Vital statistics

Collected Papers of R. A. Fisher. Five Volumes. Edited by J. H. Bennett. (University of Adelaide: Adelaide, 1971–74.) A$87.00.

THE University of Adelaide has completed its five-volume edition of the scientific papers of the late Sir Ronald Fisher. These preserve the original typography of the nearly 300 items, and make available, in very agreeable form, all Fisher's important publications in scientific journals and some short articles of more general interest. Unlike other great scientists of this century, Fisher has not been widely known to the public, yet few men have so much changed the face of science. In statistical theory, he has profoundly influenced even those who differed from him philosophically. Almost every field of quantitative experimental and observational science has been affected by considerations of experimental design, of randomisation, and of the practice of statistical tests and inference, most of which can be traced to the impact of Fisher's papers and books between 1920 and 1935. To those who knew Fisher, there is special delight in again savouring the intellectual excitement that the early papers produced and the highly individual style of the author. The argument is often difficult, sometimes obscure, but always strikingly presented. To look again at "Two new properties of mathematical likelihood" is to gain insight into the real nature of statistical inference, so often concealed by the wrappings of rigour in later developments. A series of papers on the rhesus blood factor shows how statistical thought contributed to the unravelling of a genetic complexity—in retrospect simply, but highly controversial at the time. "The logic of inductive inference" remains not only a classic in the development of statistical inference but a superb example of scientific disputation enlivened by human passion. Any library with pretensions to coverage of statistics and statistical genetics needs these volumes, not merely for their historic interest but also for their continuing powers to stimulate new thought, and for the contrast with the pedestrian style and content of so much modern statistical writing. **D. J. Finney**

Control theory

Control Theory in Biology and Experimental Psychology. By F. M. Toates. Pp. 264. (Hutchinson Educational: London, 1975.) £6.50.

ALTHOUGH many biologists, physiologists and psychologists realise that the concepts of control theory provide powerful unifying principles which relate not only the functional behaviour of diverse systems in their own fields, but also the physical systems of engineers and others, there is still great reserve concerning the benefits to be gained from a deep study of the theory. Although a certain amount of reluctance is due to unfamiliarity with the theoretical and numerical methods on which control theory is based, there are even more profound doubts concerning the ultimate usefulness of the subject. Before a biologist embarks on a long and often difficult study, in which he must become familiar with much of the usage of system and control engineers, he must be convinced that the outcome will offer at least one of several possible advantages. He may wish to formally pose problems which are ill-defined in non-numerical terms. Any theoretical or computer studies of a problem must produce results which at least should give reliable guides to the cause–effect relationship in his systems. He should feel confident to extend the use of any mathematical models developed to regimes beyond the scope of his experimental techniques. Above all, control theory should enable him to sharpen his choice of experiments and to plan a unique and unambiguous route of experimental deduction, for it is in the laboratory that the biologist makes his significant contributions.

There is a wealth of literature on control theory written for the specialist, but much of it is little considered outside the realms of the University. Faced with this, the biological scientist first has a considerable threshold of theoretical technique to overcome and then he must be able to discern which of the abundance of control theoretical techniques are useful to him. There is a distinct shortage of books which are written specifically for the biological sciences and which give a sufficient introduction to the mathematical rigour which will be needed. I have seen texts in which an introduction to control concepts has been attempted deliberately avoiding mathematics but, as Dr Toates knows, this is a sterile approach.

The present book approaches the problem squarely, attempting to show the importance of differential equations, and theoretical and numerical techniques for solving them, in studying the transient behaviour of any system. These methods are firmly set in a background of biological and psychological processes which, if somewhat basic, are useful enough to demonstrate the power of the techniques in analysis and deduction. The author has clearly concentrated on systems with which he is most familiar and has not tried to cover an extreme range of examples. The result is a neat text which the control engineer would find fascinating reading and which should lead the biologist gently into a more exacting study of this subject. Only when this step has been made will the considerable potential of control theory for the life sciences be realised.

J. M. Nightingale

Space odyssey

Pioneer Odyssey: Encounter with a Giant. By Richard O. Fimmel, William Swindell and Eric Burgess. Pp. 170 (NASA: Washington, 1975.) $5.50.

THIS is another in the series of commendable little books resulting from the recent (and continuing) exploration of the Solar System by NASA spacecraft. Although the book is in parts self-congratulatory, and reads in places like a publicity handout (which, in a sense, it is), the amount of worthwhile information and the spread of Jupiter pictures from Pioneer provide excellent value for the very modest cost. *Pioneer Odyssey* is highly suitable for use in introductory astronomy courses, but would serve equally well as an introduction to modern planetary science for someone specialising in another discipline but with a peripheral interest in the subject.

A lengthy introductory chapter describes Jupiter, "Giant of the Solar System"—the history of observations of the planet, how its structure probably differs from the terrestrial planets—and gives a thumbnail sketch of ideas concerning the formation of the Solar System. Although the central emphasis of the book is on the technology and techniques of this deep space mission, the section on scientific results from the Jupiter observations (and from study of the interplanetary medium) provides an excellently clear non-technical summary of the Pioneer 10 discoveries. This, and the whole book, is flawed only by the knowledge that Pioneer 11 has since made further investigations which fill out the overall picture rather more fully. I hope that the NASA/Ames team will be persuaded to produce a second edition with a fuller account of the new understanding of Jupiter in the light of Pioneer 11 data. **John Gribbin**