

# Using DNA and Historical Research to Extend Your Family Tree

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## Introduction

Genealogists have learned to use many different types of complex records without having specific degrees in history, law or other specialty fields. In this same way, it is possible for genealogists to use DNA testing as another record type to resolve questions of kinship and identity.

When any record (including DNA) is analyzed, it generally leads to one of three outcomes:

1. The record provides evidence to support a research hypothesis.
2. The record provides evidence to refute a research hypothesis.
3. The record provides information that leads to additional evidence or sources to be analyzed and correlated.

Those who are most successful with using DNA “records” in their genealogical research understand that a DNA test will not immediately solve all of their research questions, but that DNA test results are often part of conducting “reasonably exhaustive research.” Researchers also understand that evidence derived from DNA test results must always correlate with historical records and other information.

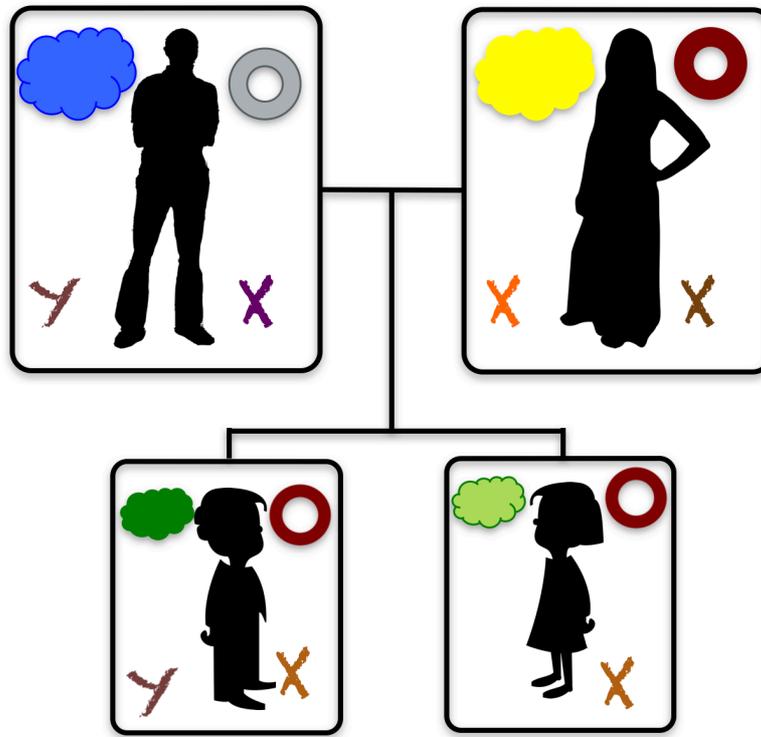
## Genetic Inheritance

The types of records that are most valuable to the genealogist are those records that provide evidence of inheritance. Vital records show inheritance of surnames; probate records show inheritance of personal and real property; DNA testing shows inheritance of biological material. By understanding basic patterns of genetic inheritance, genealogists can effectively and efficiently use DNA testing to answer questions of kinship and identity, and in some cases, reconstruct kinships for which no records exist. The growing field of genetic genealogy aims to combine information contained in our DNA with traditional genealogical records to determine how related we are to others. In the last 15 years significant scientific advances have occurred allowing genealogists to use this biological record as a genealogical research tool in unprecedented ways.

**A single DNA match in isolation proves nothing, although it does indicate that there is a biological relationship between two people.** Another piece of evidence is required to determine exactly what the relationship between two people is. It may be another DNA test result or another piece of documentary evidence, or both. Understanding genetic

inheritance and correlating that with historical research provides the foundation of using DNA test results to extend and expand your family tree.

### *Inheritance Path of DNA*



Direct line testing (Y-DNA and mtDNA) provides evidence that two people share a common ancestor on that particular direct line, but they do not differentiate how long ago that common ancestor may have lived – genealogical research is required to determine how many generations separate these individuals. See the following links at Family Tree DNA for additional information on how to interpret the closeness of a DNA match:

- mtDNA: <https://www.familytreedna.com/learn/mtdna-testing/tell-closeness-relationship/>
- Y-DNA: <https://www.familytreedna.com/learn/y-dna-testing/y-str/expected-relationship-match/>

For relationships closer than a second cousin, autosomal DNA testing provides strong evidence of how many generations separate two people. Autosomal DNA testing can also provide evidence for relationships more distant than third cousin, however, the analysis and interpretation of results becomes more difficult. The “Shared cM Tool” hosted at the DNA Painter website (<https://dnainter.com/tools/sharedcmv4>) provides a listing of possible genealogical relationships based on the amount of autosomal DNA shared. A key question to consider when working with DNA test results is: **Does the genealogical and genetic evidence support the hypothesized relationship?**

