IN THEIR OWN WORDS

Six weeks after I submitted the first samples, the results started to roll in. Every company told me that my mother's female ancestors were all African. But after that things got murky.

African Ancestry said my DNA was a match with that of the Mende and Kru people from Liberia. Family Tree DNA's database showed a match with one person who was Mende. But my DNA also matched that of several other groups, like the Songhai in Mali, and various ethnic groups in Mozambique and Angola. Other peoples cited were the Fula-Fula (also known as the Fulani), who live in eight African nations, and the Bambara, who are primarily in Mali.

Why so many? "We try to be brutally honest and give you everything the test results show," said Mr. Greenspan of Family Tree DNA. "If there are multiple matches, we're going to show you that."

Mr. Ely's African American DNA Roots Project, which examined DNA sequences that other companies provided to me, confirmed many matches from Family Tree DNA and African Ancestry, but added additional ethnic groups. DNA Tribes, whose test shows DNA results from a combination of genetic material from both parents, added even more ethnic matches.

I once thought that my ancestors, like those of most African Americans, would have come from West Africa. But some of the results showed links to regions that I had thought weren't engaged in the slave trade with the United States—like Mozambique. But then a search of the TransAtlantic Slave Trade database, which was compiled from slave ship records, showed that some Africans from Mozambique did indeed end up in the United States. So maybe the Mozambique results were possible.

The companies also offered technical support to understand the results, and I spent considerable time trying to make sense of them. I learned a lot about how they reached conclusions, but not much about where I or my ancestors ultimately came from.

"What this all means is that you can't take one of these tests and go off and say you're this and that," Mr. Gates said. "Somewhere down the road, the results could change and you might have another group of people who might also be your genetic cousins."

Sandra Jamison contributed reporting.

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cholera, plague, and measles, which swept through continents, undoubtedly contributed to the shaping of the genetic landscape. (Mielke et al. 2011, 105–06)

Several evolutionary processes may affect a population at the same time. For example, a rare, helpful allele (say, one that increased resistance to a disease like malaria) might appear in a population through mutation. If malaria were an environmental threat to that population, we would expect natural selection to increase the frequency of this new allele. But suppose a natural disaster like an earthquake struck the population and many people died. If the new allele were still very rare, it might be completely lost if its few carriers were among those who perished (genetic drift). Alternatively, the frequency of a harmful new allele might increase in subsequent generations if its carriers survived such a disaster and if they introduced the new allele into a larger population through inbreeding (gene flow). Niche construction could also be implicated if, for example, gene flow were enabled or intensified as a result of persisting, environment-modifying activities of the populations exchanging genes.

Measuring the interaction among these evolutionary processes allows population geneticists to predict the probable effects of inbreeding and outbreeding on a population's gene pool. Inbreeding tends to increase the proportion of homozygous combinations of alleles already present in a population. If some of these alleles are harmful in a double dose, inbreeding increases the probability that a double dose will occur in future generations and thus decrease fitness. If helpful combinations of alleles occur in an inbreeding population, their proportions can increase in a similar way.

At the same time, inbreeding over several generations tends to reduce genetic variation. Natural selection on genes has a better chance of shaping organisms to changed environments if it has a wider range of genetic variation to act on. Perhaps for this reason, mating with individuals from outgroups is widely observed in the animal kingdom. Monkeys and apes, for example, regularly transfer into a new social group before they begin to reproduce (Figure 5.1). Human beings ordinarily do the same thing, except that our reproductive practices are shaped by culture; people in different societies draw the boundaries around in-groups and out-groups differently. In one society, the children of brothers and sisters may be considered members of the same family and, thus, off