Genetic diversity among Australian Aborigines.

(Australian Aboriginal Studies Research and Regional Studies No. 3.) By C. Balakrishnan, L. D. Sanghvi, and R. L. Kirk. (Pp. ix + 115; 18 figures + 15 tables + 6 maps. \$4.95-Aust.) Australian Institute of Aboriginal Studies, Canberra. 1975.

The aboriginal populations in different parts of Australia have attracted many biological and social studies, and have provided an interesting setting for the application of models, ecological, genetic, and demographic, in an endeavour to understand the processes by which the population differences have been brought about. The present monograph examines the diversity among aboriginal populations in the frequencies of Mendelian traits detectable in samples of blood. The first chapter summarizes the available information for blood groups, serum protein groups, and red cell enzyme systems, much of which data derive from the excellent survey work of Kirk and his colleagues themselves. There follows a useful discussion of methods of measuring genetic distance, which leads in chapter 3 to the application of cluster analysis to groups of populations from the northern territory, the western desert, the Cape York peninsula, and finally to a more comprehensive analysis incorporating these and covering a wide area of Australia. The measure of distance employed is the B statistic of Balakrishnan and Sanghvi (1968), and the results are visualized in diagrams by extracting and plotting the first three principal components of the distance matrix. Comparing the results with geographical distance, linguistic differentiation, and climatological data, the genetic distances indicate a general differentiation proportional to the geographic separation of populations, but with a few important exceptions in the case of some island groups and a migrant group into north-east Arnhem land. The genetic differentiation in general also agrees with the linguistic pattern.

These concordances are both rewarding and curious. They establish that the genetic differences between the Australian aboriginal groups are certainly not random, but the exciting implications are by no means fully discussed. The discussion of measures of genetic distance is primarily mathematical, and there is little criticism here. The authors recognize the primary difficulty of the B statistic, the need to pool dispersion matrices which may be quite different from one population to another, but point out that on other grounds B is to be preferred as a distance measure (e.g. it takes into account sampling variation and properties of the phenotype distributions); they justify their theoretical argument by comparing the results using 10 different distance measures and show that it makes little difference which measure is used.

It is essentially in the biological discussion where one would have wished for more. The results are dismissed in a few all-too-brief paragraphs couched in terms of successive immigrant waves, with further differentiation due to drift, selection, and fresh mutation, which could almost all have been said at the outset. The authors recognize the difficulties of small sample size, of identifying tribal or linguistic affiliation in samples from localities such as church missions or government settlements. But one wonders how far samples from such locations relate to particular family groups, and how far the present results may represent not population frequencies and distances but those of the few families that are represented. The patterns that emerge perhaps argue against this. A similar positive relation of genetic distance with geographic distance and with linguistic differentiation in Northern American populations was shown by Spuhler (1972), and comparison of the two continents would show whether there is some fundamental rate of genetic change with these.

The present work is obviously the starting point for further studies. The programmes are written, the material is accumulating, and the next step is for the authors to utilize what is already achieved in an endeavour to quantify their interpretations. For example repetition of the analysis, but omitting one locus at a time, would perhaps indicate which loci are more aberrant and hence which are candidates for recent selection. Altogether this is a remarkable study whose results carry implications which will stimulate population genetic studies, not only in Australia, for some years to come.

D. F. ROBERTS

Chromosome Variations in Human Evolution.

Edited by A. J. Boyce. (Pp. vii + 131. £5.00.) Vol. XIV of the Symposia of the Society for the Study of Human Biology. London: Taylor and Francis Ltd. 1975.

Volume 14 of the Symposia of the Society for the Study of Human Biology is based on papers presented at a Symposium held in January 1974. Contributors are distinguished and chapters are concisely written, pertinent to the overall theme of the symposium, and well illustrated. References are provided for more detailed reading. Much of the work described is either not previously published or not otherwise easily obtainable in a form acceptable to the lay reader. There are useful author and subject indices. The present reviewer would have found a more extended glossary of value.

