

Using Y-DNA for Genealogy

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This is one article of a series on using DNA for genealogical research. There are several types of DNA tests offered for genealogical purposes. Researchers must understand that only like tests can be compared: Y-DNA to Y-DNA, mitochondrial DNA (mtDNA) to mtDNA, and autosomal DNA to autosomal DNA. To use DNA to solve a problem, an understanding of DNA inheritance and the limits of the evidence is paramount. This article covers Y-DNA.

WHAT CAN YOU DO WITH Y-DNA?

Genealogists began using Y-DNA as evidence for direct paternal line problems about fourteen years ago. We have made tremendous advances in using Y-DNA during these years. Only men have a Y chromosome. Women who want to use Y-DNA to answer a genealogical question must recruit a male to take the test. The male to be tested must have a straight patrilineal descent—through men with no intervening women—back to the ancestor of interest. Like mtDNA, Y-DNA provides conclusive evidence to answer some questions; less strong evidence for other questions.

Even the low resolution Y-DNA test provides strong evidence for some situations. (1) Was Native American ancestry inherited down the direct paternal line? Native American ancestry can be indicated, but DNA cannot isolate to a specific tribe. (2) Could two men share a common ancestor or not? Test results from more comprehensive tests may be needed to answer more detailed questions.

Framing your genealogical question in the context of the known family tree and the results of others will help determine which test should be taken. Surname project administrators can be invaluable in helping determine which test can provide evidence for your particular research problem. Administrators are volunteers with varying amounts of free time and varying degrees of knowledge. Most have been studying their project for years and have in-depth knowledge they are happy to share with their project members.

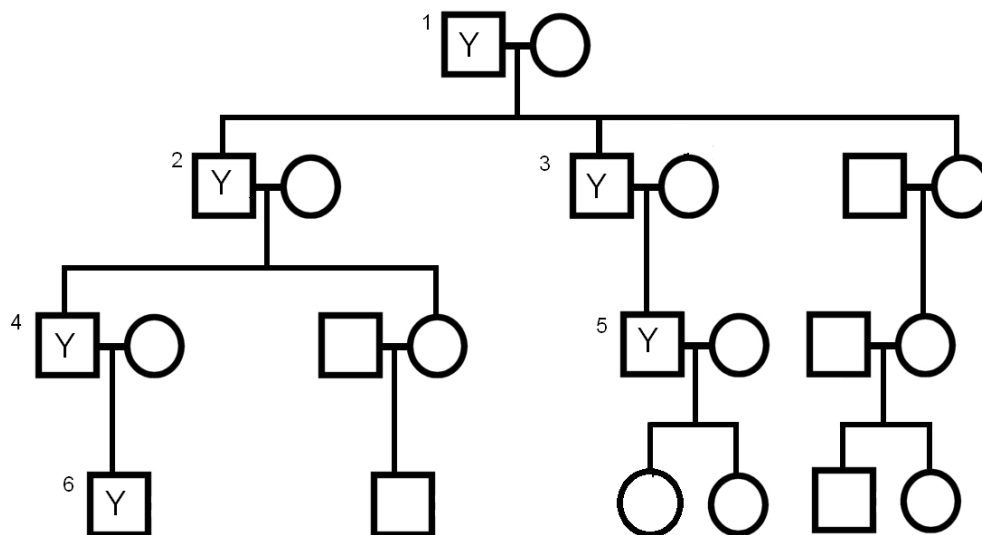
Y-DNA INHERITANCE

Y-DNA is passed only from a father to his sons. Daughters do not inherit Y-DNA. This inheritance pattern is illustrated in figure 1 where men are depicted as squares and women as circles. The father (1) passes his Y-DNA to his sons (2) and (3). One son (2) passes his Y-DNA to grandson (4) who also passes it to great-grandson (6). One son (3) passes his Y-DNA to grandson (5) who does not pass on his Y-DNA as he only has daughters. Of the descendants shown on the bottom row, only great-grandson (6) will pass the Y-DNA of his paternal great-grandfather (1) to the next generation.

The Y-DNA passes from father to son unchanged, unless a mutation occurs. A mutation is a change caused by a copying error when the DNA is duplicated. Mutations occur at random intervals and

locations. These mutations are what allow us to trace a family tree using DNA, grouping those with like changes. Two men with an exact Y-DNA match, or a small number of differences (mutations), share a paternal ancestor. While statistics can predict how far back that common ancestor may be, the Y-DNA results must be combined with a well-researched paper trail to draw valid conclusions. The random nature of DNA mutations makes it impossible to accurately predict the exact number of generations back to a common ancestor based on the number of differences. The statistics offer a starting point for comparisons.

Figure 1.



