

parts of the molecule and especially between pairs of subunits in the tetramer ($\alpha_1\beta_2$ contacts). A major aim of this work is to understand the peculiar sigmoid form of the oxygen-dissociation curve which adapts it to its physiological role. This type of curve is a property of the tetramer, with its two kinds of constituent chains, α and β , and is attributed to some kind of interaction between these subunits such that uptake of one molecule of oxygen by one of them facilitates uptake by others (so-called haem-haem interaction). At present the resolution of x-ray analyses of Hb is about 3.0 Å but information about movements a good deal smaller than this can in principle be obtained by other less direct methods. Among these electron spin resonance and nuclear magnetic resonance have been much used and several papers in this symposium deal with them. They have proved valuable in examining the structure of smaller, simpler molecules and are now being applied to much more complicated ones, such as proteins. In these methods spectra are obtained by putting the molecule in a strong magnetic field and exposing it to microwave radiation. These effects depend on quantum-mechanical energy states of some of the atoms or groups of atoms in the molecule and are particularly useful for studying the valency and spin states of the haem iron atoms and their reactions with oxygen. The interested reader will have to judge for himself whether any clear conclusions emerge from the papers presented in this section of the symposium.

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THE GROWTH AND STRUCTURE OF HUMAN POPULATIONS: A MATHEMATICAL INVESTIGATION. By Ansley J. Coale. xvii + 227 pp., figures, glossary, index. Princeton University Press, Princeton, New Jersey. 1972. \$9.50 (cloth).

This book is an exceptionally good one, well written, well organized, and well produced. Its aim is "to explain the rela-

tionships between specifiable features characterizing sequences of fertility and mortality schedules, and the consequent general structure of birth sequence or age composition which results." While employing a mathematical approach, Coale never loses sight of his demographic goal, nor contact with his non-mathematician reader.

The book begins with a discussion of the nature of human mortality and fertility schedules, including some extremes of these rates found in human populations worldwide. The second chapter is the best, and clearest, description of the stable population ever written. Not only does Coale discuss all basic parameters and concepts of the stable population, including those of two-sex populations, but he directs his attention especially to revealing the interrelationships among the basic parameters. He does this largely by using approximation formulas, most of which are new and many of which will prove to be very useful. The effects of changed vital rates on the age distribution are discussed. Coale then presents a new general theorem relating the maximization of *any* age-specific characteristic of the population to its age pattern of incidence. He also considers typical differences in human mortality and fertility schedules in this chapter.

Chapter 3 is a thorough discussion of the approach to stability of a population with fixed vital rates. The effects of the dominant and of the secondary (oscillatory) roots of Lotka's basic renewal equation on the trajectory of births over time are analyzed. Given various starting populations, Coale examines their paths to stability to show the behavior of the stabilization process. This discussion of the approach to stability is not available in any other book.

Coale then follows with a discussion of the effect on the birth trajectory of (1) changes in overall fertility level, (2) changes in overall mortality level, and (3) oscillatory fluctuations in fertility. Each of these cases is examined by making reasonable simplifying assumptions, and is directed to understanding the demographic relationships rather than to equation-solving. His methods of approach will lead the way to investigating other situations. This is followed by an ad hoc, totally

descriptive method of fitting Fourier series to the past history of births.

The book concludes with an outstanding and comprehensive review of itself. This is presented in intuitive, non-mathematical terms, and serves to summarize the demographic findings of the book. Coale always aims at the demographer and shows an unusually frank appreciation of the strengths and weaknesses of his approach. It is rare to find this kind of perspective, and the candid nature of the conclusion convinces one that few, if any, weaknesses have been hidden.

The meagerness of the treatment of changing mortality rates is unfortunate, in light of their importance in analyzing demographic transition, currently a major problem. Also, sections on oscillatory fertility and Fourier analysis of birth history are interesting but rather academic, as Coale himself states. It would have been better had these sections been shortened and other, more directly applicable, variations in fertility and mortality patterns been considered.

The stable age distribution can be fitted well to contemporary national and to anthropological populations, and is therefore a useful method of short-term demographic analysis. However, the use of constant exponential growth rates is unrealistic for long-term studies of human populations. It is unfortunate that this Malthusian model of population receives continued development while the problem of modeling populations which reach ecologically stable zero-growth equilibrium is ignored. At least the problem should be acknowledged in a book with so general a title.

The book treats only the continuous case, because Coale wants to reveal analytically how the age structure comes about and "to help us to see by inspection what age structure would result from a specified sequence of fertility and mortality schedules." Most basic relationships which Coale derives can be expressed in approximate discrete terms. However, dynamic studies generally require the use of the Markov matrix analog of Leslie, which Coale does not discuss. Therefore, what Coale has revealed analytically must be simulated by matrix projection using specific data.

It is doubtful how applicable this book is for many anthropologists. First, it is a mathematical approach and requires a calculus background at least. Second, and more important, its methods require far more data than we are privy to. In particular, the analysis is largely concerned with processes over time, and time depth is the weakest area of anthropological data. Although some of the book is thus beyond our present means, the discussion of the stable population alone is worth the price of the book, and we can certainly apply much of what he has done already. This is especially true of simulations which many people are using at present. The book is so clearly written and so idea-oriented that it is sure to be a lasting work, and should be in the library of anyone seriously interested in human demography.

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PREHISTORIC BIOLOGICAL RELATIONSHIPS IN THE GREAT LAKES REGION. By Richard Guy Wilkinson. vii + 161 pp., figures, tables, appendix, bibliography. *Anthropological Papers No. 43*, University of Michigan Museum of Anthropology, Ann Arbor. 1971. \$3.50 (paper).

Wilkinson's monograph provides a further example of how biological and cultural evidence can be used in conjunction to reconstruct prehistoric events, and consequently, is of interest to both biological anthropologists and archaeologists. The study attempts to clarify some problems involving Middle and Late Woodland populations from the Great Lakes area by analyzing the biological relationships between certain archaeological populations. Biological distances between populations are estimated by multivariate discriminant function analysis and computation of Mahalanobis' D^2 .

Wilkinson's use of regression analysis to predict missing metric data seems to be the best solution so far to the problem of maximizing sample size while minimizing the artificial intrasite homogeneity produced by substituting group means for missing data.