doubtful that their treatment of these alternative arguments and opposing observations will convert the proponents and sympathizers of the selectionist view.

It is my feeling that Kimura and Ohta's book presents a very strong argument that random frequency drift *may* serve to explain much of protein evolution and a major proportion of the observed protein polymorphisms. Clearly, what proportion of these observations *will* be explained by this mechanism remains an entirely empirical question. Existing in their theory are many testable hypotheses. Kimura and Ohta's book is an important contribution to evolutionary biology.

B. R. LEVIN
Department of Zoology,
University of Massachusetts, Amherst

Pest Control Strategy

Microbial Control of Insects and Mites. H. D. BURGES and N. W. HUSSEY, Eds. Academic Press, New York, 1971. xxii, 862 pp., illus. $33.

The first attempts to use microorganisms for the control of insect pests were made about a century ago, and since then the study of insect diseases and their development as control agents has progressed at an increasing pace. With the recent concern about purely chemical means of pest control, and the attendant reexamination of pest control strategies with greater emphasis on the integration of biological agents within control programs, there has been renewed interest in microbial control and an expansion of research effort in this field by industry and government agencies. Because of the specificity of many of the microorganisms causing insect disease and their apparent harmlessness for nontarget organisms, microbial control offers a means of selective suppression of many insect pests without the disruptive effects of broad-spectrum chemicals.

In this new book, the editors have brought together the expertise of over 40 contributors to provide an authoritative assessment of the present and future potential of microbial control of insects and mites. With 33 chapters by different authors, some unevenness of treatment is inevitable, but the central theme of practicality, together with careful editing, has minimized the disjointedness.

Early chapters provide a guide for the identification of the more common insect diseases and are followed by appraisals of the main groups of pathogens with respect to their status and use as control agents. Readers unfamiliar with the field are thus able to obtain essential background information otherwise widely scattered in the literature. *Bacillus thuringiensis*, the commercially produced pathogen most widely used in microbial control, is the subject of more detailed treatment, a reflection of the greater body of knowledge available concerning its structure, biochemistry, and host specificity. The main body of the book consists of reviews of the many factors affecting the potential of microbial control in pest management programs. Attention is given to the safety of microbial control agents for vertebrates and to the interactions of these agents with other insect pathogens, environmental factors, and chemical insecticides. The editors' declared intent to point out areas where further research is required is well fulfilled by the discussion of the possibilities of pest resistance to microbial control agents and of the safety of pest-insect pathogens for beneficial insects, concerning which the paucity of information is such that any appraisal of long-term effects in the field must be largely speculative. Clearly, the reactions of both pest and beneficial insect populations to repeated exposure to microbial control agents should be investigated as a matter of urgency.

The closing chapters of the book are concerned mainly with the economics and production of microbial control agents, and are of more interest to the specialist. Although formulations are discussed, there is, regrettably, relatively little information given on field application techniques, which are often of critical importance to the success of microbial control schemes. There are seven useful appendices giving sources of information and materials of particular relevance to microbial control. As a whole, the book provides the most authoritative and thorough coverage of microbial control in the English language, presented in such a manner as to be comprehensible to students and workers unfamiliar with this field. It is probable that it will become the standard reference work on the subject for some years to come.

DUDLEY E. PINNOCK
Division of Entomology,
University of California, Berkeley

The Sciences of Heat

From Watt to Clausius. The Rise of Thermodynamics in the Early Industrial Age. D. S. L. CARDWELL. Cornell University Press, Ithaca, N.Y, 1971. xvi, 336 pp., illus. $11.50.

Bicentenary of the James Watt Patent for a Separate Condenser for the Steam Engine. A symposium, Glasgow, Sept. 1969. ROBERT DONALDSON, Ed. Published for the James Watt Bicentenary Committee by the University of Glasgow, Glasgow, 1971. 224 pp., illus. £2.

From Watt to Clausius is detailed, explaining unfruitful as well as fruitful ideas leading to the engineering sciences of heat transfer and thermodynamics, and it follows a chronological pattern. It thus emphasizes rather than suppresses the confusion of diverging and converging chains of ideas and indicates the distance that lies between a logical textbook exposition of a science and the tortured path that its development actually followed. The book is intended for teachers of thermodynamics as an antidote to the arbitrary and sterile treatment usually found in the textbooks they use. It would be a pity, however, if other readers were not also attracted to the book, for Cardwell, a historian of science at Manchester University, has much to offer even those who will not follow all of his arguments to their conclusions. His insights speak not only to the sciences of heat but also to the nature of scientific thought and understanding.

He points out, for example, that most engineers acquire from textbooks not only their knowledge of the substance of the sciences they use but their ideas of the very nature of science. The notion that engineers think only in logical fashion, often asserted as a fact by engineers, certainly derives in part from the assumption that a textbook reflects the logical (and thus the only possible) development of a science.

Cardwell also describes some of the distortions that result from the chauvinistic tendencies in textbooks of thermodynamics. In the pioneering textbook of P. G. Tait, for example, British contributions are stressed at the expense of others. It was Tait who claimed that Newton was responsible for the doctrine leading to the mechanical theory of heat. Actually, the concept of caloric, an imponderable fluid flowing from a higher to a lower temperature, being absorbed by a body as it was heated and squeezed out of a