

Using Genes to Track Down Migrations

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Migrations have played a constant and important role in the history of the populations of Europe. Migrations in prehistoric times are not well documented and one can use genetic information, obtained from current populations, to support or refute various hypothesized migratory events. Historical documentation of more recent migrations changes the emphasis in studies relating genetic patterns and population movements. In such cases, the genetic information testifies to the biological consequences of the migration event which may, or may not, be far reaching. In my talk, I shall discuss one example of each of these situations, drawing upon the populations of Europe.

The first example concerns the mode of spread of agriculture in Europe at the beginning of the Neolithic. It is generally agreed that European farming originated in the Near East (Anatolia) about 9,000 years ago and spread from there into Europe by well-known paths. Were these paths the tracks of new populations of farmers, who displaced the indigenous hunter-gather populations of the Mesolithic, or was this a case of cultural diffusion, with knowledge of agriculture spreading, but not the people? The first alternative would lead to clear genetic consequences, the second would not. A mechanism for the former process called "demic diffusion" has been postulated by Ammerman and Cavalli-Sforza (1984). Its effect can be tested by means of genetic distances tested against design matrices that represent the demic-diffusion model. The results are unequivocal. There is strong evidence from several genetic systems that the present distribution of gene frequencies is such as to strongly support the demic diffusion model (Sokal *et al.*, 1991).

As an example of later migrations, we may consider the origin of the Indo-Europeans. These are the original peoples, speaking Indo-European languages, who are distributed over most of Europe. The conventional view of their origin has them coming from the Pontic steppes, an area northeast of the Black Sea, and reaching the Bal-

kan peninsula in a series of waves commencing around 4,500 BC, called the Kurgan Culture (Gimbutas, 1973, 1979, 1986). This view has been challenged by Renfrew (1987) who believes that the early Indo-Europeans were the early farmers and hence came from Anatolia much earlier, around 7,000 BC. To test the origin of the Indo-Europeans, correlations between genetic and linguistic distances for Indo-European speaking peoples of Europe were studied and related to design matrices representing geographic contiguity, the origin of agriculture, the hypothesis of Gimbutas, and that of Renfrew. Only geography serves to explain some of the genetics-language correlation. There is no evidence that either the hypothesis of Gimbutas or that of Renfrew is supported by the available data (Sokal *et al.*, 1992). Alternative models have to be constructed for the origins of the Indo-Europeans.

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