## Testing with Purpose

Seasoned researchers in every field know that developing a research plan and hypotheses that they can test is often key to their success. For many genealogical questions, incorporating DNA testing as another “record” to search can often lead to answers to difficult questions. DNA testing plans should target the specific genealogical relationships being queried. Developing a testing plan generally consists of three basic steps:

- Identify the subject or ancestor to be researched.
- Determine who carries the DNA of the subject (all types). This often requires a significant amount of “reverse genealogy” or descendency research.
- Evaluate the available types of tests and the databases and features available at each company to maximize the usefulness of the test results.

All DNA testing relies on matching others (whether a reference population for the ethnicity estimate, or other testers as a genetic cousin) in the databases that have taken the same type of DNA test, and then comparing your data against those individuals. Determining which test and which company to use relies heavily on this concept. As you plan your research and identify individuals to test, realize that just as your ancestors may not be found in a traditional record collection, there may be no DNA matches or descendants of these ancestors found that have tested their DNA.

## General Testing Strategy

Autosomal DNA testing is useful for genealogical questions involving individuals who are approximately 5-6 generations removed from the test taker. For ancestors who are further removed than this, it can be difficult to use autosomal DNA test results to make any conclusion of relationship, and direct-line testing and historical records should be the primary source of evidence. The reasons autosomal DNA becomes less useful include:

- (1) At approximately the 6<sup>th</sup> generation, ancestors start to drop from the genetic family tree. In other words, there comes a point where a test taker would not receive any DNA from an ancestor.

Relationship	Likelihood of Inheriting DNA
Parent	100%
Grandparent	100%
Great-grandparent	100%
2 <sup>nd</sup> great-grandparent	100%
3 <sup>rd</sup> great-grandparent	100%
4 <sup>th</sup> great-grandparent	99.99%
5 <sup>th</sup> great-grandparent	99.5%
6 <sup>th</sup> great-grandparent	96%
7 <sup>th</sup> great-grandparent	84%
8 <sup>th</sup> great-grandparent	64%

- (2) The probability of sharing DNA with another known cousin or descendant is 98% for 3<sup>rd</sup> cousins and 77% for 4<sup>th</sup> cousins. The probability of sharing DNA with known cousins starts to drop drastically after this point.

Relationship	Likelihood of Sharing Detectable DNA
Sibling	100%
1 <sup>st</sup> Cousin	100%
2 <sup>nd</sup> Cousin	100%
3 <sup>rd</sup> Cousin	98%
4 <sup>th</sup> Cousin	71%
5 <sup>th</sup> Cousin	32%
6 <sup>th</sup> Cousin	11%
7 <sup>th</sup> Cousin	3.2%

- (3) Beyond six generations individuals may share DNA because of multiple common ancestors or because they have similar genetic origins. It becomes difficult and even impossible to determine exactly why two individuals may share DNA after this number of recombination events. This in turn complicates the ability for identify specific shared match groups and create genetic networks. Identifying and using genetic networks is the most powerful technique for using autosomal DNA to extend your family tree.

Targeted autosomal testing of known descendants of the “brick-wall” ancestor allows for the best sorting and grouping of relevant shared matches to identify those matches most likely to lead to genealogical breakthroughs. Testing first and second cousins descended through different family lines allows for the greatest differentiation and grouping of matches to identify those that will help in answering the research question. The further back the ancestor in question the more descendants that will need to test. Testing all individuals with AncestryDNA<sup>®</sup> is recommended for the following reasons:

- (1) AncestryDNA<sup>®</sup> has the largest database, and many users have an attached family tree.
- (2) AncestryDNA<sup>®</sup>'s database is heavily skewed towards the U.S. population.
- (3) The raw data file from AncestryDNA<sup>®</sup> can be uploaded to other testing sites.
- (4) AncestryDNA<sup>®</sup> has the best tools for sorting and grouping matches to identify those matches that might lead to a research breakthrough.

Specific targeted testing and reaching out to unknown relatives is becoming less and less necessary as more and individuals take DNA tests. It is generally recommended that the matches be reviewed first to determine which (if any) family members have already tested. Once the autosomal DNA testing has been completed additional historical research and possibly direct-line testing is usually required to meet the GPS. DNA is a powerful new piece of evidence that can be used to extend family trees. In most instances, no “special” knowledge is required other understanding how DNA is inherited.