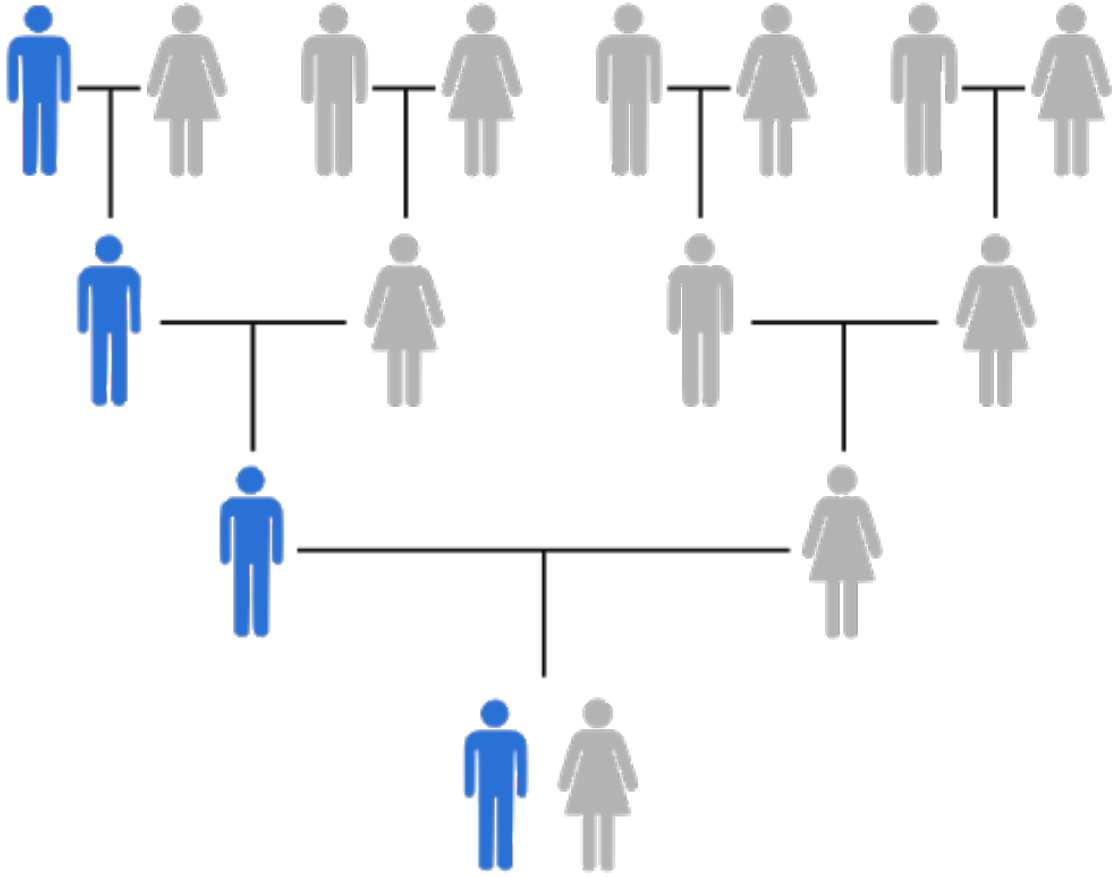
Types of DNA Testing

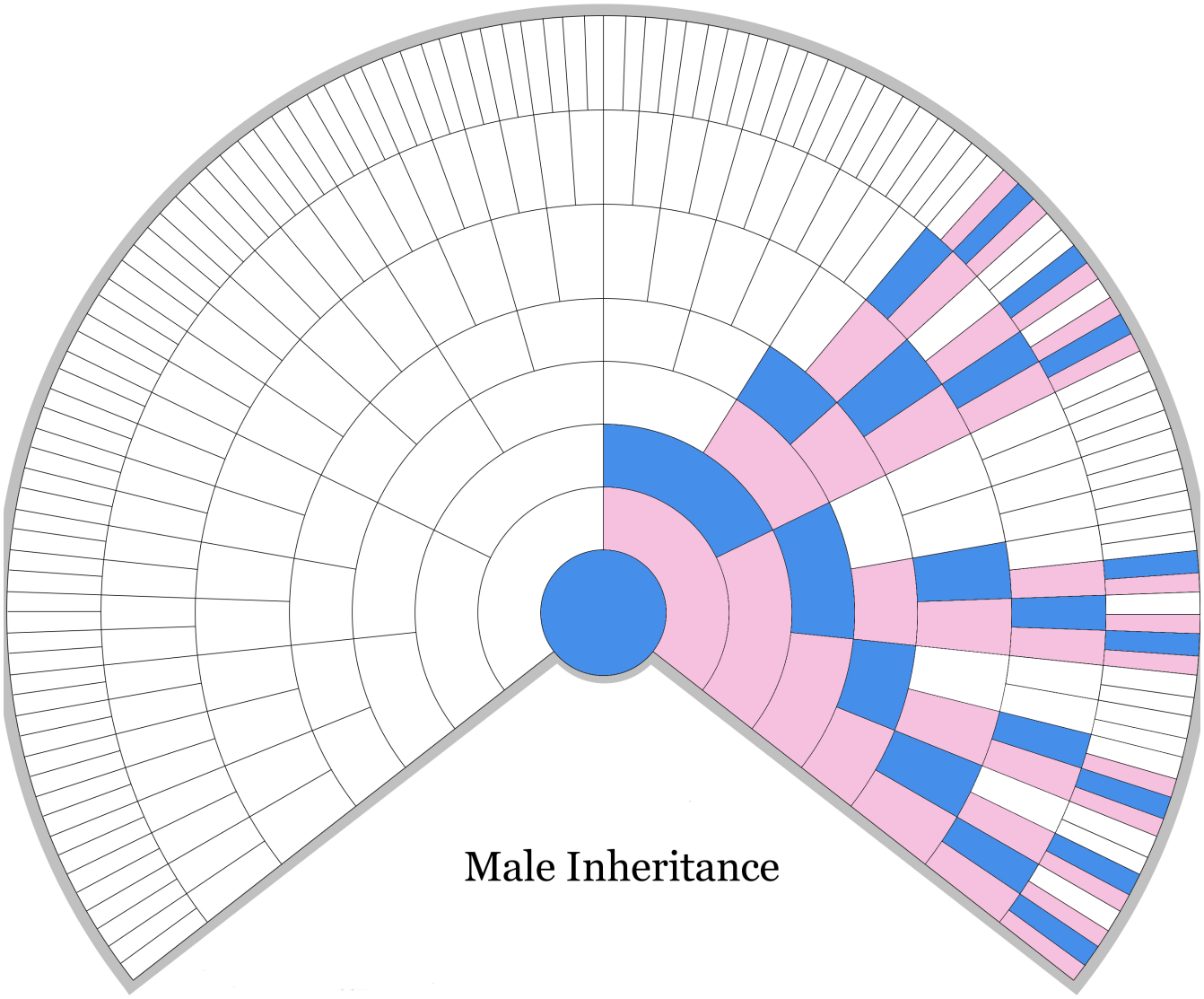
Y- DNA



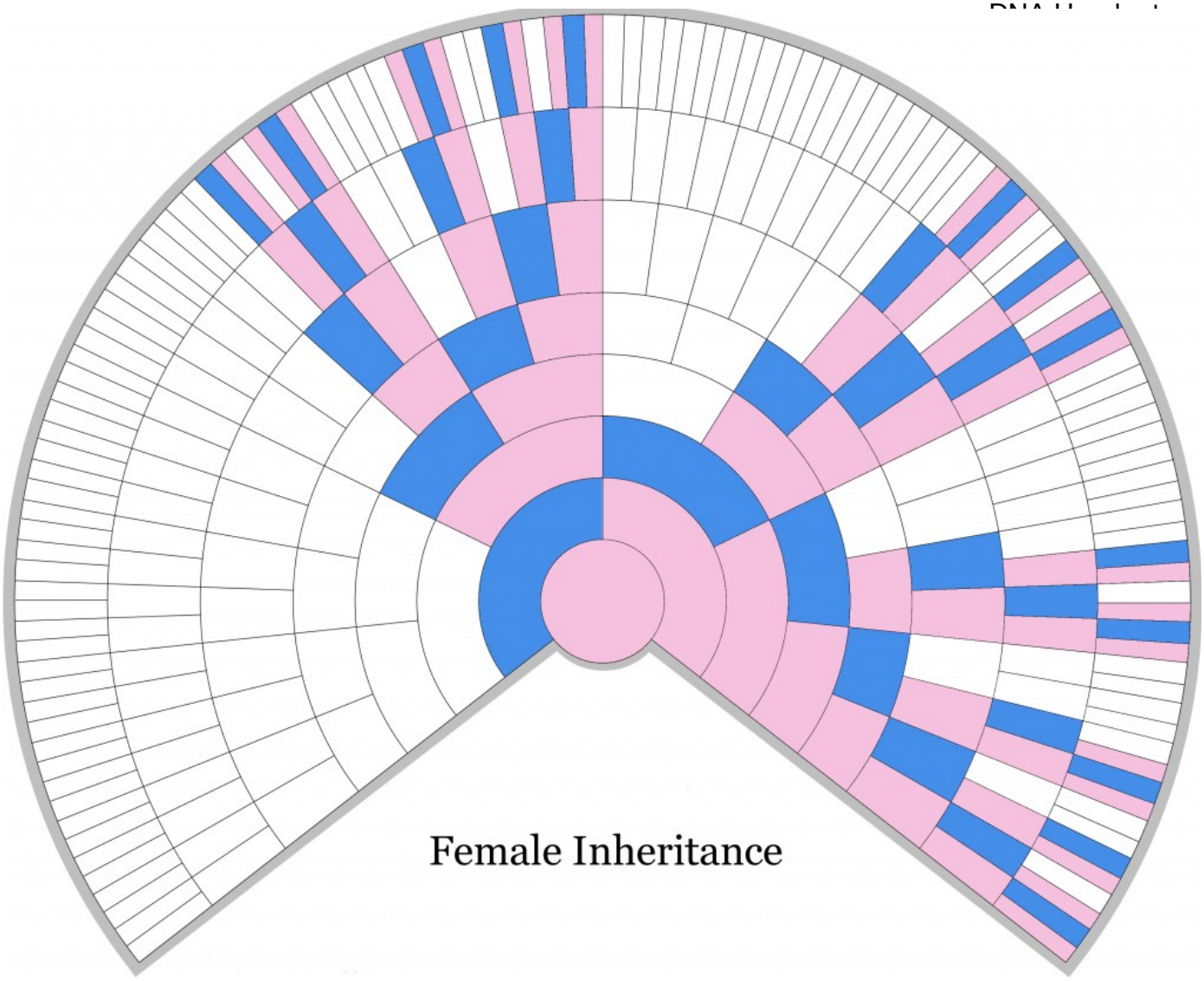
Y DNA INHERITANCE CHART

- Only males have Y-DNA, therefore only males can Y-DNA test.
