

New Guinea populations. Other features reflect more recent gene flow between late Holocene immigrants and the Orang Asli. Overall genetic differences are less than the perhaps more superficial distinctions in skin color and hair. Soehardjo reports frequencies for four alleles for the Short Tandem Repeat (STR) system TH01 in 100 individuals representing a Surabaya/East Javan population and suggests this system can be used in forensic analyses and paternity testing. Nakajima uses a nerve lamination technique to elucidate the relationship between structure and function in the masticatory muscles. Patterns of innervation conform closely to expectations based on movement. Kidd reports on a series of measurements of the talus, calcaneus, navicular, and cuboid bones from humans representing Southern China, Roman and Victorian Britain, and South Africa (Zulus). Canonical variates analyses demonstrate significant differences among three geographical groups: combined British, Zulus, and Southern Chinese. Oxenham and colleagues describe in detail individual cases of trauma from the northern Vietnamese archaeological record and find that the risk of major trauma was greater during the Da But (~6,000 years BP) versus Metal (~2,500-1,700 years BP) Periods. Gutnik and colleagues compare repetitive movements of the upper limbs in three groups of males (undergraduates age 17-30 years, nine trained squash players age 17-18 years, and six persons age 78-99 years) in terms of "simple harmonic motion of mass-spring systems and computed the stiffness of the involved muscles" (p. 113). The athletes most closely resemble the model of simple harmonic motion of the upper limb and exhibit the highest stiffness and the elderly males exhibited the lowest values. Ali and Ohtsuki study growth in three maturity groups of Japanese boys and girls (n = 423 and 243, respectively). They are grouped into early, average, and late maturity groups three ways: 1) 10th and 90th percentiles, 2) mean  $\pm$  1 standard deviation (SD) for age at peak height velocity (APHV), and 3) mean  $\pm$  2 SD of APHV for early and late maturity groups, respectively, and in general, early-maturing children, age 2-13 years, are taller than average-maturing children and both are taller on average than late-maturing children. However, differences in predicted adult statures among the

three groups are statistically insignificant. Artaria documents the physical growth and functional development of 1,691 Javanese schoolchildren age 6-19 years living in Malang, East Java, Indonesia. She found nutritional status to be adequate but the majority of children did not attain optimal growth relative to reference standards. Finally, Gurry describes the biological consequences of and the social and historical contexts for the castrations performed on young boys considered worthy of voice training from 1650-1850. Italy was the center for this practice that coincided with the rise and popularity of opera.

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DOI: 10.1002/ajhb.10100

*Paleodemography: Age Distributions from Skeletal Samples.* Edited by Robert D. Hoppa and James W. Vaupel. xiv + 259 pp. Cambridge, UK: Cambridge University Press. 2002. \$80.00 (cloth).

Paleodemography has a checkered history and this book will mark a milepost. Its 12 chapters contain a diversity of opinions, a hopeful sign that past periods of stagnation are behind us.

The subtitle indicates the focus of the book: "Age distributions from skeletal samples." For some contributors the basic question is how to estimate the ages of a series of (often incomplete) skeletons of unknown genetic and lifestyle history. For all, the next question is how to deal with the fact that the estimated age of each individual is not an accurately pinpointed specific age. Some contributors concentrate on the means by which age indicators can serve as the starting point for the generation of an age-at-death distribution, a more sophisticated approach to the old problems of adjustment and smoothing of data. Some seem to ask whether the distribution will be meaningless if the starting age indicators are inadequate.

Chapter 1, by Hoppa and Vaupel, introduces "the Rostock Manifesto" on the need for: 1) new, well-tested age assessment methods; 2) statistical methods to find the

probability of observing certain morphological characteristics in a known-age skeleton; 3) primary attention paid to the probability of a skeleton having a certain age, given the morphological characteristics of that skeleton; and 4) recognition that the probability of a skeleton having a certain age cannot be calculated without some idea of the mortality schedule of the population. This is an interesting precept, since the age-specific probabilities of death are the values we seek. Four steps of analysis are outlined, leaving out several that others might consider essential.

In Chapter 7 there is a useful summary of the purport of the manifesto (pp. 131–132). Labeling a statement of interest a “manifesto” may suggest constraint, and rigorous adherence to the Rostock Manifesto is mentioned (p. 217), but many of the contributors focus on the complex issues subsumed under point 1 and tension between the statistical and osteological perceptions is implied (p. 74), indicating a healthy diversity of approaches.

In Chapter 2, Hoppa provides a brief historical overview and discusses whether the pattern of human mortality and the rate and nature of human senescence are stable enough throughout time and different lifestyles to allow estimation of past ages at death (yes and questionable, respectively, according to Hoppa). Hoppa provides a good overview of further issues, ending with the just observation that osteologists cannot control material to suit their questions.

Chapter 3, by Usher, lists known age collections that can be used as reference samples. This is perhaps more appropriately published as a note in a journal soliciting information; the listing is available on the Web, but without corrections on the items I checked. The chapter ends with the statement that 20th Century reference samples must be assumed “to give valid information for estimating the ages of medieval European peasants. Without this assumption, no paleodemographic data would be valid” (p. 41). Yet Hoppa has already questioned this assumption on p. 11.

Chapter 4, by Kemkes-Grottenthaler, provides an excellent overview of studies of age indicators, apart from one of the few editorial oversights I noted (“culminating” used incorrectly). She states that all markers used in age assessment are “inherently flawed” (p. 53) and urges that research be

directed towards the rate of morphological change with age and the exploration of intra- and interpersonal as well as interpopulation variation. She emphasizes that the elderly are not aged adequately and concludes that interest in the causes of age changes and in the use of multiple changes from various regions of the body should be the focus of the future; both are good points, but neither here nor elsewhere is there adequate discussion of the fact that age indicators from different regions of the body have different trajectories of age-dependence.

