BOOKS: ANTHROPOLOGY

Wandering Genes

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When Alfred Cort Haddon published *The Wanderings of Peoples* in 1919, he reflected anthropologists' fascination with migration. In the following decades, the topic rapidly became unfashionable, and independent adaptation and cultural diffusion became the preferred explanations for similarities among human populations. But the advance of molecular anthropology and the emergent consensus for a recent African origin of modern humans have brought migrations back to importance in anthropology. Alan Fix's *Migration and Colonization in Human Microevolution* is a major contribution and one of very few significant works on this topical issue in recent decades.

The book's six chapters review the theories of human migration; describe the ecological, demographic, and socio-cultural parameters that shape migration in ten well-studied human populations; and use these case studies to identify key factors influencing migratory patterns. Fix discusses the applicability of classic population genetics models, and he uses computer simulations to explore the outcomes of complex situations. He reaches three major conclusions: (i) The principles behind population and phylogenetic perspectives on human diversification should be integrated analytically to explore the mechanisms underlying branching and more dynamic population events. (ii) The frequent violation of the assumptions underlying classic population genetics models call for the development of more complex models, for which computer simulations are the main tool. (iii) A theory of human migration (one based on the relations between migration and demography, ecology, and culture) is needed to test the applicability of different models to past events.

Migration and Colonization in Human Microevolution
by Alan Fix

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Fix, an anthropologist at the University of California, Riverside, argues that several key factors shape the outcome of migrations. Social and ecological factors can be correlated with patterns and frequency of movement of individuals among populations. For example, low-density, low-intensity foragers marry distantly, whereas high-density, high-investment agriculturalists marry locally. In forager societies, long-distance kin networks are associated with an absence of higher political structure, but in horticultural societies that absence (very prominent in disputes) is linked to population fission. Political stratification generates variation in mobility within populations, through different costs and benefits of land tenure and local marriage. Geographic and demographic factors illustrate the importance of integrating actual parameters into models, as parental and recipient populations rarely have equal population sizes, demographic stability, or constant migration rates. But it is in showing the complex interaction of deterministic and stochastic processes that these factors play a central role.

On the move. As depicted in the Codex Boturini, four god-bearers lead the migration of the Aztecs from Aztlan.

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The author discusses most of the major factors linking migration and microevolution. Although classic population genetics predicts that gene flow will lead to homogenization, under certain circumstances migration can increase the differences between populations. Fix examines these circumstances in his discussion of the usual assumptions made for six key factors underlying the classic migration models. He shows how the results can differ from those predicted by spatial correlation, stepping-stone, and isolation-by-distance models. One factor is the timing of migration during the human life cycle. Outcomes can depend on whether dispersal occurs before or after childhood mortality (which is often high) has altered population variance. Another is a consideration of the "unit of migration": gametes, individuals, families, or larger groups. Smaller units increase the probability that migrant gene frequencies will differ from the population mean. Kin-structured migration (KSM), involving relatives with a shared genetic ancestry, can also increase the stochasticity of migration. The movements of groups of relatives can augment the genetic effects of migration on both recipient and parental populations. If gene frequencies of groups of relatives migrating to different destinations are more dissimilar than those of random groups from the parental population, KSM can even result in a negative correlation between geographic and genetic distances. Simulations show that complex models of kin-structured "trait groups," representing units of natural selection within a kin-structured mating hierarchy, can account for the rapid evolution of certain genes. To the factors that Fix discusses, I would add another: gender-specific mobility and reproductive variance. Increasingly evident in the distribution of female and male lineages, this potentially allows faster evolutionary rates in male lineages through repeated lineal-founder effects.

Above, I mention how recent developments in genetics has brought migration back to anthropology. Fix's book brings anthropology back into theories of migration. Human societies are not static, dimensionless, homogeneous units flowing through featureless environments. The improved resolution provided by recently developed techniques for uncovering the evolution of human diversity now has to be matched by more sophisticated models of migration. Fix's exploration of the complexities of human migration and his many examples (in which the book is enormously rich) are the greatest contribution he could offer the field at the moment. The assumptions of classic population genetic models or the branching pattern of gene genealogies fail to reconstruct the dynamics of human history. Computer simulations, as illustrated by Fix and others, are one of the key ways forward. Another is an increased integration of paleoanthropology and genetics in formulating hypotheses, so temporal dimensions can be added to models based on demographic and ecological parameters. The book's chapter on migration in human evolution reflects the fact that this has not yet happened. The major questions of what shaped the human dispersals over the past 100,000 years and what determined the social boundaries that constrained or stimulated population exchange remain unanswered.

Nonetheless, as a contribution towards a general theory of human migration, Fix's book is extremely successful. *Migration and Colonization in Human Microevolution* will be an important source for students and specialists in a variety of fields. Haddon would have been delighted.