- Y-DNA passes from a father to his male children.
- Y-DNA testing for genealogy is used to test the direct male line of the tester (the tester's father's father's father's, etc, line of inheritance."

X-DNA



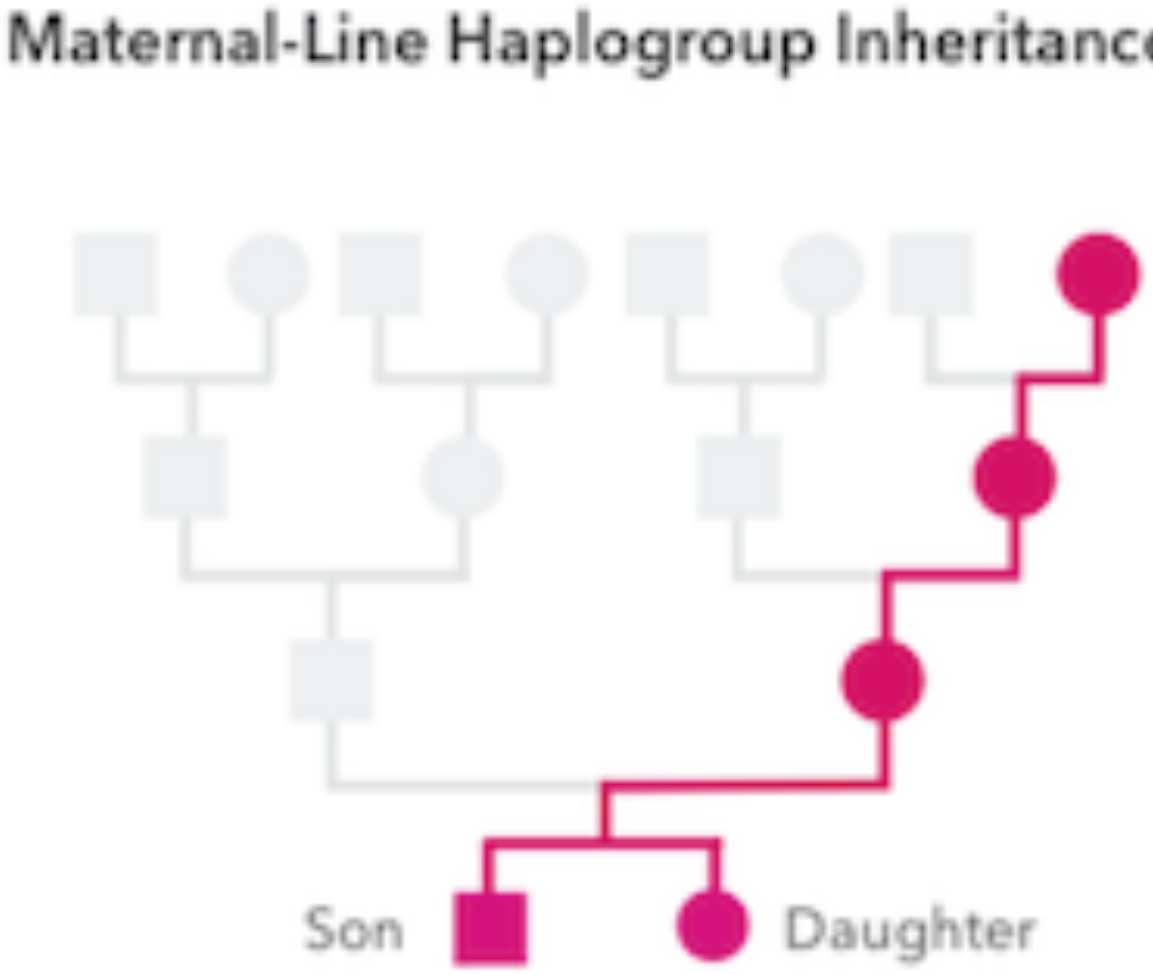
MALE X-DNA INHERITANCE (MALE CONTRIBUTORS IN BLUE, FEMALE CONTRIBUTORS IN PINK. PHOTO CREDIT: BLAINE T. BETTINGER



FEMALE X DNA INHERITANCE CHART. MALE CONTRIBUTORS IN BLUE. FEMALE CONTRIBUTORS IN PINK. PHOTO CREDIT: BLAINE T BETTINGER.

