ph.bunri-u.ac.jp

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Wandering in the Gardens of the Mind: Peter Mitchell and the Making of Glynn
John Prebble, Bruce Weber; Oxford University Press, 2003, 344 pages, ISBN 0-19-514266-7, £40.99

The second half of the twentieth century saw two major advances in chemical biology. The Watson–Crick DNA model and the identification of the genetic code, initiated modern molecular genetics in explaining the transmission of the genome from generation to generation and the way in which it controls the characteristics of organisms. By contrast, the recognition of the role of proton gradients in both the generation of ATP and its utilisation to provide means of active transport against the energy gradient was a major advance in understanding how biological systems survive and grow in a thermodynamically hostile environment. The basis of this latter was the chemiosmotic-hypothesis (then theory) propounded by Peter Mitchell from 1961 onwards. This book provides a fascinating account of how the theory came about and was developed.

Peter Mitchell was a genius, or at least unconventional in his approach. His theory stemmed from a succession of theoretical models, starting out with a philosophy, already expounded by the Greek philosopher, Heracletus, in which natural systems were seen as statids or fluctoids, the latter being characterised by the environment flowing through a defined space. From there, Mitchell came to distinguish the activities of organisms in space as well as in time. The biochemistry of the day was based largely on kinetics, change with time, with little or no reference to spatial change. Mitchell developed ideas of vectorial biochemistry, involving the directed movement of molecules in which the cell membranes played a pre-eminent role.

These ideas were not welcomed with open arms. The reviewer was present at the Biochemical Society meeting at Oxford in March 1961; the presentation was not helped by some rather pawky traces, and provoked total scepticism from many in the audience. Even in 1968, a seminar attended by senior and junior members in an Oxford College in chloroplast photophosphorylation ended in confusion: what are the intermediates? Name them. It needed a full 20 years before these problems were recognised to be biophysical rather than biochemical.

Yet plant biochemists should know that the evidence was more easily come by with chloroplast preparations. The acid-bath experiments of Jagendorf, and the demonstration of alkalinity in illuminated isolated grana and its discharge with the production of ATP satisfied most. Meanwhile, the mitochondrialists struggled with membrane resides, some inside out, often leaky or partially uncoupled, while chloroplasts provided granal preparations, intact and with the optimum CF_1, orientation.

Nevertheless, by 1978, the walls of resistance to the theory had collapsed, and Mitchell was awarded, unshared, the Nobel Prize for Chemistry. A final battle was to be lost by Mitchell. He hung on too long to a P/O ratio of 3 for oxidative phosorylation, claiming that the cytochrome oxidase stage provided no ATP. With better mitochondrial preparations, Wikstrøm proved to be right, although Mitchell's opposition had provoked experiments, which put the matter beyond doubt.

Phosphorylation was not the whole story of proton gradients. It was recognised that these could be generated by the hydrolysis of ATP by ATPases in all membranes, and with the assistance of uniports, symports and antiports, the proton concentration gradient or its electrical counterpart could provide the energy for the active transport of ions and solutes. An all-embracing theory.

It seems small to cavil about such an excellent account in this book. Yet a mere detailed statement of the chemical intermediate theory, provided by Slater in 1953, might have been given in the appendix, the better to assess its importance in the arguments over Mitchell's theory. During the 1950s and 1960s, investigators were always about to find the elusive high-energy intermediate (rather like the WMDs in Iraq today). Bob Williams's (1959) approach deserved more explanation; he provided the chemical rationale for the utilisation and provision of protons during the synthesis and hydrolysis of ATP, by mass action, but missed out on the essential vectorial component.

This book contains much about Mitchell, his life and loves, his eccentricities, his artistic interests. His health was never good, and it was in a period of poor health that he founded the Glyn Laboratory at Bodmin away from the distractions of academic life, but demanding much time soaking funds to finance it. Tribute is paid to the ever-loyal Jennifer Moyle, who carried out the experimental work, and to able colleagues in Ian West and Peter Rich. For two decades, the laboratory was the Mecca for bioenergeticists.

An excellent book about a deservedly famous biochemist. Very well written, hard to put down. Recommended to any biochemist, to any historian of science as a source book with a complete bibliography, and to any intellectual interested in how scientific investigations proceed.

Vernon S. Butt
Emeritus Fellow, Pembroke College, Oxford University, Oxford, UK

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