Y-DNA Inheritance Patterns, © 2013, Debbie Parker Wayne

WHAT IS Y-DNA?

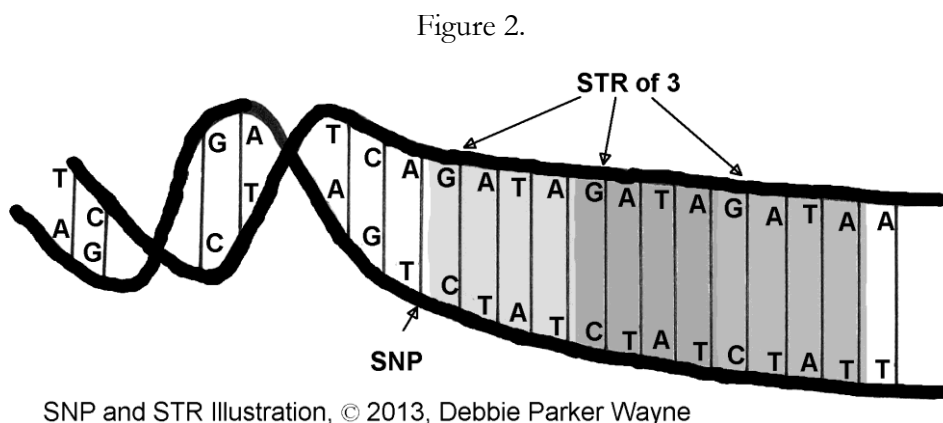
Y-DNA is one of the chromosomes found in the cell nucleus. The X and Y chromosomes are known as the sex chromosomes. Men have one each X and Y chromosome; women have two X chromosomes. The Y chromosome consists of about 59-million locations.¹

For genealogical purposes we analyze a small number of those 59-million locations. When a chromosome is uncoiled it resembles a ladder as illustrated in figure 2. Each rung of the ladder is called a base pair. When the chemical at an individual ladder rung changes or mutates it is called a single nucleotide polymorphism (SNP, pronounced snip). When a segment of the DNA has a small, side-by-side, repeating pattern it is called a short tandem repeat (STR, pronounced stir). Both SNPs and STRs may be referred to as markers or locations in common language.

All URLs accessed 14 November 2013.

¹ "What is the Y Chromosome?," *Genetics Home Reference, Your Guide to Understanding Genetic Conditions*, U.S. National Library of Medicine, National Institutes of Health (<http://ghr.nlm.nih.gov/chromosome/Y>).

Each of these locations has a name assigned by the scientific community. The locations that have been identified as genealogically significant are those generally tested by genetic genealogy companies for ancestry purposes. Traditionally, STR tests have been used for more recent ancestry and SNP testing for deeper ancestry. New discoveries show SNP values can be useful for recent genealogy in some situations.



Y-DNA TEST RESULTS CONSIST OF MULTIPLE PARTS

One part of the test results will be a haplogroup with a name that has changed format in recent years. This represents the deep roots of the patrilineal ancestry—the location of ancestors tens of thousands of years ago. Two people in the same haplogroup share a common ancestor, but it might be thousands of years ago.

A few years ago the haplogroup names used would have been short such as R1a, R1b, or I2a. These names were easy to remember when only a few digits were involved. As the Y-DNA tree split into more branches the names were expanded. They became more difficult to use, for example, R1a1a1g2 is harder to remember than R1a. Today, Y-DNA haplogroups are referenced by the first digit or two of the older name followed by the defining SNP for that branch of the Y-DNA tree. For example, a man determined to be in haplogroup R1a1a years ago is now in haplogroup R-M198 (sometimes seen as R1-M198). His haplogroup has not changed, his DNA has not changed, only the way we name the group he is part of has changed.

The second part of Y-DNA test results depends on whether an STR or SNP test is performed.

The most common test done for genealogy is an STR test for a certain number of markers: 25, 33, 37, 46, 67, or more. The results consist of marker names and the number of repeats at that location. The results are compared to the results of other testers to find relatives with exact or closely matching values. For example, DYS393 = 13 indicates the location on the Y chromosome named DYS393 contains thirteen repeats of the pattern normally seen at this location. In most situations, comparing one marker provides no useful genealogical information; comparing many markers helps group families with a common ancestor.

For a SNP test the results consist of marker names and either the exact chemical value at that location (G, C, A, or T, defined in the mtDNA article in the last issue) or a symbol indicating whether this location has a mutated value (indicated by a plus sign) or still contains the unchanged ancestral value (indicated by a minus sign). For example, M198+ indicates this person has the mutated value at marker M198.

