



Beginning Genealogy: Session 4 Basic DNA

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Your Session 4 objectives.

Understand the following:

- What is DNA and why test?
- Types of DNA and testing companies
- Surprise results and ethical considerations
- Consanguinity chart and DNA percentages
- Leeds method for grouping cousins
- DNA cousins
- Participant successes and problems

DNA is a complex topic. In no way will you be an expert after this session!

Ask questions throughout!



What is DNA and why test?

- Deoxyribonucleic acid, or DNA, is a self-replicating material present in nearly all living organisms as the main constituent of chromosomes. It is the carrier of genetic information.
- What are some of the reasons to have your DNA tested?
 - To learn about the national or regional origins of your ancestors. Did you ancestors come from Europe or Africa? Did you have any Native American or Jewish ancestors?
 - To confirm that your tree reflects your ancestry. Is your tree accurate or did you follow a wrong line in your research?
 - To confirm relationships between people. Is the family story about being related to President Lincoln really true?

See <https://wheatonwood.com/introduction-to-genetic-genealogy-dead-people-can-talk-after-all/>



What is DNA and why test?

- To validate a theory of where someone came from. Did your great-grandfather really come from Greece?
- To break down a brick wall in your research. If published records cannot get you to that next generation, maybe DNA will provide a clue.
 - You might find a DNA cousin who has lots of family history information you didn't know!
- To find an adoptee's biological relatives. Who were your real parents? Do you have living siblings?
- To learn where traits came from. What are your potential health risks?

See <https://wheatonwood.com/introduction-to-genetic-genealogy-dead-people-can-talk-after-all/>



Three types of DNA tests

- Y-chromosome (Y-DNA) – tests the Y-chromosome only which is the male line of ancestors generally following a specific surname.
- Mitochondrial DNA (mtDNA) – for female ancestors.
- Autosomal DNA – both male and female lines.



Testing companies

- Five major companies conduct DNA testing:

- AncestryDNA,
- 23andMe,
- Family Tree DNA,
- Living DNA, and
- MyHeritage DNA.



- Each company does its own unique testing; however, most of the sites allow downloading of raw results and uploading of results from other companies (with some limitations).
- The number of tests the company has in its database influences the accuracy of the results.
 - The more tests, the better. The more tests with specific ethnic origins, the more accurate the results



Testing companies

- In addition, the website GEDmatch.com provides DNA tools and genealogy analysis of DNA tests from multiple companies.
 - GEDmatch is the website that has been used by criminal investigators to help solve murder cases.
- See https://isogg.org/wiki/Autosomal_DNA_testing_comparison_chart for a detailed comparison of testing companies.



Surprise results are possible

- You have a match with a previously unknown close relative, e.g., you've got a half sibling no one ever mentions.
 - Wife's father was adopted, found his sister years later.
 - Previous parental relationship yielded a sibling. Might not be an affair, by the way.
- One of your parents turns out not to be biologically related to you.
 - One of your parents was switched at birth and nobody knew.
 - One of your parents had an affair.
 - You were adopted and never knew.
- Your child turns out not to be biologically related to you.
- A supposedly deceased relative actually is still living.
- You find you have an unsuspected ethnic origin.
- You find you are at high risk for a medical condition like cancer.



Male/ Y-DNA

- Tests the Y-chromosome only which is the male line of ancestors generally following a specific surname.
- Fairly unchanged for several hundred years.
- Passed only to male descendants. Cannot be passed to female descendants because they have no Y-chromosome (*rare exceptions*).
- A clue to a distant paternal ancestor, shared by all male descendants.

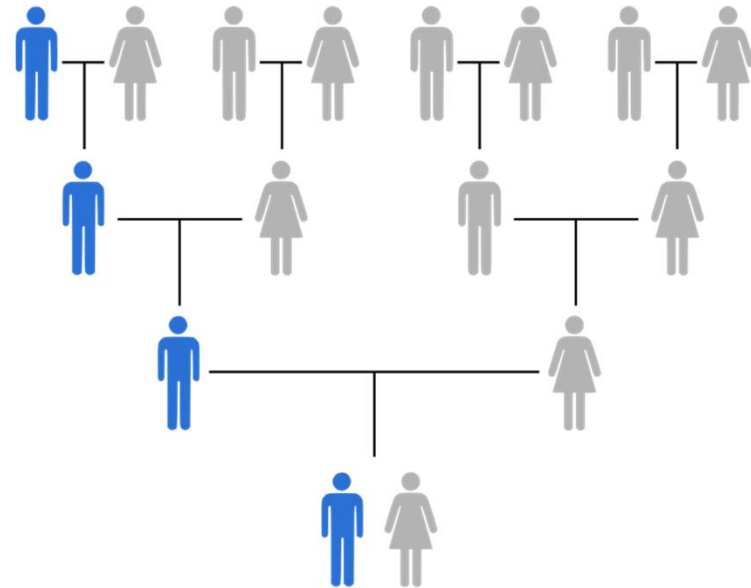
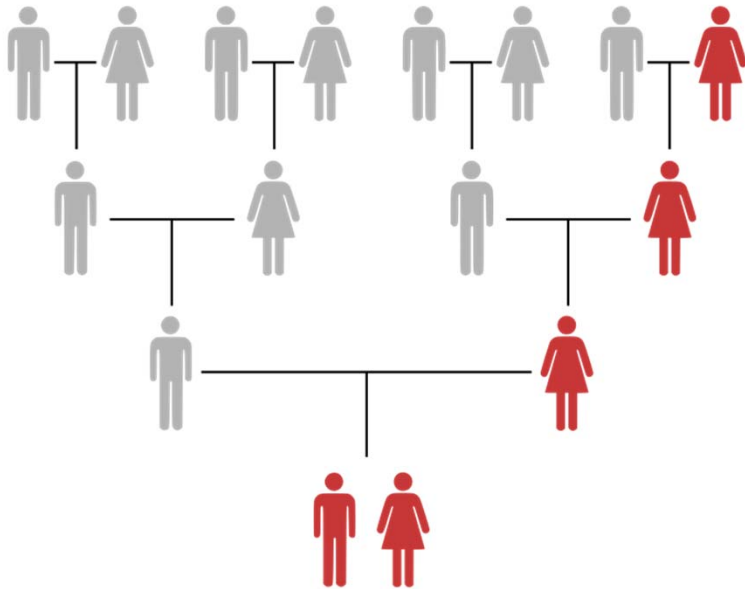


