What Happens Genetically When a Small Population Is Introduced into a Larger One?

A Hypothetical

If a group of, say, fifty Phoenicians (men and women) arrived in the Americas some 2,600 years ago and intermarried with indigenous people, and assuming their descendants fared as well as the larger population through the vicissitudes of disease, famine, and war, would you expect to find genetic evidence of their Phoenician ancestors in the current Native American population? In addition, would their descendants be presumed to have an equal or unequal number of Middle Eastern as Native American haplotypes?

Responses

Peter Bellwood, Professor of Archaeology, School of Archaeology and Anthropology, Australian National University, Canberra: "I would expect, had substantial numbers of Semitic speaking people settled North America from the Middle East around 2500 years ago, and thrived even with intermarriage, that some of their Y and mtDNA lineages would still survive in the living Native American population. If none survive, then either there were very few of them, or none at all!"

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Mark Stoneking, Professor of Biological Anthropology, Department of Genetics, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany: "There is actually no simple answer to your question, as whether or not one expects to find surviving genes from this hypothetical group depends on several factors:

1) the size of the Phoenician group that mixed with the native Americans;
2) the size of the native American group that mixed with the Phoenicians;
3) how much additional migration there was from other native American groups into this mixed group over the past 2,600 years;
4) whether the mixed group remained the same in size, grew in size, or shrank in size over the past 2,600 years (or some combination of these, i.e. perhaps the mixed group grew slowly in size or remained constant in size, shrank along with other native American groups after European contact, and then perhaps grew again).

"All of these can have potentially big effects on what one would expect to find today among the descendants of this hypothetical mixed group. The way to go about answering this question would be to carry out computer simulations, varying the above four factors across all 'reasonable' scenarios, and then see what proportion of the genes of the current descendants would be of Phoenician origin."Just as an example of how much the answer can depend on what you think the history was, a question that some scientists have been investigating recently is how much mixing could there have been between Neandertals and early modern humans? We have as yet no evidence of any Neandertal genes in modern human populations, so what sort of upper limit does this observation put on the amount of mixing there could have been? In other words, if there was a lot of mixing, we can reasonably expect that we should see some Neandertal genes in modern humans today, so the fact that we don't see any Neandertal genes today means that we can estimate an upper limit to how much mixing there could have been. Various studies have been done, and the answer is that, based on the data we have today, the upper limit could be as low as 0.1 percent or as high as 25 percent; it all depends on what you think happened with early modern humans as they expanded across Europe and what happened after any mixing took place in terms of population growth."

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Daniel L. Hartl, Higgins Professor of Biology, Department of Organismic and Evolutionary Biology, Harvard University: "The term 'swamping out' [used by Signature Books in introducing the question to Dr. Hartl] has no meaning in population genetics. I suppose what people mean by that phrase is that alleles at low frequency in a finite population can get lost by chance. The probability that any admixed genes would be lost by chance in roughly 100 generations depends on the effective population size of the indigenous population. If it were large, then the probability of loss is reasonably high. But when you say that the Middle Eastern interlopers and their descendants fared as well as the larger population, you seem to be implying that the situation was such that the genes were not lost, and in that case evidence of ancestry should certainly be found among contemporary DNA sequences, including perhaps mtDNA and Y chromosomal DNA where the evidence of ancestry would be the strongest."

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Henry C. Harpending, Distinguished Professor of Anthropology, University of Utah: "I doubt that we would pick up [evidence of the Phoenicians] today at all, but it does depend on how they intermixed once they were here. If they intermixed freely and widely, and if there were several millions of people here in the New World, then the only trace would be an occasional strange stray haplotype. Even if we found such a haplotype we would probably assume it was the result of post-Columbian admixture.

"Imagine instead that they stayed together and became their own unique tribe. If there were some admixture, like 2 percent per generation, then after one generation they would be 98 percent Phoenician, after two generations they would be .98 squared Phoenician, and so on. In 104 generations, 2600 years, they would be .98 to the 104 power Phoenician or about 12 percent. In this extreme case of tribal endogamy, with only a trace of admixture, after this long time period most of the Phoenician trace would be gone.

"The second scenario is roughly like that of northern European Jews: since the great diaspora they have only intermarried at a rate of about 1 percent per generation, and the result is that their genome is about half European and half Middle Eastern.

"I vaguely know that there is a local issue about this sort of thing because of an article I read in the *L.A. Times* a few months ago. I never heard about it at all at the U."

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