Bolsden and four other authors in Chapter 5 look at four issues: the unavoidable uncertainty of adult age estimation, the influence of the distribution of ages in the reference sample, how to deal with the intercorrelation among age indicators, and how best to score morphological changes with age. They propose a method to determine probability of death in small samples. They suggest first the use of a uniform probability of death over all adult ages, justifying this by saying that “the age information contained in a skeleton. . . is much greater than the age information that comes from knowing that it was randomly sampled from a particular adult mortality profile” (p. 78). They develop a multicomponent method of observing age-dependent changes (an approach questioned in the previous chapter) and suggest new traits for older individuals. The rather counterintuitive relationships of proliferations at ligament attachments with sex, robusticity, and conditions leading to bone proliferation or bone loss are not considered. The statement “there has been little reason to look for” indicators of advanced age (p. 95, see also p. 81) demonstrates the stranglehold that former preconceptions have had on anthropology. The authors make a number of good points in applying their method (information said to be on the Web, but unavailable). A striking suggestion is that differences may be so great as to require separate reference samples of the appropriate sex and ethnic group (p. 91). The authors state that, in their experience, their subjective assessment of skeletal age is as good as any single method yet developed (pp. 95–96).

I find Chapter 6 by Wittwer-Backofen and Buba the most interesting, since it is in line with my own approach of developing multiple adult age categories using discontinuous

and continuous traits and identifying the "oldest old" and key individuals in younger adult categories in order to establish *sample-specific* variations of morphology and rates of change from one age category to the next. The chapter is an excellent report on a validation study of cemental annulation on 500 modern teeth.

Chapter 7, by Wood and others, is a well-written and clear exposition of mortality models with the ideas firmly grounded in demographic and biological realities. Differential mortality between the sexes and among the different broad age groupings is emphasized.

In Chapter 8, Paine and Boldsen use a ratio of early to late childhood deaths in order to examine changes through time. The use of such ratios has a long history and satisfies the need for a method of generating data which are comparable. The choice of age 5 as the cut point needs discussion, but the use of material only from Central Europe, and presumably aged by the same standards, makes the general approach reasonable. Since we are given no information on sample sizes (and could justifiably assume that the Iron Age is represented by few and poor samples), the value of the database cannot be judged. The chapter ends with a test of the effect of epidemic cycles of different lengths. To have individuals beyond infancy surviving an epidemic and then succumbing to its return is an unusual idea. It is acknowledged (p. 176) that "biological realism" will have to be introduced. In fact, patterns of age-specific susceptibility and mortality, general and disease-specific, are the first elements the authors should consider, since they are modeling "age-independent" death (p. 175). Their conclusion is that their data are "highly improbable" (p. 178) and perhaps biased; a discussion of the data might have been more fruitful.

Love and Muller, early in Chapter 9, make the following statement "...a skeletal remain [sic] with age-at-death A has the same probability of being assigned into category C for all populations, and the population from which the skeletal remain is derived does not influence the assignment. This is a minimal assumption that must be made to analyze the target data. Any assumption that is weaker would make the analysis virtually impossible" (p. 185). Data available to me indicate that this assump-

tion is not true even within restricted time and ethnic groupings. Further, it is pointed out (p. 223) that the analysis here is carried out with the assumption of a multilevel response with no ordering, clearly inappropriate for senescent stages.

In Chapter 10, Holman, Wood, and O'Connor suggest that little can be done to improve on age indicator methods (a contradiction of a statement made in the previous chapter, p. 183), but that statistical methods can be improved. Attention is directed towards multiple nonindependent age indicators, with the aim of producing "some parameters [which] may be of genuine biological interest" (p. 196). One untenable assumption is that missing data are "missing at random" (p. 198), but the conclusion emphasizes the need for practicality and realism. Their plea for the identification of numerous binary and continuous indicators (p. 218) seems unrealistic.

Testing methodology on the reference sample by drawing a subsample of that reference sample is regarded as questionable, but in Chapters 10 and 11 (pp. 214, 225), tests are done in that fashion. However, the tests are of statistics, not of biology. We will eventually require practical demonstrations that the statistics overcome the basic problems of osteology. In fact, based on "necessary assumptions" (p. 238), success may prove elusive.

In Chapter 12, Hermann and Konigsberg perform a test using Indian Knoll, the subject of several previous analyses. The reference sample ages of stage transition (p. 249) (when expressed as integers) suggest that especially the pubic indicator would be unsuitable for detailed study of samples with many middle to old-age adults, but since 120 years is specified as the close of the adult age range, we would expect a lengthening of the right tail of all curves. They conclude that previous survivorship curves were not significantly different from that generated here (p. 255), as supported by the age-specific survivorship figures given (p. 253). A major difference from Kelley's recent study of Indian Knoll lies in the numbers estimated as dying between ages 30 and 40 years. The authors suggest (p. 251) that "some would say" osteological rather than statistical methods may be the cause, so we need more detail on Kelly's methods. The matrix (p. 251) providing details on the 346 adult individuals for whom two age indica-

tors could be observed indicates bimodality in the later pubis indicator stages and the equivalent matrix from the Terry Collection would have provided an interesting comparison.

The focus here on one aspect of paleodemography is certainly justifiable because the problem is major. We can hope that somewhere here is the beginning of a pragmatic approach to the problem of estimation of adult ages within the framework of ap-

propriate population parameters relative to the damaged and incomplete nature of archaeological samples.

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DOI: 10.1002/ajhb.10101