

Physical Anthropology in Micronesia: A Closing Statement

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The present session has emphasized in large measure the critical problem of identifying the ancestral origins of Micronesians, of seeking out the roots of the colonizers of the region's many far-flung islands (Brace *et al.*, Howells, Pietrusewsky, Turner this volume). The discovery of new island homes, a process doubtless repeated again and again in an on-going spread across the Pacific was, however, only the first step. Whatever their ancestral sources, Micronesians are the descendants of the members of those founding colonist groups who survived and successfully flourished after reaching each island's shores. Demographic processes were critical in achieving these successes, as also in producing the genetic and biological characteristics of past and living Micronesian populations.

Population biologists and biogeographers, as MacArthur & Wilson (1967) eloquently showed, provide convincing theoretical reasons and empirical data to confirm the bleak prospects of achieving long-term ecological success in the distant island habitat by limited numbers of founders, even of highly motile individuals belonging to species with characteristically rapid rates of reproduction and generation turnover. Computer simulation models (McArthur *et al.* 1976) produce high probabilities of extinction for human groups under varying conditions of initial colony size, marital restriction systems, or mortality and fertility schedules. While relaxing these model constraints enhances probabilities of survival, the retention of one condition—maximum population size of $N = 500$ —assures that random processes affecting population structure make likely the potential extinction of simulated island populations under all tested conditions.

Thus, ecological and demographic considerations suggest maximum likelihood of successful colonization for populations which achieve high rates of increase in numbers, at least during early settlement periods and until carrying capacity limits are approached. Ethnographic data (e.g. Birdsell 1978) provide examples of human groups at different technological levels which have approximated the maximum intrinsic rate of increase for limited periods of time after moving into open environments. Certainly there is no reason to suspect that Micronesians were incapable of similar feats on repeated occasion during the limited time span in which settlement of Micronesia could have taken place, as now indicated by archaeological studies (Bonhomme & Craib 1987). High birthrates in Micronesia are likely to have occurred in continuing response to demographic instabilities among populations on smaller islands and atolls and in socially segmented populations living on high islands (Underwood 1983). I would suggest that the requisite excess of births over deaths needed to fuel rapid growth rates in these closed populations was effected in large part by a "Micronesian pattern" of reproductive behavior, with women bearing at least as many children in the latter part of their reproductive lifespans as at early ages (Kubary in Lessa 1978, Underwood unpub.). As the outcome of this pattern was

always subject in the last resort to control through infanticide of children born later in a woman's life (cf. Hainline 1964), it also provided a mechanism for relatively rapid and reversible responses to changing conditions. Thus, Levin (1976: 110) reports that the ". . . great increase in fertility on Eauripik has been caused by the raising of age at birth of the last child since age at birth of the first birth has remained relatively unchanged and spacing between children has not changed significantly during the twentieth century."

On the other side of the demographic equation, ecological considerations would predict relatively low mortality levels among founding and settler groups, horticulturalists and fishers, as they expanded into habitats renowned for lack of predators and pathogens (Pirie 1972, Ritter 1978). Historical documents repeat the tragic story of death and depopulation which followed the Contact period introduction of infectious and venereal diseases, but osteological studies describe aged and edentulous individuals who obviously survived many years (Katayama 1985, Pietrusewsky & Batista 1980), some after recovering from serious injury (Pietrusewsky & Douglas unpub.). In brief, some individuals lived to advanced years, despite handicaps, recovering successfully from trauma and illnesses (iron deficiency anemia, yaws), while others died at all ages, suffering from periostitis, osteoarthritis, dental caries and periodontal disease and, surely, from a wider variety of maladies and specific diseases which are undetectable from skeletal analysis.

