GENETIC GENEALOGY

Genetic testing can be combined with genealogical research in order to trace familial connections by comparing how genetically similar two individuals are.

A person inherits roughly half of their DNA from each parent, and that parent inherited approximately half from each of their parents. This means a person inherits roughly 25% of their DNA from each of their grandparents, and so on as you move further back with each generation. This process can also be used to determine which unique genetic patterns are shared by specific ethnic groups — this is how autosomal and chromosome DNA testing can provide ethnicity estimates and population haplogroups, respectively.

All humans are roughly 99.5% genetically identical. DNA testing analyzes that unique 0.5% that results from SNPs (see reverse).

How DNA is Inherited (Simplified)

A gene is a segment of DNA that tells your cells how to function and what traits to express. These genes are passed between generations in the form of chromosomes. Humans typically have 23 pairs of chromosomes (each containing thousands of genes), with one chromosome in each pair coming from each parent.

DNA is randomly shuffled and then sorted into each sperm and egg. Over many generations, this results in each sperm and egg containing a unique recombination of DNA from many different ancestors.

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TYPES OF DNA TESTS

Autosomal Testing
This test provides an ethnicity estimate, usually broken down into percentages in a pie chart. Your estimate may also include “low confidence” or “trace” results — results that were inconsistent or very small.

Sex Chromosome Testing
This test provides a haplogroup, not an ethnicity estimate. This is a much broader view of your genetics. It traces one direct line based on your sex chromosomes (X, Y). Not all DNA providers offer these tests.

Mitochondrial (mtDNA) Test
Follows the direct maternal line based on the mitochondrial DNA of the X-chromosome. This type of DNA is inherited from the mother and remains identical between generations.

Y-Chromosome Test
Follows the direct paternal line based on the Y-chromosome. It uses the degree of change in this DNA between generations to estimate the most recent shared ancestor. Y-DNA haplogroups are separate from mtDNA haplogroups. (Individuals with a Y-chromosome can take this test.)

What is a Haplogroup?
A haplogroup is a population connected by a single line of descent from a common ancestor. Some haplogroups are branches off of a larger group.

Example: mtDNA haplogroup H18 is a branch of H found in the Arabian Peninsula. Individuals in H18 possess the genetic mutation G14364A.

CHOOSING A PROVIDER

Common Test Providers
- Ancestry DNA
- 23andMe
- MyHeritageDNA
- FamilyTreeDNA

Questions to Ask
- How diverse and large is the reference panel and relative matching pool?
- What kinds of tests do they offer?
- Is a subscription fee required to access all the features and services?
- What are the privacy and retention policies?
  * Do they keep my sample and genetic information and for how long?
  * Can I have it destroyed?
  * What is the Informed Consent policy?

Adoptees Searching for Family Members
Matching features can help connect you to biological relatives. If you are specifically looking for relatives, select a provider with a large pool of customers for cousin matching.

The Limitations of DNA Testing
The sample panels that companies compare your DNA with do not contain DNA samples that represent historical populations. They use samples from people with a long family history in one place or within one ethnic group. Also, separate ethnic groups may share the same genetic mutation and ethnic groups regularly intermarried. DNA testing can only make educated guesses about which group it came from. This can lead to an overestimation of the European or British ethnicity you have.

IMPORTANT TERMINOLOGY

Reference Panels and Algorithms
Test providers compare your sample to their reference panel, a unique collection of DNA samples from around the world. Each company has its own panel; some are more diverse and comprehensive than others.

Each company’s algorithm, the process of mapping and analyzing the digitized raw data of your DNA, is unique and proprietary, and therefore, often secret. This is why you may get very different results from two separate test providers depending on the quality and size of their reference panel and the algorithm used to analyze your sample.

SNPs or “Snips”
Single nucleotide polymorphisms (SNPs) are essentially genetic typos in the process of recombing and copying DNA between generations. Some can affect things like appearance or predisposition to certain diseases, but most have no visible effect. The number of shared SNPs between two people can help determine how closely related they are. Ethnic groups share specific genetic mutations and autosomal testing compares your SNPs to those possessed by various ethnic groups.

centiMorgans (cM)
centiMorgans are the unit of measurement for genetic linkage used to estimate how closely related two people are. To put it simply, when reviewing your results, the larger the amount of cM shared by two people, the closer the relation.