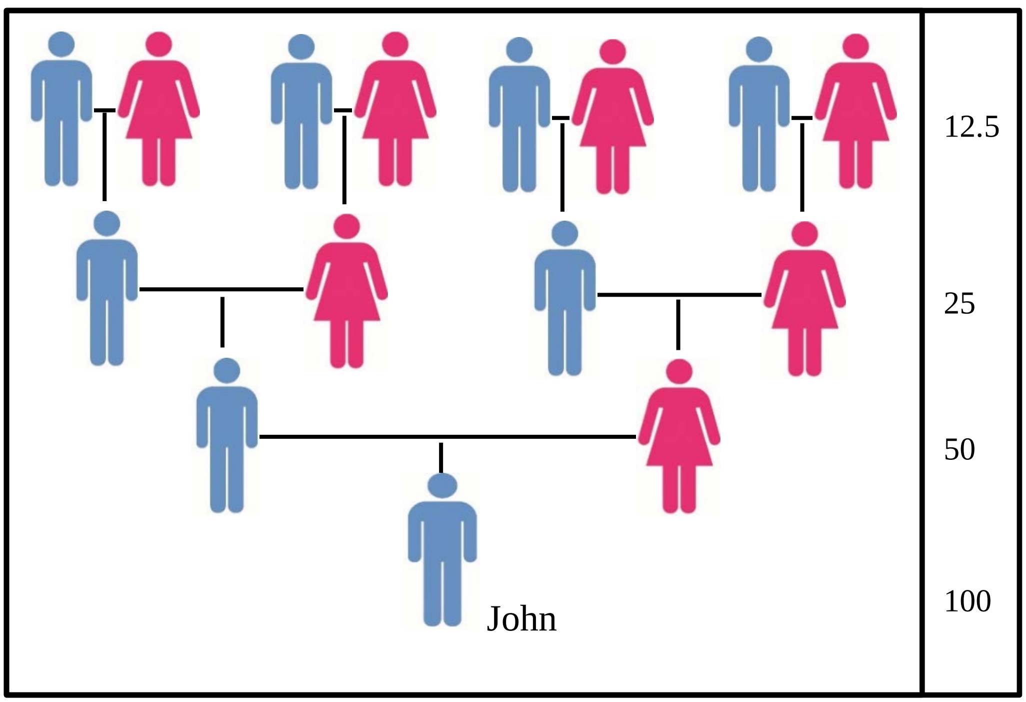
Using Autosomal DNA for 18th and 19th Century Mysteries

Blaine T. Bettinger, Ph.D., J.D.
www.TheGeneticGenealogist.com
blainebettinger@gmail.com

Using Autosomal DNA

Autosomal DNA is the 22 pairs of non-sex chromosomes found within the nucleus of every cell. The 22 autosomes, or autosomal DNA chromosomes, are numbered approximately in relation to their sizes, with autosome 1 being the largest and autosome 22 being the smallest. The following figure follows the inheritance of autosomal DNA through four generations of a family, from eight great-grandparents to their great-grandchild John:

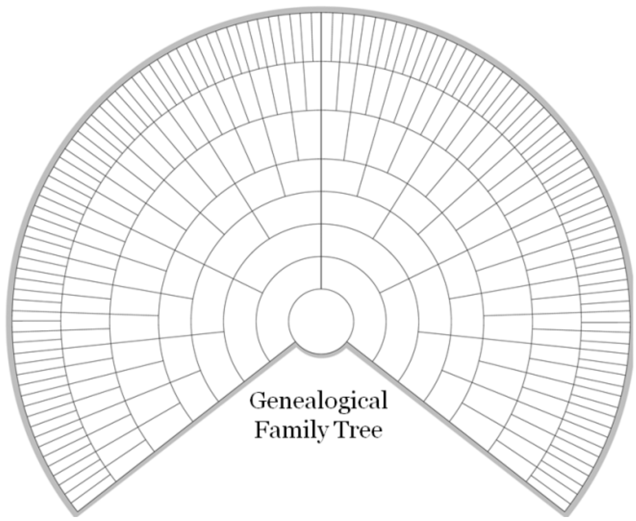


John received about 50% of his DNA from each of his parents, about 25% of his DNA from each of his grandparents, and about 12.5% of his DNA from each of his great-grandparents. Although not shown in this figure, Frank will inherit about 6.25% of his DNA from his great-great-grandparents, and so on.

1. You Have TWO Family Trees

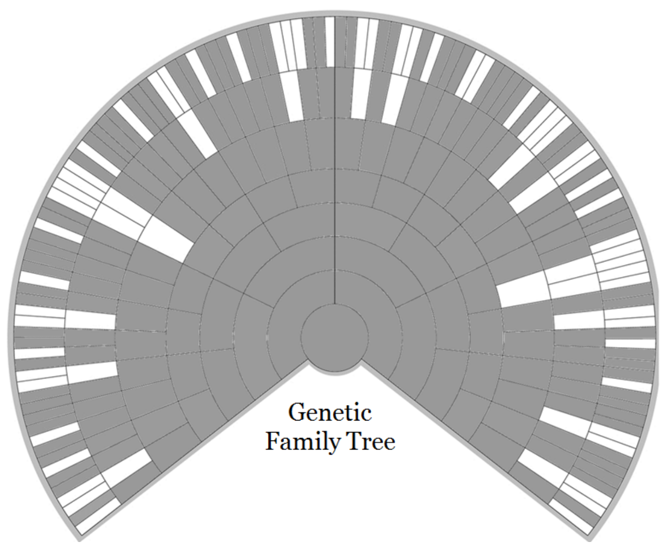
One of the most important aspects of genetic genealogy required to completely understand and interpret autosomal DNA test results is the fact that everyone has two very different, but overlapping, family trees.