Levels of infant and childhood mortality among prehistoric populations as indicated by Hanson's analyses of Rotanese remains would certainly depress overall population growth rates despite impressive levels of completed reproductive performance by adult females. But it is probably premature to judge whether such mortality levels were characteristic of Micronesian populations in general. Pietrusewsky & Douglas (unpub.) identified eight preadults among 35 individuals recovered at Nan Madol, Pietrusewsky & Batista (1980) found one subadult in the cranial remains of 28 to 33 individuals from the San Antonio site on Saipan, and Pietrusewsky (unpub.) identified seven subadults out of 27 individuals whose remains were recovered from the Pre-Latte age site (Fujita) at Tumon Bay. Hanson (this volume) notes that his estimates of infant mortality trends are in contradiction with Pietrusewsky's findings from the latter remains. However, in the context of discussing dietary restrictions, Hanson alludes to archaeological evidence from Rota of an evident decline through time in reliance on pelagic resources, a shift with considerable demographic implications.

Accurate reconstructions of population size and composition from Micronesian skeletal collections must inevitably suffer from the absence of remains of those individuals, mainly adult and juvenile males, who failed to return from fishing expeditions. Historical reports occasionally recorded the safe arrival of survivors at other Pacific islands, even the Philippine Islands (Underwood 1973, 1989), but it is certain that many more voyagers were less fortunate. The consequences, even under fertility-maximizing mating systems, could only have exacerbated the effects of other stochastic processes, constraining fertility, reducing effective population size (N_e) and exaggerating inter-island variation.

Archaeological and ethnographic reconstructions suggest that later settlement periods on high islands were often characterized by horticultural intensification, sociopolitical elaboration and declining population growth rates (Hunter-Anderson 1981, Parker & King 1981, Cordy 1982, Athens 1983, Haun 1984, *inter alia*). Decreasing use of pelagic re-

sources and increasing single-crop dependence may have been accompanied by the extinction and/or disuse of such animal protein sources as pigs in the Palau Islands (Intoh 1986), dogs and rats on the Truk Islands and in the Western Carolines (Takayama & Intoh 1978, Sinoto 1978, Intoh 1981) and, perhaps, of domestic fowl in the Mariana Islands (Egami & Saito 1973). More intensive use of reef resources and areas by numerous populations on high islands could only have led to conditions favoring the spread of intestinal parasites, which constituted a more likely cause of iron deficiency anemia than any hemoglobinopathies associated with disease resistance. Any decline in male mortality resulting from a de-emphasis on fishing would have been far outweighed by the increased morbidity and mortality risks to which all, and children particularly, were exposed from synergisms of protein deficiencies and heavy infestation loads. And, I would suggest, we should anticipate as a result some stress-related morphological differences between populations of high and low islands, differences which were not leveled out by any genetic exchange which accompanied continuing interactions, well-documented in archaeological and ethnographical materials, between high and low islanders (Takayama 1981).

I am awed that we can speak here with some statistical sophistication about the biological relationships of Micronesians with other peoples of the Pacific and of adjacent world regions. Poor preservation conditions, variant methods of corpse disposal, geomorphological dynamics, and the limited numbers of pioneer groups preclude any chance of directly determining the composition or biological attributes of founder groups. Even those osteological remains which have been recovered must surely include appreciable proportions of individuals whose premature deaths removed them from direct ancestry and an indeterminate number of mature individuals who may have made no lasting contribution to the gene pools of descendant populations.

Now there is a need to develop a more ecologically- and demographically-oriented framework within which to integrate the results of very different kinds of data and approaches to the study of Micronesian physical anthropology. Continuing efforts to identify the changing selective pressures to which prehistoric colonizers and settlers were exposed, exemplified in Pietrusewsky's many contributions and in Hanson's analyses here of Rotanese materials, are a beginning part of interpreting the results of comparisons of DNA sequences, mitochondrial DNA, HLA antigens and a host of biochemical traits in living Micronesian populations. In turn, the study of biological attributes of living populations can inform the efforts of those whose seek to unravel from osteological materials intra- and inter-relationships of island peoples, to discern the common and divergent features of microevolutionary processes operating in small population isolates in Micronesia over a few millennia.

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