

for those in vertebrate neurophysiology. Unfortunately, this aim was not achieved. Most of the chapters are short (average length seven pages) reports of current research on insect vision. Because of their brevity they make few concessions to those unacquainted with the history or significance of the problems. There are, however, some notable exceptions. For example, the paper by K. Kirschfeld is an up-to-date account of his elegant experiments on the fly "neural superposition eye", and M. F. Land has provided a lucid review of his work on the orientation and pattern recognition behaviour of jumping spiders. Although the book fails in its broader purpose, it is for the specialist a useful and interesting collection of research papers.

One of the hopes of the editor is that this book will display the advantages of the arthropod visual system for relating visual physiology and behaviour. But the impression gained from this collection is that, with the possible exception of the optomotor system, there is still a very wide gap between physiology and behaviour. Our knowledge of the physiological organization of the optic lobe is restricted to the periphery; beyond the photoreceptors and second-order cells it is very sketchy. Apart from the papers by R. Hengstenberg, W. Kaiser, and F. Zettler and M. Jaervilehto all the neurophysiological contributions in this book deal with receptors or electroretinograms. On the other hand, the ingenious and elegant behavioural mechanisms adopted by arthropods are amenable to sophisticated behavioural analysis, as shown beautifully by the papers of M. L. Mittelstaedt-Burger and P. Goerner on course-correction and of R. Wehner's group on the various cues ants use to guide their way home. But we are still very far from understanding the physiology of behavioural mechanisms of this complexity.

THOMAS COLLETT

Beyond Reason

Science and Christianity: A Partnership. By Robert E. D. Clark. Pp. 192. (Pacific Press: Mountain View, California, 1973.)

ABOVE the blackboards in the main physics lecture theatre of a Scottish university where I once worked there used to be written in large letters: "Truth will in the end always flow in the direction of the greatest speculative reflection." I never fully understood the significance of this text; but it could equally well do as a short summary of this book by R. E. D. Clark. Dr Clark is a professional organic chemist, and he has written this book to show not so much that there is no conflict between science and Christi-

anity, but rather that the parallels between them are so close that they may be called a partnership. Precisely this word is the sub-title of the book.

Dr Clark sets out to show how similar are the processes at work in a scientist and a Christian. The greatest of these is creativity, for he sees the innovation of the scientist, and of the religious person, as a kind of quantum jump—a creative act that transcends reason. "Logic", he writes, "is the enemy of discovery". To discover, we must be prepared to abandon the past, to believe at least temporarily in things which seem absurd, to accept "reason's humble role", and, having once started on the high road to discovery, not to stop till more and more has been accomplished—certainly not spend time arguing about it with your friends, for then the new light will flicker and fade away.

It is not surprising that such a view involves the author in a strong anti-authoritarian attitude: for the pundits never accept new truth (here there is an echo of Max Planck, who argued that new scientific ideas were not accepted until the older generation had actually died). Our author evidently dislikes the establishment, whether in Church or science, as much as any of those younger folk who are only half his age. Time after time he draws attention to errors accepted by scientific leaders; and he buttresses his argument with a superb collection of quotations and illustrations, many of which were completely new to me.

But is it all as simple as this? Surely the author overstates his case when disparaging the reaction of the scientific establishment to new ideas. For example, although a full acceptance of relativity did take about 30 years, Schrödinger's wave equation of 1926 was universally established and taught by 1936, and the Watson-Crick model of DNA took no longer. The establishment may be slower than some would wish; but the pace of modern scientific discovery, and the number of good scientists all over the world, soon leads to the clearing-up of residual doubt.

Nor is it quite true to argue that you have to forget the past if you would discover the future: it is the "prepared mind" which is most often visited by chance.

Accepting this we come to the sub-title of the book. If science and Christianity are partners, then what are they partners for? And do they ever disagree as they go about their joint responsibilities? The answer to the second question is, surely, yes. There do remain disagreements which no doubt the passage of time will help us to remove. But he would be foolish who pretended that they did not exist. As for the first question, this is left unanswered. If the answer is that both

are seeking truth, we compel ourselves to enquire just what are scientific truth and religious truth. The methodologies of the two movements may be closely parallel, as Dr Clark shows; but there is more both in science and in Christianity than methodology. The author has written an interesting book, but there is still need for a sequel, to lead the reader from methodology to content.

C. A. COULSON

Inconstant Stars

Variable Stars. By W. Strohmeier. Edited by A. J. Meadows. Pp. viii + 279. (Pergamon: Oxford and New York, December 1972.) £6.50.

VARIABLE star research is one of the most active fields of astronomy. Observations and theories of stellar pulsation are fundamental to our knowledge of stellar structure. Much work on little understood phases of stellar evolution centres on variable star studies and these objects retain their importance for studies in galactic structure. The whole field has been given enormous impetus by the application of new techniques which have revealed many unexpected phenomena. Infrared and other work has shown the importance of dust shells around some variables. Some red variables show emission at microwave frequencies. X-ray stars are often variable at either X-ray or optical wavelengths. Recent years have seen the study of objects (for example, eruptive binaries and, of course, pulsars) which vary on a very short time scale.

It would be very difficult for one person to do justice to all aspects of this large field at research level. A general account at a slightly lower level is desirable, however. Professor Strohmeier is an active variable star worker and his book will no doubt be useful to many readers. But mainly because of his attempt to get everything in (quasars in two pages), the book tends to become a rapid summary of facts and conclusions and some theory with little indication of how conclusions follow logically from facts. As a result, the book may prove useful not so much as a means of understanding the subject but as a condensed source of reference. The level of presentation is somewhat variable; for example, there seems little point in giving a description, however brief, of the principle of the photo cell if the UBV system is introduced without explanation. There are some puzzles in the book (Tables 3, 4 and 5 are not referred to in the text, some axes are unlabelled). Table 2 contains some misprints, but is surely memorable for the introduction of a new class of variable. Variables are, apparently, pulsating, eruptive, symbiotic, eclipsing or twitchety.

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