- X-DNA is inherited by both men and women. Men receive only one X chromosome from their mother. Women receive one X-chromosome from their mother and one from their father.
- Because of inheritance patterns and genetic recombination, X-DNA is not considered to be as useful for genealogy as some other tests (although it is not useless!).
- Therefore, no major companies offer X-DNA testing alone. Some testing companies include X chromosome information with their autosomal DNA testing.

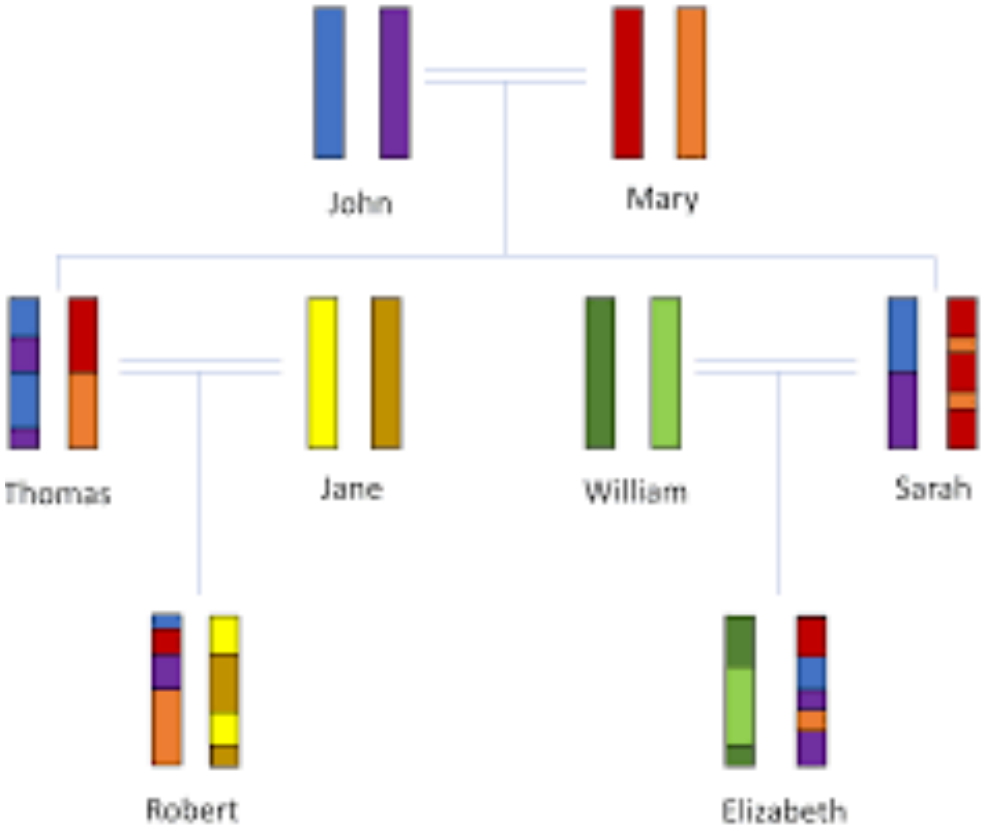
MtDNA (mitochondrial DNA)



MTDNA INHERITANCE

- Mitochondrial DNA (mtDNA) is passed down from a mother to all of her children, both male and female.
- Males do not pass on MtDNA.
- Both males and females can test their mtDNA.
- mtDNA tests trace the line of the tester's mother's mother's mother, etc.

Autosomal DNA



AUTOSOMAL DNA INHERITANCE

- Everybody has autosomal DNA (atDNA). Everyone, both male and female, can take an autosomal DNA test.
- Autosomal DNA testing is currently the most popular and most utilized consumer DNA testing on the market.
- Everyone in inherits 50% of their autosomal DNA from each parent, thus anyone can take an autosomal DNA test to test DNA on both sides of their family.
- More information can be gleaned by testing additional family members.

DNA Testing Companies

AncestryDNA

- Offers Autosomal DNA Testing.
- Both males and females can autosomal DNA test.
- Ancestry offers many features, some are included with the price of the DNA test, others require a subscription to ancestry.com.
- Does not allow transfers of DNA from other testing companies.

