

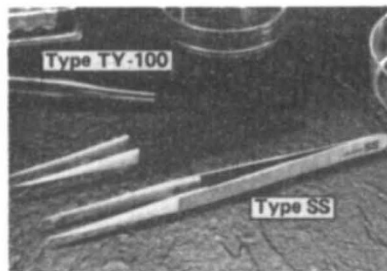
ecologically sustainable society which its editors and authors believe to be possible.

Having emphasized the virtues of these reports, I should point out what they do not offer. They do not provide a comprehensive survey of scholarly and scientific research on the topics covered (nor should this be expected). And, although they are policy-orientated, I believe that few social scientists would regard their views on such matters as adequate or indeed as realistic.

*World Resources 1986* is largely a straightforward and factual account. I have no quarrel with the conclusions reached in the treatment of policies and institutions, but the report as a whole does not address the question of the human will to achieve the "global possible". Neither, unfortunately have social and behavioural scientists seriously addressed this question although some have begun to ask it. The "global probable" would have more to do with values, assumptions, ideologies and behavioural patterns than with ecosystems or energy production. An assessment of human prospects for realizing the possible could be very useful in developing strategies for a sustainable future. □

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## Energy for life

Owen T. G. Jones

**The Vital Force: A Study of Bioenergetics.**  
By Franklin M. Harold. *W.H. Freeman:*  
1986. Pp.577. Hbk \$37.95, £19.95.

BIOENERGETICS attempts to explain how cells generate useful energy and how this conserved energy is used in the enormous range of activities that can be defined as work. As these activities include the capacity to respond to changes in the environment, to move, to grow and to reproduce, it is apparent that a comprehensive account of bioenergetics could encompass much of biochemistry and cell biology. Dr Franklin Harold has accepted the challenge in *The Vital Force*. He not only covers well the expected topics of oxidative phosphorylation, photophosphorylation, ion transport, active transport processes and muscle contraction, but also includes the motility of bacterial and animal cells and the involvement of ion fluxes in the transduction of signals from the cell membrane to the cytosol and the nucleus.

It is, of course, ambitious of one author to range over topics which are so extensive and which are developing rapidly, but his attention to the bioenergetic aspects of these complex events permits him to disentangle common properties of apparently disparate processes. The significance of protein phosphorylation in regulating cellular activities and the ever-increasing evidence of the importance of changes in the concentration of intracellular  $Ca^{2+}$  and other ions in cell division and differentiation support Harold's wide-ranging coverage.

The book opens with a comprehensible and simplified account of the thermodynamics necessary to understand problems of bioenergetics. The author adopts the view that the major disputes of the chemiosmotic wars are now settled and that energy conservation is by mechanisms closely related to those proposed by Peter Mitchell. He does, however, give an account of the background to these disputes — such as whether energy coupling arose from protons extruded into the bulk phase or from protons localised within the anhydrous phase of the membrane — and also explains why there have been such a range of values for the ratio of protons translocated during electron flow to ATP produced. In following his explanations, the reader will gain an understanding of the thermodynamics of ion movement and ATP synthesis and why it is important. From this clear account the reader will also learn what a proton-motive Q cycle is why it is necessary for a satisfactory formulation of the chemiosmotic hypothesis, and the relative merits of redox loops

and conformational pumps as mechanisms to transport protons.

The author is particularly familiar with the energetic problems of microorganisms and he writes on these with authority. Bacteria can face alarming problems of maintaining osmotic pressure and cytoplasmic pH near neutrality whilst growing at a pH 2 or pH 11 or in salt concentrations around 5M. Their strategies for coping with life at these extremes are not fully understood but Harold does show how much information of very general significance can come from the study of relatively obscure organisms. Halobacteria, for example, have the simplest of proton pumps and the determination of its structure has been a great stimulus to thought. One minor criticism is that Harold's description of the reaction centre of photosynthetic bacteria does not include an account of its crystal structure which has so elegantly confirmed the arrangement of pigments and electron transport carriers which he describes. These had been predicted by bioenergeticists from their more usual techniques of measurement of flash-induced spectroscopic changes during the generation of light-driven transmembrane electric field. Such structural studies on complex protein assemblies are at last starting to answer some of the important questions about fundamental mechanisms in energy conservation.

*The Vital Force* is a substantial volume, in size and content. It will be a useful reference book for the specialist and will provide a good initiation for the more general reader. In the area of accepted bioenergetics its coverage is comprehensive and authoritative. On the topics Harold is now claiming for bioenergetics — the cytoskeleton the generation of intracellular signals and morphogenesis — he brings to our attention much important and exciting work. The measurement of the movement of  $Ca^{2+}$  ions is likely to provide as much employment for biochemists and cell biologists in the future as has the measurement of proton movements in the past. □

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### New Editions

- *Energy and the Atmosphere, 2nd Edn.* by I.M. Campbell (Wiley; hbk \$57, £34.95; pbk \$22.25, £13.50).
- *State of the World 1986*, by Lester Brown *et al.*, Worldwatch Institute. (Norton; pbk \$10.50, £7.50).
- *Techniques in Bioproduktivity and Photosynthesis, 2nd Edn.* edited by J. Coombs *et al.* (Pergamon; hbk £24.50, \$32; pbk £12.75, \$17).
- *The Periodic Table of the Elements (2nd Edn)*, by R.J. Puddephatt and P.K. Monaghan (Oxford UP; hbk £15, \$27.50; pbk £6.95, \$10.95).