All but two chapters concentrate on a single survey of 2945 whites conducted during the winter of 1968 in 15 northern cities for the National Advisory Commission on Civil Disorders. There is therefore no possibility of causal inferences and the generalization of the findings to the nation as a whole. Yet the results are consistent with national survey findings over the past two decades, though the author fails to do more than hint at the relevant literature.

The study shows that most white urbanites in the North reject notions of the innate inferiority of blacks. But they tend to believe that blacks are largely responsible for their own condition and therefore should improve themselves. A majority favor antidiscrimination laws in hiring and promotion; but they equivocate on open housing ordinances. Overwhelmingly, they reject white counterviolence.

The analyses of the social correlates of these attitudes are disappointing, for they barely go beyond those provided earlier in Campbell's article with Howard Schuman in the supplementary volume to the Advisory Commission's report. Two interesting findings are uncovered, however. First, special samples in the Cleveland and Detroit areas revealed no sharp differences in the racial attitudes of suburbanites and central-city residents. Second, a suggestive age-sex-education interaction emerges. Among both young and old women, the college-educated are consistently more favorable in their racial views. But only among those under 40 years of age is college shown to have had this effect on men. Campbell speculates that colleges since World War II have made a significant difference in moderating the racial beliefs of their students; and this stands in marked contrast to the lack of effect in these data of churches and secondary schools.

The most critical findings derive from secondary analyses of three national voting studies conducted by the author and his colleagues in 1964, 1968, and 1970. Three surveys designed for a different purpose are hardly ideal sources of data, but better ones are not available. Campbell's successive findings, like those of other studies (not mentioned in the book), show a steady though not dramatic improvement in white racial attitudes during these riot years. This improvement appears quite general across regional, educational, and age categories. Particularly noteworthy are the significant increases in the percentages of both blacks and whites who report having friends of the other race. Campbell cites reasons for expecting this trend toward favorability to persist.

White Attitudes toward Black People was not written for a technical audience and can be recommended to all interested readers. Despite its neglect of the relevant literature and failure to probe deeply, the volume offers a useful overview. But there still remains the national need for intensive, longitudinal data on this and related subjects gathered specifically for the purpose every three or four months. Only a major commitment from an agency such as the National Science Foundation can satisfy this need in the future.

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Nonselectionist View

Theoretical Aspects of Population Genetics. MOTOO KIMURA and TOMOKO OHTA. Princeton University Press, Princeton, N.J., 1971. x, 220 pp., illus. Cloth, $12.50; paper, $5. Monographs in Population Biology, No. 4.

The application of the biochemical techniques of electrophoresis and protein sequencing has led evolutionary biology into a new and exciting period and theoretical population genetics into somewhat of a dilemma. Estimates of the frequencies of polymorphic loci and rates of gene substitution obtained from protein data are orders of magnitude greater than the frequencies and rates that can be explained by traditional genetic models of natural selection. Efforts to explain these observations have led to two major lines of justification, one involving the development of alternate, more ecologically based models of natural selection and the other involving the development of the stochastic theory which can account for these observations by the occurrence of selectively neutral or near neutral mutations. It is this latter approach that has been developed and championed by Kimura and Ohta in the recent periodical literature and that is the major theme of their book.

As the title indicates, a number of topics of population genetic theory are treated. The book includes a consideration of the fate of individual neutral and selected mutations in finite populations, a concise and lucid account of molecular evolution from a genetic viewpoint, some treatment of the theory of genetic load, linkage and selection, effective population size, breeding structure, mechanisms for the maintenance of genetic variability, and the role of sexual reproduction in evolution. Although their approach is primarily theoretical, Kimura and Ohta make extensive use of the recent empirical literature. As is the case with the other books in the Princeton series on population biology, Kimura and Ohta's book is not a textbook but rather a personal view of its subject. It has a recurrent theme, the importance of neutral mutations and finite population effects as an explanation for a major portion of the observations on protein evolution and protein polymorphism. I quote: "Protein polymorphism can thus be regarded simply as the transient phase of molecular evolution. In this view, the protein polymorphisms and the molecular evolution are not two separate phenomena, but merely two aspects of a single phenomenon caused by random frequency drift of neutral mutations in finite populations" (p. 152).

Much of the underlying mathematical treatment has been relegated to the appendix or exists in other cited sources. The verbal treatment of the subject is lively and for the most part quite lucid. The mathematics presented in the text is generally straightforward and should not present an excessive challenge to most biologists. In a number of cases numerical simulation results are presented both to check mathematical approximations and to illustrate points. However, most of the authors' arguments for neutral mutations and finite population effects as an explanation for the protein evolution and protein polymorphism data are not empirical. To accept their thesis requires acceptance of their mathematical treatment.

The arguments Kimura and Ohta present for the neutral gene hypothesis seem thorough and convincing. Their arguments against alternative, selectionist, hypotheses and opposing empirical observations seem less so. In some cases, alternative mechanisms such as truncation and regulation selection and potentially opposing empirical observations such as the similarity of gene frequencies for polymorphic proteins among subdivided populations are dealt with somewhat summarily. It seems

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.

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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.

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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