Chapters 1 to 4 discuss findings in chromosome gross morphology, DNA content, and gene localization pertinent to an understanding of human evolution. The

past few years have seen the introduction of a new range of techniques in mammalian cytogenetics, e.g. G-banding, C-banding, R-banding, and T-banding. Chapter 1 expertly elucidates the different merits of some of these techniques in an easily readable manner. The author has some interesting points to make with regard to interspecific and intraspecific comparisons. In Chapter 2 the chromosomal characteristics of man and the anthropoid primates are enumerated and discussed with respect to phylogenetic significance. Chapter 3 illustrates the usefulness, in evolutionary terms, of an analysis of repetitive DNA differences between species. Findings substantiate the argument that the ancestor to the gibbon diverged from the higher primate stock before divergence of the common progenitor of the other higher primates. Support is also given to the views that the Asiatic apes are more distant from man than are the African apes and that the separation time between the chimpanzee and the orang-utang may have been just as long as that between man and the chimpanzee. There do, however, seem to be important differences in the rate of change between ribosomal genes (28S) and 'unique genome' DNA. The contribution of somatic cell hybridization to genetic analysis in man is reviewed in Chapter 4. The possible evolutionary significance of these findings is discussed. It is probable that gene localization studies will prove fundamental to an understanding of evolutionary processes in man.

Chapter 5 discusses environmental agents that result in chromosome damage in somatic tissues *in vivo*. This review is comprehensive and of particular interest to the medical practitioner concerned with the use of ionizing radiation, non-ionizing radiation (e.g. ultrasound), and chemical mutagens. The next chapter, which makes stimulating reading, is essentially a quantitative assessment of the part played by chromosomal aberration in prenatal loss in man. The author points out that many of the environmental factors believed to be associated with a raised incidence of chromosome abnormality have arisen in recent times and in the developed countries. The final chapter deals with the frequency and type of chromosome abnormality observed in the liveborn and will be of particular interest to the practising physician. Surveys of the type described are expensive and difficult to organize: they are, nevertheless, crucial for a proper assessment of the pathological effect of individual chromosome abnormalities. The author raises the possibility that testicular failure in the infant male may have important effects on psychosexual behaviour in the mature individual. She also suggests that routine screening for chromosome abnormalities at birth would be a worth-while medical procedure.

The Society for the Study of Human Biology has performed a valuable service in publishing this compact and up-to-date review which will be of interest to all those concerned with human evolution and chromosome abnormality as a cause of developmental abnormality in man. At £5.00 it is very reasonably priced.

C. E. BLANK

Chromosome Hierarchy. An Introduction to the Biology of the Chromosome. By Bernard John and Kenneth R. Lewis. (Pp. viii + 171; 50 Figures + 27 Tables. Paper covers: £3.50; boards edition: £7.00.) London: Clarendon Press; Oxford University Press. 1975.

This book considers the structure, behaviour, and cellular functions of chromosomes, and their role in evolution. The chromosome is depicted as a hierarchy of interdependent genetic units, rising from nucleotide to genome, through codon, cistron, and linkage group.

The opening chapter discusses the molecular aspects of gene synthesis in relation to chromosome structure, including the effects of mutation. This is followed by a chapter on chromosome architecture which includes sections on the chemical composition, physical topography, and mechanical activities of chromosomes during nuclear division. The chapter on epigenetic activities illustrates the wide variety of control systems which have evolved at all levels of the genetic hierarchy as a means of regulating gene activity. In this interesting and informative chapter, sections on gene amplification, inactivation, and elimination at the chromosomal level are followed by a section on cell differentiation, in which hormones and chromosomal proteins are implicated in genetic control at the molecular level. The remainder of the book is devoted to the significance of chromosomal mutation in evolution and includes detailed coverage of the meiotic behaviour of structurally rearranged chromosomes.

The book is an erudite review of the elements of genetics, in which the chromosome is seen as the organizational hub of the hierarchy of hereditary units. It will be appreciated by those who already have a knowledge of genetics and cytogenetics, but it is not a text for the uninitiated. In this respect, the subtitle, 'An introduction to . . .' may be misleading. The book will be of value to anyone who teaches cytogenetics, and to students who intend to specialize in the subject, but will be of limited interest to many readers of the *Journal of Medical Genetics*.

A. McDERMOTT

Chromosomal Variation in Man. A Catalog of Chromosomal Variants and Anomalies. By Digamber S. Borgaonkar. (Pp. xvii + 230. £8.25.) Baltimore and London: The Johns Hopkins University Press. 1975.

Chromosomal Variation in Man is intended to complement the McKusick's 'bible' on the *Mendelian Inheritance in Man*. A similar computerized system of cataloguing has been used and though the Johns Hopkins Press is the publisher in both instances, it is a pity that the quality of the production of Digamber Borgaonkar's book is not equal to McKusick's. Between the hard covers most of the book has been xeroographed—or was this only a poor copy for the reviewer?

The book is unevenly divided into a section on the structural variation and anomalies of chromosomes (190 pages), numerical anomalies (20 pages), and chro-