REVIEWS

GENETICAL STRUCTURE OF POPULATIONS. K. Mather. Chapman and Hall, London. Pp. 197+25 text figures. £4.00.

Professor Mather's latest book provides a clear insight into evolution in action through a genetical study of populations. The central focus is on quantitative variation, and the underlying polygenic systems which are capable of providing the smooth adaptive change to environmental pressures demanded by the Darwinian concept of evolution. Quantitative inheritance is an area of study in which Professor Mather has long played a leading role and his easy familiarity with this subject has been combined with a wide knowledge of natural biological situations to achieve a very valuable synthesis, in a most readable form.

In a short introduction the theme of the book is established as the interplay of heritable variation and natural selection. The second chapter considers types of variation and advances a lucid explanation of why genic, particularly polygenic, rather than chromosomal variation is the basis of evolutionary change. Chapter 3, entitled "Equilibria" briefly discusses principles and classical concepts of changes in gene frequencies by reference to a single gene locus. The mathematical treatment is restricted to a few simple algebraic formulae. The Hardy-Weinberg law, the effects of inbreeding, mutation and selection are all placed in context, and an opportunity is taken to emphasise the importance and consequences of competitive and frequency-dependent selection under natural conditions. It is pleasing here to see concepts which in the past have often served to confuse rather than clarify put into a reasoned perspective. For example, does the concept of "genetic load" as it has been defined and used (*i.e.* in an absolute sense), contribute to our understanding of populations and their structure? The author cannot see that it does, in so far as fitness is comparative and disabilities dependent on the environment—in particular the competitive environment. These qualifications will particularly appeal to those plant and animal breeders who may have been puzzled by some aspects of the controversy surrounding the concept (and the related one of gene neutrality), since they continually are aware that they can give prominence to some traits and enforce neutrality on others only if the organism is compensationally buffered from environmental factors—particularly competition. In Chapter 4 the theme is expanded to consider the special properties of polygenic systems in relation to their capacity to store and release variation, and this is followed by a short chapter on types of selection and their impact on the systems.

The remaining four chapters are devoted to considering these properties in relation to the life-styles and life-cycles of natural populations. The genetic system (which comprises reproductive mode, outbreeding control and chromosome system) is seen as a means of governing the rate of release of polygenic variation, ensuring that enough is offered for steady environmental pressures but avoiding any wastage in response to short-term fluctuations. The genetic systems too are under (the ubiquitous) polygenic control and usually, like good democratic government, can be changed in response

to environmental demands. However, their responses are ruled by the controls which they have themselves instigated and absolute dictatorship can arise as obligate inbreeders, apomicts or asexuals. But because of the strict orthodoxy these impose they are inflexible and thus contain the seeds of their own defeat and ultimate extinction. The penultimate chapter considers the way the machinery of government can be built up to deal with diversified requirements—through disruptive selection. Where there is specialisation for niches within the population's habitat which are separated in space and time this results in new emergent species. The inevitability of this, even with 50 per cent gene flow if selection pressures are high enough, is striking. If specialisation occurs for interdependent functions within the population the result is a system of closely integrated polymorphisms each with an appropriate environmental or genetic switch mechanism (*e.g.* sex). All these principles are related to ecological observation and experimental evidence in a full and well-balanced discussion. The book concludes with a chapter on the importance of the individual organism as an integrated unit of the population and outlines what inference may be drawn in relation to the structure and evolution of human societies.

Biologists will be relieved to find that although the approach is quantitative the mathematical treatment is reduced to a bare minimum. The few elementary algebraic equations and statistical concepts used provide a quick intuitive grasp of individual topics and allow these to be considered jointly as interactive forces in the whole complexity of evolutionary change. Those mathematicians who demand formal proof may be less satisfied with this approach. Nevertheless, they will gain much from a study of this book. It sets out clearly what is important in our present knowledge of evolutionary dynamics of populations and hence what is relevant in mathematical model building. Particularly, the need to consider the integration of the whole genetic system with the full complexity of environmental forces spells out the dangers of oversimplification for the sake of mathematical expediency. At the same time it presents a challenge for developing mathematical descriptions of fully realistic models which can circumscribe and predict more rigorously the capacity for change.

In a synthesis of this sort there are bound to be assertions which will require further experimental evidence before they receive unqualified acceptance. In this sense the book has to be regarded as a framework to be buttressed and modified by further observation, experiment and mathematical modelling. It is unlikely, however, that the edifice will require drastic reshaping.

The author considers that although genetic systems and polygenic variation are by no means the whole of the picture, they are of central importance in our understanding of population structure. The book convincingly demonstrates this. It is particularly valuable in bringing together in a most logical fashion, and with a sustained coherence, evidence and argument which have hitherto existed in fragmentary form. It assumes a basic knowledge of genetics and chromosome behaviour and is aimed at the advanced undergraduate and post-graduate student. It should be required reading for these. It clearly should also have wider appeal to research workers in all branches of genetics, and to all those interested in the application of genetic principles. In the author's words . . . "the action of selection in the past must determine the capacity for response to selection

in the future" and in this sense plant and animal breeders will have a particular interest. Perhaps too few sociologists will have the necessary genetic grounding to fully appreciate the theme. This is a pity. It leads to a fuller understanding of human society and, so perhaps, to a more sympathetic appreciation of the problems in achieving co-operation and integration of race and creed.

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INTRODUCTION TO BEHAVIORAL GENETICS. G. E. McClearn and J. C. DeFries. San Francisco: W. H. Freeman, 1973. Pp. 349. \$10.00.

McClearn and DeFries have provided a restrained and well-documented introductory textbook to a heterogeneous area of research encompassing large aspects of genetics and psychology. The growth of psychogenetics and the belated recognition of its social significance have created a need for a cool appraisal of the evidence which led geneticists and psychologists to claim at least some genetical basis for behavioural differences. The importance of behavioural variation can only be appreciated fully against a background of genetical and evolutionary theory so the authors introduce their work by a historical perspective illustrated by pertinent quotations from the writings of pioneers in biology and psychology. There are necessary chapters on elementary genetics and statistics which are aimed at remedying the educational deficiencies of psychologists on the one hand and biologists on the other. These chapters are a prelude to a systematic consideration of the behavioural consequences of single gene differences and cytological abnormalities. Further chapters relate the mechanisms of gene action and development to behavioural traits. Their account of population genetics considers the quantitative aspects of inheritance and evolution in relation to behaviour and is followed by a chapter which reviews various approaches to the understanding of behavioural evolution and the evolutionary consequences of behaviour. A final chapter "Behavioral Genetics and Society" considers "perennial problems" including the genetics of schizophrenia, intelligence and criminality and evaluates the wider importance of behaviour genetics. Towards the end the authors make a plea for a changed outlook with which it is easy to sympathise: "We need also most urgently for the old nature-nurture dichotomous model to be replaced in the citizenry at large, as well as in the perspectives of the social and behavioral scientists, with a model of genotype-environment co-action . . . a naive environmentalist position . . . may lead to ignorant decisions" (p. 311). This book should inspire interest and enlightenment among those to whom it is addressed.

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AN INTRODUCTION TO ANIMAL BREEDING. J. C. Bowman. Studies in Biology No. 46, edited by the Institute of Biology. Edward Arnold, London. Pp. 76. £1.70 (Boards), £0.85 (Paperback).

This is a highly condensed account of the genetical basis of animal breeding practice. Single genes and the elements of population genetics are dealt