FamilyTreeDNA

- Offers Y-DNA testing, mtDNA testing, and Autosomal DNA testing.
- No subscription once you have tested. All features are available for life with your test.
- Free DNA projects for testers and researchers to join.
- Allows transfers of atDNA from other testing companies.
- Works with law enforcement.

MyHeritage

- Offers autosomal DNA testing.
- Many features are offered, some included with the testing, and some requiring a subscription to MyHertiage.com (much like AncestryDNA).
- Allows transfers from other testing companies.

23andME

- Autosomal DNA testing.
- All features at the time of testing are available for life with no subscription.
- Does not allow transfers from other DNA testing companies.
- Testing available for just genealogy or for genealogy and health purposes.

Terminology

Chromosome- A threadlike structure made up of DNA and found in the nucleus of the cell. Everyone, with a few exceptions for certain conditions, has 23 sets of chromosomes; twenty-two sets of autosomal chromosomes and one set of sex chromosomes (Y/X).

Centimorgan- A unit of measurement for the frequency of recombination. In short, centimorgans are the unit of measurement used when discussing segments of shared DNA between two autosomal DNA test takers.

Triangulation- Triangulation is when three people all share DNA on the same segment of the same chromosome, meaning all three inherited that DNA from the same ancestor/set of ancestors. Triangulation is how we definitively prove where the family trees of DNA matches intersect and who the common ancestor/ancestors are between the matches.

Chromosome mapping- Chromosome mapping involves triangulating between matches and determining which segment of which chromosomes were inherited from a specific ancestor, then labeling that section of chromosome on a visual “map.”

Transfer- When we discuss transferring DNA raw data from one testing company to another, it does not mean you are removing your raw DNA data from one site and moving it to another, but rather downloading your raw DNA data from one website and uploading it to another so you can utilize their tools and matching in addition to the testing site you are already on. Transferring does not remove your DNA from the original testing site.

The Shared cM Project – **Version 4.0** (March 2020)

Blaine T. Bettinger
www.TheGeneticGenealogist.com

How to read this chart:

Aunt/Uncle
1741
1201 - 2282

Relationship
Average
Range (min-max)

								Great-Great-Great-Grandparent		GGGG-Aunt/Uncle	
							Great-Great-Grandparent		GGG-Aunt/Uncle		
Half GG-Aunt/Uncle 208 103 – 284	**Great-Grandparent** 887 485 – 1486							**Great-Great Aunt/Uncle** 420 186 – 713	**1C3R** 117 25 – 238	**2c3R** 51 0 – 154	Other Relationships
Half 1C2R 125 16 – 269	**Half Great-Aunt/Uncle** 431 184 – 668	**Grandparent** 1754 984 – 2462					**Great Aunt/Uncle** 850 330 – 1467	**1C2R** 221 33 – 471	**2c2R** 71 0– 244	**3C2R** 36 0 – 166	**6C** 18 0 – 71
Half 2c1R 66 0 – 190	**Half 1C1R** 224 62 – 469	**Half Aunt/Uncle** 871 492 – 1315	**Parent** 3485 2376 - 3720			**Aunt/Uncle** 1741 1201 - 2282	**1C1R** 433 102 – 980	**2c1R** 122 14 – 353	**3C1R** 48 0 – 192	**4C1R** 28 0 – 126	**6C1R** 15 0 – 56
Half 3c 48 0 – 168	**Half 2c** 120 10 – 325	**Half 1C** 449 156 – 979	**Half-Sibling** 1759 1160 – 2436	**Sibling** 2613 1613 – 3488	**SELF**	**1C** 866 396 – 1397	**2c** 229 41 – 592	**3c** 73 0 – 234	**4c** 35 0 – 139	**5c** 25 0 – 117	**6C2R** 13 0 – 45
Half 3c1R 37 0 – 139	**Half 2c1R** 66 0 – 190	**Half 1C1R** 224 62 – 469	**Half Niece/Nephew** 871 492 – 1315	**Niece/Nephew** 1740 1201 - 2282	**Child** 3487 2376 – 3720	**1C1R** 433 102 – 980	**2c1R** 122 14 – 353	**3C1R** 48 0 – 192	**4C1R** 28 0 – 126	**5C1R** 21 0 – 80	**7C** 14 0 – 57
Half 3c2R 27 0 – 78	**Half 2c2R** 48 0 – 144	**Half 1C2R** 125 16 – 269	**Half Great Niece/Nephew** 431 184 – 668	**Great-Niece/Nephew** 850 330 – 1467	**Grandchild** 1754 984 – 2462	**1C2R** 221 33 – 471	**2c2R** 71 0– 244	**3C2R** 36 0 – 166	**4C2R** 22 0 – 93	**5C2R** 18 0 – 65	**7C1R** 12 0 – 50
Half 3c3R	**Half 2c3R**	**Half 1C3R** 60 0 – 120	**Half GG Niece/Nephew** 208 103 – 284	**Great-Great-Niece/Nephew** 420 186 – 713	**Great-Grandchild** 887 485 – 1486	**1C3R** 117 25 – 238	**2c3R** 51 0 – 154	**3C3R** 27 0 – 98	**4C3R** 19 0 – 60	**5C3R** 13 0 – 30	**8C** 11 0 – 42

Minimum was automatically set to 0 cM for relationships more distant than Half 2C, and averages were determined only for submissions in which DNA was shared

Developing a DNA Testing Plan

What question am I trying to answer using DNA testing?