Image source: https://commons.wikimedia.org/wiki/File:Y-DNA_inheritance.svg?uselang=ca



Female/ mtDNA



- Mitochondrial DNA follows the maternal line.
- Fairly unchanged for several hundred years.
- A clue to a distant maternal ancestor.
- Passed to both male and female descendants, because both have an X-chromosome.
- Males do not pass along their mtDNA.

Image source: https://commons.wikimedia.org/wiki/File:MtDNA_inheritance.svg



Autosomal DNA

- Inheritance from both biological mother and father.
- This is what gets tested when you seek your ethnic origins.
- Good fidelity back several generations, but then the inherited percentages start to get very small.
- Accuracy of testing depends on the size and precision of the reference population.

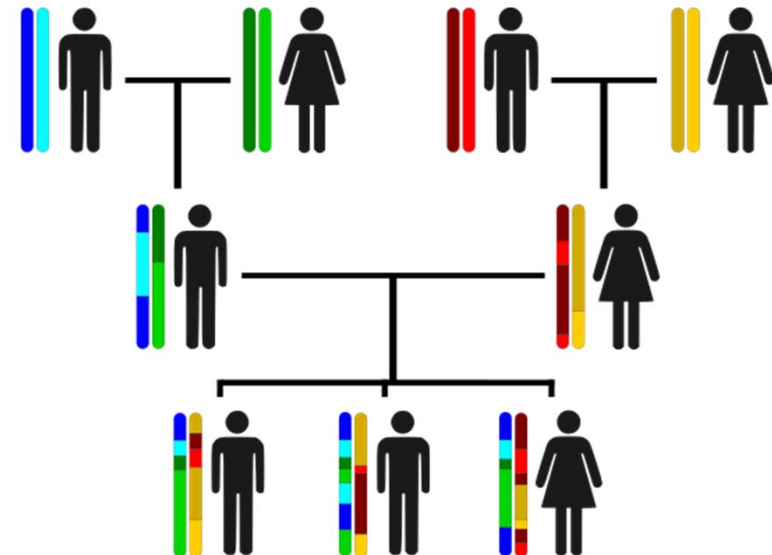


Image source: https://commons.wikimedia.org/wiki/File:Autosomal_inheritance_GPt3.svg



Ethical considerations

- You must have permission to test DNA of another person, preferably in writing.
 - See a permission template at <https://debbiewayne.com/pubs.php#quickref>, click on “Consent Form for a Project.”
- If you’re testing another person, you must ask if they want to hear about unexpected results.
- You must depend on DNA testing PLUS genealogy research for analysis of genealogical relationships beyond the first degree, e.g., parent/ child or full siblings.
- If you’re testing another person, you must have their permission to post their results to any other site or share with any other person.

Download genetic genealogy standards at
<http://www.geneticgenealogystandards.com/> .

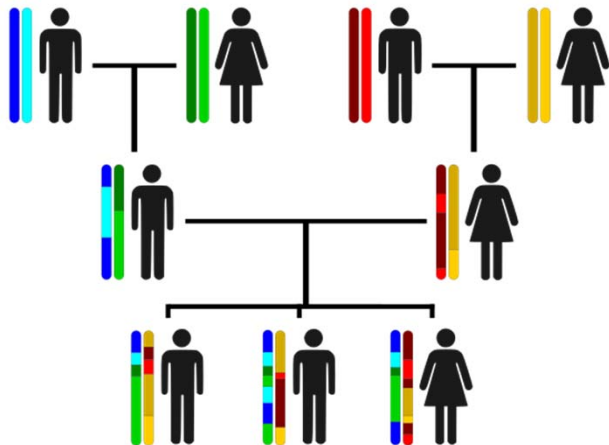


Who should you test?

