Richard Goldschmidt. Perhaps the kernel of these doubts lies in the suggestion that the relevant new variation should make possible the exploitation of previously unexploited environments or, to use contemporary imagery, the mutations must be able to rewrite the programme not merely introduce new parameters into an existing programme. These thoughtful essays may be commended to all those whose evolutionary horizons are bounded by enzyme polymorphism and the circumstances of its occurrence. How relevant is such variation to evolutionary change in phenotype? If it turns out that there is some correspondence between morphological and behavioural complexity and the physical organisation of the genome, Waddington's doubts may in due course appear prophetic.

There are plenty of stimulating ideas in this book and any biologist of a reflective frame of mind will find profit in these pages, while the historian of science will scan them for clues to the way the author's very active mind worked.

FORBES W. ROBERTSON
Department of Genetics, University of Aberdeen

GENETICS AND BIOGENESIS OF MITOCHONDRIA AND CHLOROPLASTS. Edited by C. W. Birky, Jr., P. S. Perlman and T. J. Byers. Ohio State University Press, Columbus, Ohio. Pp. 361+67 text-figures. Hardback $15.

I approached this book with considerable misgivings. For, in the most rapidly moving area of genetics, it is distanced by an eighteen-month publication lag from the colloquium held in September 1974 whose proceedings it contains. However, on closer examination, the situation is by no means bleak, and this book has a good deal to commend. The list of contributors is a distinguished one, representing many of the best North American workers (including Attardi, Mahler, Perlman, Birky, Hoober, Sager, Wildman and Laughnan) plus two very good choices from Britain (Griffiths and Tilney-Bassett). This extraordinarily well-balanced choice of contributors ensured an extensive coverage. Furthermore, in at least some cases, the manuscripts appear to have been updated to offset partially the publication lag. Sager, for example, refers to her article with Kitchin on selective silencing of eukaryotic DNA, which did not appear in *Science* until August 1975. A number of the papers, especially those of Mahler *et al.*, Perlman and Birky, take an approach which is sufficiently historical on the one hand and analytically abstract on the other to merit serious consideration as material for teaching advanced undergraduates. I think that it can be combined with Sager's *Cytoplasmic Genes and Organelles* to provide most of the essential reading material for a course in organelle genetics in a convenient way. At least, I intend to try it in my organelle genetics course this coming year.

H. N. ARST
Department of Genetics, University of Cambridge

THE DISTRIBUTION OF THE HUMAN BLOOD GROUPS AND OTHER POLYMORPHISMS. A. E. Mourant, Ada C. Kopeć and Kazimiera Domaniewska-Sobeczak. Second edition, 1976, 1055 pp. Oxford University Press. £55 net in U.K.

During the two decades that have passed between the first and second editions of this book, information about human polymorphisms and their

distribution has increased considerably, and certain changes, such as the use of computer programmes for calculating gene frequencies, have been introduced. Available information on the distribution of the human blood groups, blood proteins, haemoglobins and other biochemical polymorphisms is tabulated by Mourant and his colleagues. In all, 67 genetic systems are extensively tabulated and 36 maps illustrate their distribution. There is a relatively short text of 138 pages commenting on the main findings.

It is scarcely necessary to say that Mourant has done more than anyone else to document the distribution of the different blood group systems in the populations of the world and that this massive compendium is his legacy to science. The large amount of work was shared with Dr Kopeć, who undertook most of the statistical analyses, and Mrs Sobeczak, who carried out most of the literature searches. The work is accurate and readable, and is likely to remain a standard reference for at least a generation. It may remain so far longer. The fashion for discovering polymorphisms is passing in favour of detailed studies of histocompatibility antigens, immune response genes and their relationship to disease. These are not included in the present volume. In any case, future studies of blood groups and biochemical polymorphisms will be used to supplement the present book rather than replace it.

The enormous genetic variability in human populations revealed in the studies listed by Mourant and his colleagues leaves the reader impressed. The interpretation of the observations is still for the most part uncertain. As pointed out on page 126, " We are thus, at the present time, almost completely frustrated in our attempts to account for the blood groups and their widely varying frequencies in different populations. At present nearly all their known functions are harmful, mainly haemolytic disease of the newborn and (solely in the context of twentieth century medicine) transfusion reactions. Yet man has a score or more of these elaborate polymorphisms. . . . It therefore seems highly improbable that they do not have a positive function."

Certain selective effects have been described. The best known is the relationship of sickle-cell haemoglobin to malaria. Another is the protection against foetal loss through ABO incompatibility given by haptoglobin 1 (as compared with haptoglobin 2). Several diseases have been associated with particular blood groups, but the underlying mechanisms are unknown.

A currently expanding area of research is on the definition of the structures of blood-group antigens and identification of glycosyl transferase and other enzymes, the presence or absence of which determines whether a particular antigen is synthesised. Glycoproteins and glycolipids on cell surfaces are also being investigated in detail in normal and diseased cells. For example, the glycosyl transferases appear to be involved in intercellular reactions. Studies of this sort may reveal the advantage of possessing particular enzymes and the associated blood groups. It should then be possible to go back to the observations usefully tabulated in this volume and explain the distribution of the blood groups. At present we can only speculate on the extent to which the frequencies of most human polymorphic genes are due to random processes and how far they are due to natural selection in different environments.

A. C. Allison
M.R.C. Clinical Research Centre, Harrow, Middlesex