More Y-DNA tests are now available and we can probably expect even more in the coming years. Tests for tens of thousands of base pairs, ten-plus million base pairs, and even the full Y chromosome are now advertised.² The early adopters may soon have enough data to show how useful these tests will be for genealogy.

USING Y-DNA TEST RESULTS

The steps for using Y-DNA are similar to those for mtDNA, but the databases used and the values compared are different.

Complete your paternal lineage as far back as possible. Document this to share with Y-DNA matches looking for a common ancestor. List your paternal ancestral names, dates, and geographic origins. The more information included the easier it will be to determine when a person is common to two family trees. For example:

- Perry Anderson **Parker** (1856, Milam County, Texas, to 1925, Dallas County, Texas), m1. Bettie Morrison (unknown birth to about 1891, Lee or Milam County, Texas), m2. Tennessee Angeline Maples (1874 to about 1906, Texas), m3. Bertha Sparks (1883, Alabama, to 1976, Dallas, Texas)
- Henry **Parker** (1825, probably South Carolina, to 1902, Hood County, Texas; also lived in Illinois, Pope County, Arkansas, and Milam County, Texas), m1. Nancy Black (about 1835, Alabama to 1902, Travis County, Texas), m2. Elizabeth (O'Neal) Kline Quarles (about 1836, Alabama, to 1903, Hood County, Texas)

Create a privatized pedigree chart. For example, list information on your earliest known ancestor down to a great-grandparent or a recent generation that is no longer living. Include geographic locations and dates as above.

Join a surname project as well as Y-DNA haplogroup, lineage, and geographic projects. Ask questions of project administrators who can be very helpful in DNA analysis. To find more potential matches upload data to public databases (YSearch.org). Investigate privacy and security policies before uploading data.

Search all databases and project lists for matches. Review any ancestral information shared online, and contact the match person for more information. Contact the closest matches first as the common ancestor is likely to be more recent. If a common ancestor cannot be identified by name, look for patterns that provide additional research clues such as geographic locales, spouses' names, etc. Matches may not have posted everything they know online. Some people don't respond to contacts, but an attempt should be made. Be patient; the person may respond months after an initial query.

² "Y-DNA SNP testing chart," Wiki, ISOGG (online at http://www.isogg.org/wiki/Y-DNA_SNP_testing_chart).

UNEXPECTED TEST RESULTS

Not everyone who tests will find useful matches immediately. Those with rare haplogroups and rare STR marker values may see few or no matches until a future time when someone with the same rare DNA signature takes a test. Patience is a virtue in this situation.

Finding no matches to those with the same surname happens more often than most people expect. The misnomer non-paternity event (NPE) is used to describe this situation. Every child born had some paternity, even if not from the paternal ancestor the paper trail indicates. Misattributed paternity is a more accurate term. An NPE could be caused by: an inaccurate paper trail, name change, undocumented or unofficial adoption, a child taking the surname of a step-father, an illegitimate child using the surname of the mother, sperm donation, and many other things besides a mother giving birth to a child whose biological father is not the person presumed to be the father. The event could be recent history or many generations back. It could even be two men who took the same surname when names were first adopted. To discover the truth of the matter more research and more DNA tests may be needed.

DNA does not lie. As with all genealogical research, traditional and genetic, Val D. Greenwood's advice applies:

“If you are afraid of skeletons then stay out of closets. And if you are ashamed to have ancestors who do not meet your own social standards then stay away from your genealogy.”³

RESOURCES

This article is a short introduction to Y-DNA. For information on tests offered by different companies see each vendor's web site and the International Society of Genetic Genealogists (ISOGG) Wiki pages “Y Chromosome DNA tests” and Y-DNA SNP and STR testing charts.⁴ For information on haplogroup nomenclature and a graphic representation of the human Y-DNA phylogenetic tree see the ISOGG *Y-DNA Haplogroup Tree*.⁵ The ISOGG Y-tree is currently the most up-to-date tree available. It is referenced by scholarly and scientific papers as well as by genetic genealogists.

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³ Val D. Greenwood, *The Researcher's Guide to American Genealogy*, 3rd ed. (Baltimore, Maryland: Genealogical Publishing, 2000), 12.

⁴ “Y Chromosome DNA tests,” Wiki, *ISOGG* (online at http://www.isogg.org/wiki/Y_chromosome_DNA_tests). “Y-DNA STR testing chart,” Wiki, *ISOGG* (online at http://www.isogg.org/wiki/Y-DNA_STR_testing_chart). “Y-DNA SNP testing chart,” Wiki, *ISOGG* (online at http://www.isogg.org/wiki/Y-DNA_SNP_testing_chart).

⁵ “Y-DNA Haplogroup Tree,” *ISOGG* (online at <http://www.isogg.org/tree/index.html>).