- Test all of the oldest relatives you can.
 - Grandma and Grandpa would be great, and especially so if you can test all four (they come from different DNA origins).
 - Parents are next best, though you'll have to untangle which grandparent goes with which parent's results.
 - If you've tested your parents, there's no need to test your siblings unless there are unexpected results. Your parents have all the DNA for all their descendants.
 - Test yourself if you want to or need to.
 - I tested my parents atDNA, but later tested my own Y-DNA and mtDNA to pick up parental lines.
- Understand your reasons for testing, as they might point to other people you need to test.
- With family history brick walls or unexpected results, test farther out in the cousin pool to triangulate to ancestors in previous generations.



Consanguinity and DNA percentages



- One's DNA is rarely a 50:50 split from the parents. It'll be close.
- The unit "centimorgans" describes the length of shared DNA segments among family members.
- Usually, only segments larger than 7 cM are valid, and can be as long as 280 cM.
- The testing companies look at the size and quantity of shared DNA segments to predict your relationship to other people.
- Relationship categories can have similar ranges of shared DNA. A first cousin will have the same range of shared DNA as will a great-grandchild, for example.



Shared DNA percentages

% shared	Total cM shared	Relationship	Notes
100% (Method I) 50% (Method II)	3400.00	Identical twins (monozygotic twins)	Fully identical everywhere. [4]
50%	3400.00	Parent/child	Half-identical everywhere
50% (Method I) 37.5% (Method II)	2550.00	Full siblings	Half-identical on 50%/1700 cM and fully identical on a further 25%/850 cM.
25%	1700.00	Grandparent/grandchild, aunt-or-uncle/niece-or-nephew, half-siblings	
25% (Method I) 23.4375% (Method II)	1593.75	Double first cousins	Half-identical on 21.875%/1487.5 cM and fully identical on a further 1.5625%/106.25 cM
12.5%	850.00	First cousins, great-grandparent/great-grandchild, great-uncle or aunt/great-nephew or niece, half-uncle or aunt/half-nephew or niece	
6.25%	425.00	First cousins once removed, half first cousins, great-great-grandparent/great-great-grandchild, great-great-aunt/uncle, half great-aunt/uncle	
6.25%	425.00	Double second cousins	



Shared DNA percentages

% shared	Total cM shared	Relationship	Notes
3.125%	212.50	Second cousins, first cousins twice removed, half first cousin once removed, half great-great-aunt/uncle, great-great-great-grandparent/great-great-great-grandchild	
1.563%	106.25	Second cousins once removed, half second cousins, first cousin three times removed, half first cousin twice removed	
0.781%	53.13	Third cousins, second cousins twice removed	Up to 10% of third cousins will not share enough DNA to show up as match. See cousin statistics
0.391%	26.56	Third cousins once removed	
0.195%	13.28	Fourth cousins, third cousins twice removed	Up to 50% of fourth cousins will not share enough DNA to show up as match. See cousin statistics
0.0977%	6.64	Fourth cousins once removed. third cousins three times removed	
0.0488%	3.32	Fifth cousins	Only between 15% and 32% of fifth cousins will share enough DNA to show up as a match. See cousin statistics

Source: https://isogg.org/wiki/Autosomal_DNA_statistics



What to do with all those Ancestry cousins?

- Your results may include hundreds of distantly related cousins, 5th to 8th. There will have to be extensive trees to find your common ancestor, which for an 8th cousin would be your 7th-great-grandparents.
- The previous chart shows that a 4th cousin (common ancestor is 3rd-great-grandparent) shares about 0.195% common DNA. Not much!
- Ergo, first thing to do is to focus on your close relationships and ensure your results are linked to a public tree.
- Second, group your DNA cousins into “mom’s side” and “dad’s side.”
 - If you have your parents’ tests, then this works for the next older generation.
 - Look for surname matches and known cousins to add to a group.
 - Ancestry.com provides the built-in grouping function, so you can work there.
- Review each parental match list



Leeds method to group cousins

- Works well with Ancestry cousins to assign them to grandparent quadrants.
- Methodology (<https://dnawithdana.com/dna-color-clustering-the-leeds-method-for-easily-visualizing-matches/>)
 - Step 1: List 2nd and 3rd cousins.
 - Step 2: Assign a color to your first DNA match.
 - Step 3: Open that person's shared matches and assign each of them the same color in the same column.
 - Step 4: Locate the first person who does not have a color assigned and assign them a color in the next column.
 - Step 5: Open that person's shared matches and assign each of them the same color in the same column.
 - Step 6: Repeat steps 2 through 5 until all of your 2nd & 3rd cousins have at LEAST one color assigned to them.
 - Analyze results!
- See a variation of this method at <https://dna-explained.com/2018/09/26/the-leeds-method/>.
- These methods help you sort and assign people within your family tree.



Time for your genealogy.

- Open discussion and questions.
- Homework for next session:
 - Describe what you want to get from a DNA test.
 - Ethnic origins?
 - Answer a particular family history question?
 - Decide which DNA test will be most useful in the short run.
 - Decide who you will test and on which platform.