Or, What is my goal in DNA testing?

Who do I have available to test besides myself?

Which type of test is best suited to answer my DNA testing question?

Which testing company most suits my needs?

What is my DNA testing budget?

Do I have the funds and the availability to test more than one person or at more than one testing company?

If so, who should I test besides myself to help answer my DNA testing question?

Which free or low cost DNA tools should I use in conjunction with my DNA test?

Thrulines

- Thrulines is available on ancestry.com only and is only available with an active Ancestry subscription.
- Thrulines provides data on ancestors and possible ancestors back to 5th great grandparents.
- AncestryDNA does not offer a chromosome browser or chromosome data for matches. Thrulines is an attempt to to offer users a substitution to triangulating matches with a chromosome browser.
- Like many other genealogy tools, Thrulines is a hint of where to look further. Thrulines should not be solely depended upon to verify genetic descent from an ancestor. Further research/work is still needed.

DNA Painter

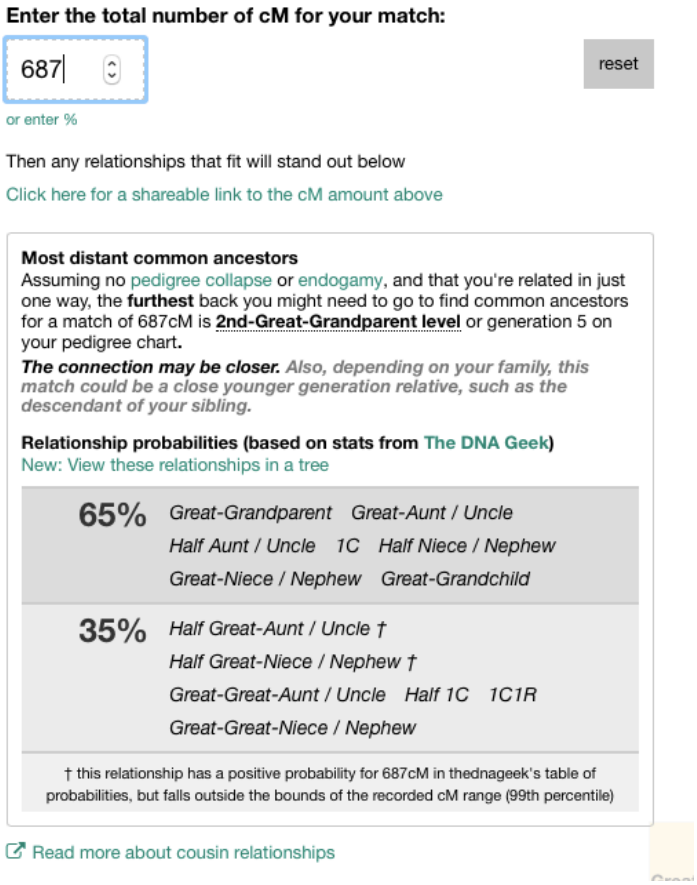
- DNA painter is a third party tool to be used with autosomal DNA test results. It cannot be used with Y-DNA or mtDNA tests.
- You do not upload your raw DNA data to DNA Painter.
- The DNA painter website now offers several tools to help interpret DNA test results and matches.
- www.dnapainter.com/help has helpful information for using their tools.

Shared cM Project Tool

- Using the shared cM project data and chart (found on page 8 of this handout), the Shared cM Project Tool allows user to input the amount of DNA shared by two matches and calculates the possible relationships

for that shared amount of DNA as well as the probability of each of these relationships.

- The shared cM project was created by Blaine T. Bettinger and more information can be found on his website, thegeneticgenalogist.com



