

troubles began. With no limitations on the number of students entering, and with very long courses before graduation, student numbers were high and teaching was mainly didactic, with the formal lecture to extremely large audiences the predominant mode. There was little small-group teaching and virtually no tutorials and, therefore, little personal contact with the full professors until the student proceeded to the level of serious research and the preparation of a thesis. Reforms were certainly overdue in Germany, France, Italy, Belgium and Holland. These reforms seemed beyond the imaginative power of the academics, at least during crisis, and even if the reforms could have been devised they would have been likely to be beyond the legal power of the university to implement. Therefore the state had to intervene. The forms that this intervention took in different countries are described and assessed in the book.

The overriding impression these accounts give is one of general ineptness on the part of politicians and bureaucrats; in matters of university governance they overreacted and overshot the mark by a large margin. They did so in part because they themselves were unsure of what universities should be and in part because of a rather pervasive mood that participatory democracy was a recipe for harmony in all organizations. A typical result was the imposition of the *Dreigruppenprinzip* on universities by which the governing body was made equally tripartite between elected academics, elected non-academic staff and elected students. The result was predictable; interminable and inconclusive meetings and the obfuscation of the basic truth that university education, whether vocational or non-vocational, is a partnership between the old and experienced and the young and inexperienced in which the former put their knowledge and experience at the disposal of the latter in a way which draws out their talents of intellect and personality as well as providing mental discipline, knowledge and skills. There is a memorable passage in one of A.N. Whitehead's lectures delivered 55 years ago:

Youth is imaginative, and if the imagination be strengthened by discipline, this energy of imagination can in great measure be preserved through life. The tragedy of the world is that those who are imaginative have but slight experience, and those who are experienced have feeble imaginations. Fools act on imagination without knowledge, pedants act on knowledge without imagination. The task of a university is to weld together imagination and experience.

Readers of this book will classify the actors — the professors, the politicians and the bureaucrats — in their own way. They will not always agree with the perceptive comments on this brief but exciting episode in university history, but they will find much food for thought.

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Bioenergetics: is there any demand for quantum mechanics?

Terrell L. Hill

Biology and Quantum Mechanics. By A.S. Davydov. Pp.229. ISBN 0-08-026392-5. (Pergamon: 1982.) \$45, £22.50.

AT THE end of the introductory chapter, A.S. Davydov states the theme of his book:

Undoubtedly the effective use of the chemical energy from food products by living organisms for muscle contraction, the production of concentration gradients, the conduction of nerve impulses, protein synthesis, etc., is associated with the excitation of special weakly relaxing degrees of freedom.

Davydov is referring here to excitons and solitons, especially in one-dimensional molecular systems (for example, the α -helix). If, however, he had used "conceivably" in the above quotation in place of "undoubtedly", he would have been on much firmer ground.

As it stands, most readers with some understanding of modern bioenergetics will be put off by some of the claims in the preface and first chapter. This is a pity because most of the book is, in fact, devoted to a review of assorted subjects in molecular biophysics and bioenergetics. Such a review could prove quite useful in providing a first glimpse of this field for a physical scientist. It is notoriously difficult for many physicists, especially theoreticians, to acquire the necessary background and perspective in order to move into biological research; a guide written by a distinguished physicist ought to ease the pain.

The potential reader should be aware, however, that the discussion of almost every individual topic stops well short of the present state of knowledge and understanding at the molecular level. The treatment of most subjects covered here is roughly five years out of date, that of muscle contraction models and theories even more so. A physical scientist who begins with this book would do well to turn next to the second edition of Lubert Stryer's *Biochemistry* (W.H. Freeman, 1981) to obtain a more thorough and current treatment of most of these topics.

To return to the initial criticism: conventional kinetic, thermodynamic and statistical mechanical concepts provide a completely adequate theoretical foundation, at the molecular level, for the understanding of all of the special biological topics treated in this book. This foundation has to be supplemented, of course, by still incomplete mechanistic and structural details in each individual case. It is not necessary to invoke any relatively exotic quantum mechanical explanations, as the author does (for example, for muscle contraction). This is certainly not to say that such approaches are untenable:

rather, elementary and straightforward explanations should be retained and tested until there is evidence that more complicated theories are a necessity. There is no such need in bioenergetics at the present time.

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A class apart

William Hodos

Brain and Intelligence in Vertebrates. By E.M. Macphail. Pp.423. Hbk ISBN 0-19-854550-9; pbk ISBN 0-19-854551-7. (Oxford University Press: 1982.) Hbk £20, \$29.50; pbk £10.95, \$14.95.

THE histories of comparative studies of brain anatomy and of intelligence in vertebrates have followed parallel, but for the most part independent courses during the past century. Each began with anecdote, followed by a slow accumulation of hard facts. The past two decades have seen a dramatic increase in the amount of data generated in both disciplines and breaks with theoretical tradition.

Euan Macphail's book is an attempt to achieve a fusion of these two fields. Although written with considerable clarity, much of the book does not lend itself to effortless reading. Nonetheless, the exertions of the reader will be amply rewarded by an understanding of the salient issues in the brain-intelligence field and by an awareness of the fallacies, gaps in knowledge and intellectual pitfalls that have bedevilled it since its inception.

Apart from the introductory and concluding sections, each chapter is devoted to a single class of vertebrate and has the same general organization. First, the evolutionary history of the class is briefly reviewed followed by a short account of the taxonomic organization within the class. Next, the author presents a description of the anatomy of the forebrain of some individual species characteristic of the class, before turning to a critical survey of the various types of learning procedures that have been attempted with members of the class. Each chapter ends with a summary and conclusions.

The two introductory chapters discuss the measurement of intelligence in animals and human beings, offer a classification of learning tasks, summarize the evolution and classification of vertebrates and review the literature on general morphological brain indices. The two concluding