The Genealogical Family Tree



The first family tree is your Genealogical Family Tree, which contains every ancestor that had a child who had a child who had a child, and so on, that ultimately led to you (see the figure below). This tree contains every parent, grandparent, and great-grandparent back through history. In most cases, this is the tree that genealogists spend their time researching, often using paper records such as birth and death certificates, census records, and newspapers to fill in. Many genealogists find that the paper trail ends or becomes much more difficult to identify beyond the 1800 or 1700's, making it difficult to fill in many of the openings in the Genealogical Family Tree.

The Genetic Family Tree

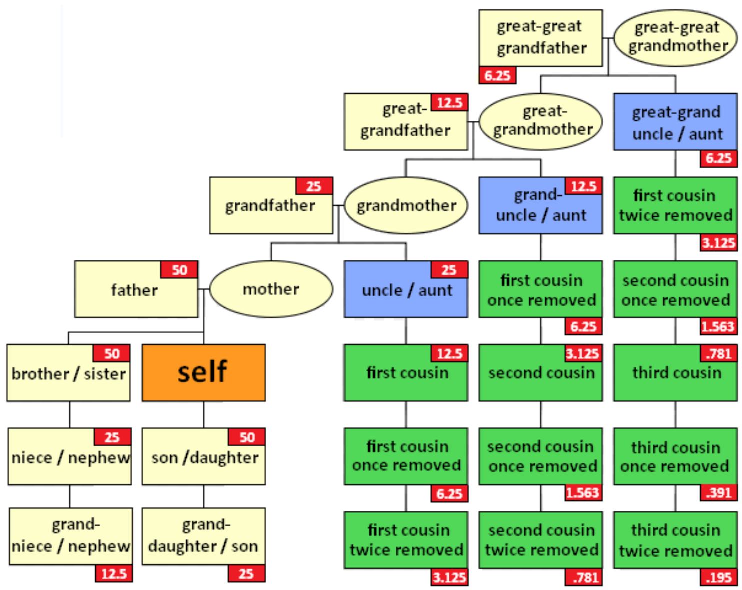


The second family tree is your Genetic Family Tree, which contains only those ancestors that contributed to our DNA. Not every person in your Genealogical Family Tree contributed a segment of their DNA sequence to your DNA sequence. A parent does not pass on all their DNA to their children (only about 50%); as a result, bits and pieces of DNA are lost in each generation. Somewhere between 5 and 7 generations back, your Genetic Family Tree starts to lose ancestors from your Genealogical Family Tree.

As shown in the figure below, your Genetic Tree is actually just a sub-set of your Genealogical Tree. Your genetic tree is guaranteed to contain both biological parents, who each contributed approximately 50% of your entire DNA sequence. Your genetic tree also likely contains each of your four biological grandparents and eight biological great-grandparents, but with each generation it is much less likely that every person in that generation contributed a piece of their DNA to your DNA.

2. Finding and Classifying Your Genetic Matches

Each of the testing companies return a list of genetic matches, which are all people in their database that share DNA with you above a certain threshold. The threshold used for matching is important; if the threshold is set too low you'll match everyone in the database. If the threshold is too high, you'll miss too many real matches.



Each company tries hard to find a suitable threshold, but it is important to keep in mind that all of the companies will provide matches that are "false positives" (matches who are not related to you in a genealogically relevant timeframe). This is just one reason that it is important to **concentrate on your best matches first**. Your "best matches" are those who share the most DNA with you.

The more segments you share with another person, and the larger those segments are, the closer your genealogical relationship with that person is. We inherit entire chromosomes from each parent, which are a collage of segments from our grandparents' chromosomes, which in turn are a collage of even smaller segments from our great-grandparents, and so on.

The chart below demonstrates the percentage of DNA that we share in common with our genealogical relatives. The more distant the relative, the fewer and smaller the segments of DNA that we share in common with that relative.

Although you are predicted to share 0.781% of your DNA with a third cousin, there's no guarantee that you will match a third cousin, as described in the next chart. Some (~10%) third cousins will not match. Anecdotally, however, no one to my knowledge has ever had a second cousin NOT match.

Chance of Matching a Genealogical Cousin	
Closer than a Second Cousin	> 99%
Second Cousin	> 99%
Third Cousin	> 90%
Fourth Cousin	> 50%
Fifth Cousin	> 10%
Sixth Cousin and More Distant	< 5%

The amount of DNA shared by two people can help determine the genealogical relationship between those two people, although it is not a perfect predictor. For example, if you share 1500 cM with someone, that match is likely a grandparent/grandchild, aunt/uncle or niece/nephew, or half-sibling. However, if you share 75 cM with a match, it is not clear whether the match is a third cousin, second cousin once removed, or a more complicated relationship (e.g., multiple cousin).

For a more detailed chart, see ISOGG'S "Autosomal DNA Statistics" at (http://www.isogg.org/wiki/Autosomal_DNA_statistics):

Percentage	cMs Shared	Possible Relationship
100%	6766	Self, identical twin
50%	3400	Mother, father
50%	2640 - 3400	Full siblings
25%	1700.00	Grandfather, grandmother, aunt, uncle, half-sibling, double first cousin
12.5%	850.00	Great-grandparent, first cousin, great-uncle, great-aunt
6.25%	425.00	First cousin once removed
3.125%	212.50	Second cousin
1.563%	106.25	Second cousin once removed
0.781%	53.13	Third cousin

The ISOGG Wiki:
https://isogg.org/wiki

The Shared cM Project:
http://thegeneticgenealogist.com/2015/05/29/the-shared-cm-project/