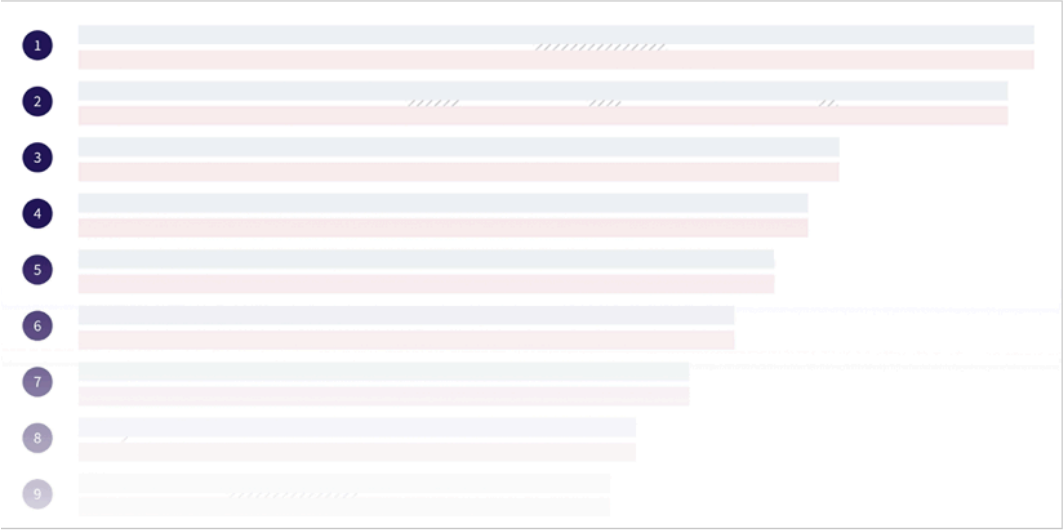
DNA Painter/Chromosome Mapping

- Allows users to visualize the actual segments of DNA you share with matches to deduce which parts of your DNA you inherited from specific ancestors in your tree.
- This does not use your raw DNA data, but rather segment data from your DNA matches. This means you cannot use DNA painter with the data provided by AncestryDNA alone because they do not provide segment data. You will need to either test with another company or download

your raw DNA data from AncestryDNA and transfer/upload it to another testing company, possibly for a small fee (ex: familytreedna.com, myheritage.com, gedmatch.com).

How to Map Chromosomes

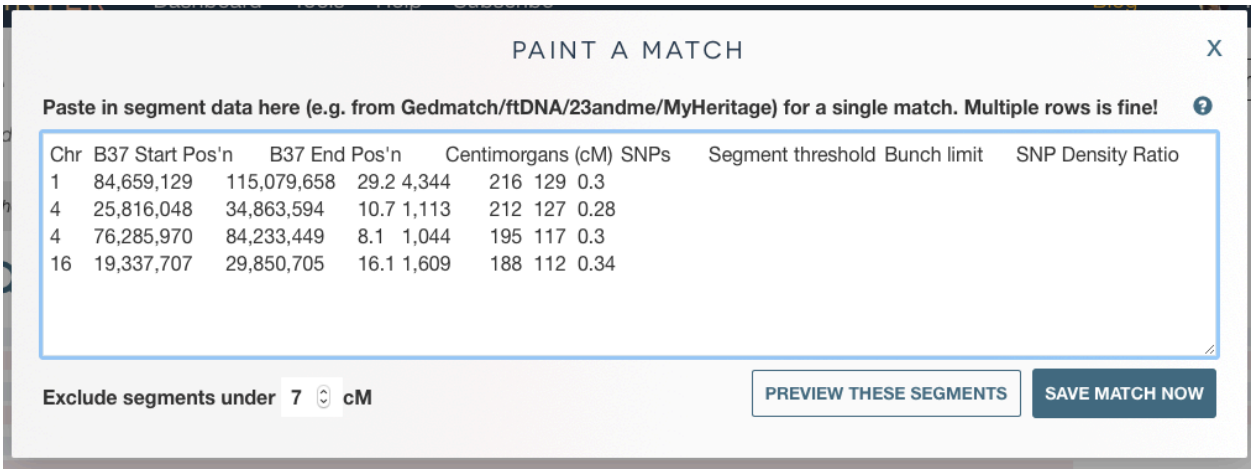
- Create a new chromosome map.
- Your chromosome map includes 22 pairs of autosomal chromosomes and one pair of X chromosomes. Y data is not able to be mapped, so men will have one X chromosome grayed out. The top chromosome in a pair on the map is paternal (marked in blue) and the bottom is maternal (marked in pink).



- Once you create a new chromosome map, you can start painting matches. Click on “paint new match.”
- You must now copy your segment data with your match from your testing company’s website.

Chr	B37 Start Pos'n	B37 End Pos'n	Centimorgans (cM)	SNPs	Segment threshold	Bunch limit	SNP Density Ratio
1	84,659,129	115,079,658	29.2	4,344	216	129	0.3
4	25,816,048	34,863,594	10.7	1,113	212	127	0.28
4	76,285,970	84,233,449	8.1	1,044	195	117	0.3
16	19,337,707	29,850,705	16.1	1,609	188	112	0.34

