

Genetic ancestry testing

There are two main types of genetic tests to estimate a person's ancestry. One type is to trace an individual person's maternal lineage (by looking at how genetic patterns are passed down from one generation to the next generation through one's mother and her mother and her mother) or paternal lineage (by looking at how genetic patterns are passed down through the father's line). These lineage-based genetic tests come in two forms: 1) mitochondrial DNA (mtDNA) which is inherited through the mother's line only and can give information to both males and females about a person's maternal lineage, or 2) Y-chromosome DNA which is inherited through the father's line and is passed down only to males in each generation and can give information only to males about his paternal lineage.

The other type of genetic ancestry test is one that makes estimates of a person's ancestry by scanning through a person's overall genome and then using the information to determine which continents their ancestors are from. These ancestry estimates use genetic markers called Ancestry Informative Markers. Scientists use Ancestry Informative Markers to make predictions about a person's ancestry using genetic markers and can tell a person if they are likely to have European, African, or Asian ancestry. These predictions are based on statistics that come from how often or rarely certain genetic markers show up across populations. For example, suppose a statistical result shows that a person is very likely to be American Indian because they have a certain set of Ancestry Informative Markers. If a different scientist took the same sample and looked at completely different set of Ancestry Informative Markers, just by chance, that person may have a statistical result that shows they are likely to be Asian, not American Indian. The results could be very different, depending on the set of Ancestry Informative Markers that are used or on the population that is being studied. It is important to keep in mind that none of these genetic markers can definitively say whether a person is American Indian or not. It is also important to note that there is no such thing as an "American Indian gene."

Tracing maternal or paternal lineage

Mitochondrial DNA (mtDNA) is inherited only through the maternal line. Every person has mtDNA and each person's mtDNA is identical to his or her mother's mtDNA, maternal grandmother's mtDNA, and so forth. Both men and women have mtDNA, but these genetic tests will only provide information about the maternal line. Geneticists have found certain mtDNA patterns that show up only in American Indians and not in people from other parts of the world. These unique American Indian mtDNA patterns suggest to scientists that people with these same patterns are likely to have American Indian ancestry, but only from information gathered about maternal lineage. Other mtDNA patterns have been found in other populations, such as in African populations, but these same patterns have not been found very often in American Indians. If a man had one maternal grandmother who was African and all of his other grandparents were American Indians, the mtDNA result would suggest that the person has African ancestry. The mtDNA test would not provide any information about the man's other ancestors. However, the lack of an American Indian mtDNA pattern in an American Indian individual is not enough evidence to say for sure that a person is or is not American Indian. Genetic information from mtDNA provides information for just one small part of the puzzle. [More information on mtDNA](#) is available from the NIH.

On the other hand, only males have Y-chromosomes. The Y-chromosome is passed down only from father to son. A man's Y-chromosome would be the same as his father's Y-chromosome, his paternal grandfather's Y-chromosome, and so forth. Women do not have Y-chromosomes, so these genetic tests will only provide information about paternal lineage. If a woman was curious about her

father's lineage, she would have to look at the genetic patterns from her father or brother in order to get a genetic result about her father's side of the family. Similar to the mtDNA story, geneticists have found that certain Y-chromosome patterns show up only in American Indian males and not in males from other parts of the world. These unique American Indian Y-chromosome patterns suggest to scientists that men with these same patterns are much more likely to have American Indian ancestry. On the other hand, like mtDNA, other Y-chromosome patterns have been found in Africans, but not in other populations. If an American Indian man does not carry a Y-chromosome pattern that suggests American Indian ancestry, it does not rule out American Indian ancestry. That test result would only provide information for one ancestor. For example, if a man has an American Indian mother and an African father, his Y-chromosome pattern would only provide information about his African ancestry and would not say anything about his American Indian ancestry. [More information on Y-chromosome DNA](#) is available from the NIH.

Estimates of overall ancestry

Some tests use Ancestry Informative Markers, which are genetic markers that can tell you something about your ancestry, but these tests tend to be more accurate for European populations than American Indian populations. Ancestry Informative Markers are a collection of genetic markers that provide information about many different parts of a person's genetic make-up. Scientists use Ancestry Informative Markers (as few as 40 or as many as a million genetic markers) to gather information about a person's genetic make-up, and then compare it to known populations, such as Asians or Europeans, and then use math formulas to calculate how similar that person's genetic make-up is to Asians or Europeans. A person who is half white and half Asian will typically have a genetic ancestry result (based on Ancestry Informative Markers) that shows that half of their genetic information looks European and the other half looks Asian.

At present, genetic ancestry tests are not completely accurate or reliable. In addition, most of these tests are better at providing information about European, African, or Asian ancestry, but are not very good at providing information on Native American ancestry. One reason for this is that Native Americans have not really participated in genetic research involving ancestry estimates, so scientists must make guesses about a person's Native American ancestry and these guesses are not always very accurate. When comparing genetic information from many different people worldwide, scientific results usually show that Native Americans look more similar to Asians compared to other populations. Further, no genetic tests exist that will determine tribal affiliation and there are no genetic markers to prove Native American ancestry.

Discussion Questions:

1. What would you do if you think you are Native to America, but a genetic ancestry test says your ancestors were from another part of the world?
2. How would your tribe handle requests from individuals wanting to enroll based on a genetic ancestry test?