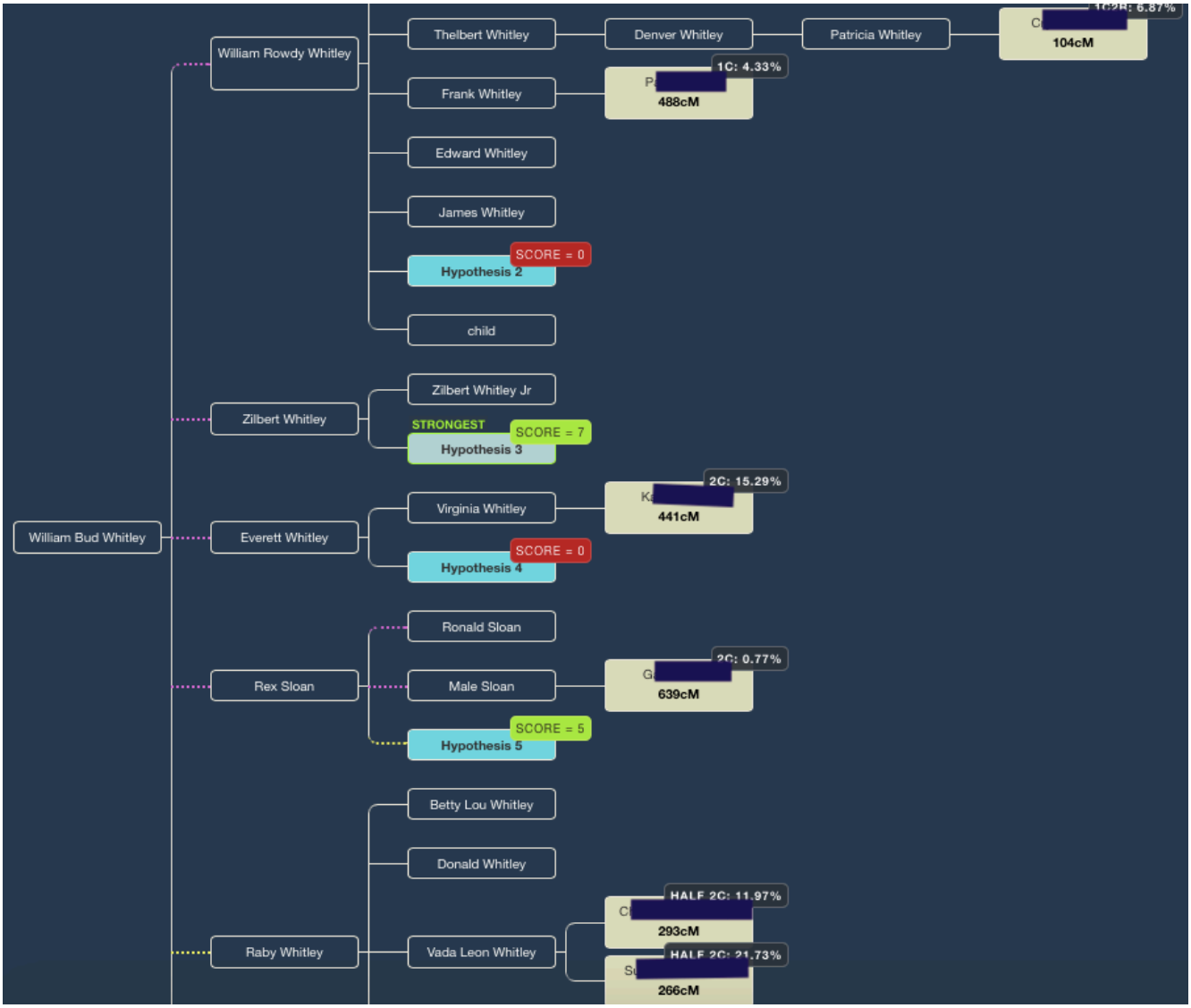
- Now you paste your segment data in the “Paint a new match” box on DNA Painter.



- You are now able to label your match with their name as well as your shared ancestors. As you paint matches for different ancestors, you will need to add those ancestors and select what color you want to represent them on your chromosome map. There is also an option to save a match as coming from an unknown ancestor and to later change it to a specific ancestor once you know who the shared ancestor is.
- It is best to start with known matches, or matches that you are certain of who the common ancestor is.
- As you match more known matches and attribute or “map” segments of your chromosomes to certain ancestors, you will be able to compare matches unknown to you to your chromosome map and determine if they are related to you through a particular ancestor. The more segments you map, the more matches you will be able to attribute to specific ancestors!

What Are The Odds (WATO)

- WATO allows a person to test a specific hypothesis about where someone fits into a family tree using segment data from several matches.
- Users then add a person as a “hypothesis” within the family tree in multiple places and WATO calculates the probability of that person fitting into that spot on the family tree and ranks the hypotheses.



Gedmatch

- Gedmatch is not a testing company itself.
- Gedmatch allows users to upload their raw DNA file from their testing company and use tools onGedmatch. Each uploaded DNA file is called a "kit."
- Gedmatch is free to use with the exception of some tools that require a membership and there is a limit to the number of kits per an account without a subscription.

One-to-Many Matching

- This tool matches a kit to other public kits on the Gedmatch server.

One-to-One Matching

- Allows users to compare one kit to another and obtain chromosome data.

People Who Match Both of 1-2 Kits

- Allows users to enter up to three kit numbers and find matches in common between those three kits.

Relationship Probability

- Functions similarly to the Shared cM Project Tool on DNA Painter.