



INTRODUCTION TO GENETIC GENEALOGY

Joseph Tritchler, M.S.

Email: ancestry.tracker@gmail.com

URL: <https://ancestrytracking.com>

What is DNA?

- The chemical blueprint for life
- Four types of DNA
 - Autosomal DNA (atDNA)
 - Mitochondrial DNA (mtDNA)
 - X-DNA (X-chromosome DNA)
 - Y-DNA (Y-chromosome DNA)

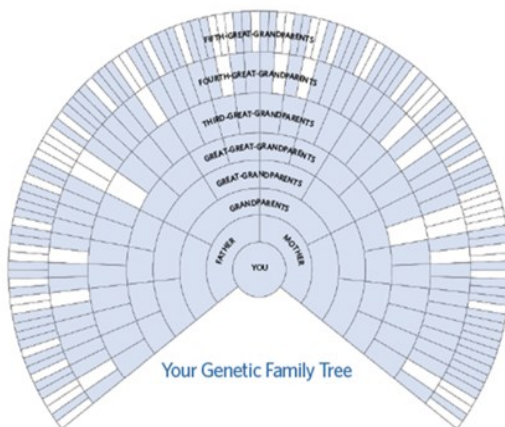
What are chromosomes?

- Made up of four different DNA “bases”: Thymine (T), Cytosine (C), Adenine (A), and Guanine (G)
- Two long twisted strands of DNA bases

Where is the DNA found within the cell?

- Nuclear DNA (within the nucleus of the cell) includes:
 - 22 pairs of autosomes (numbered 1 through 22 from longest to shortest strands) (atDNA)
 - 1 pair of sex chromosomes (two X chromosome in females, one X and one Y chromosome in males) (X-DNA and Y-DNA)
 - 97% of nuclear DNA is “junk” or “souvenir” DNA – This is what is largely used for genetic genealogy.
- Mitochondrial DNA (mtDNA)
 - Small circular strands of DNA
 - Each mitochondria carries 5 to 10 copies

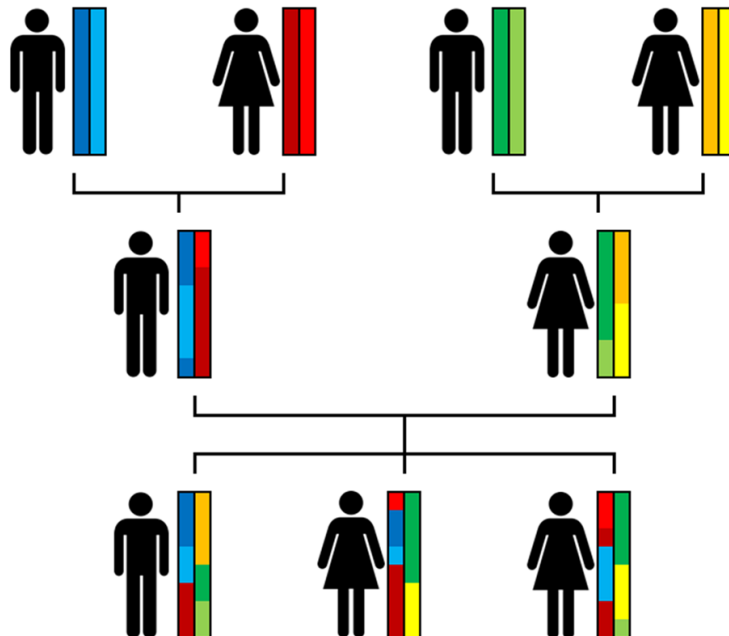
YOUR GENEALOGICAL FAMILY TREE	versus	YOUR GENETIC FAMILY TREE
Every ancestor back through time		Only those ancestors from whom you inherit DNA



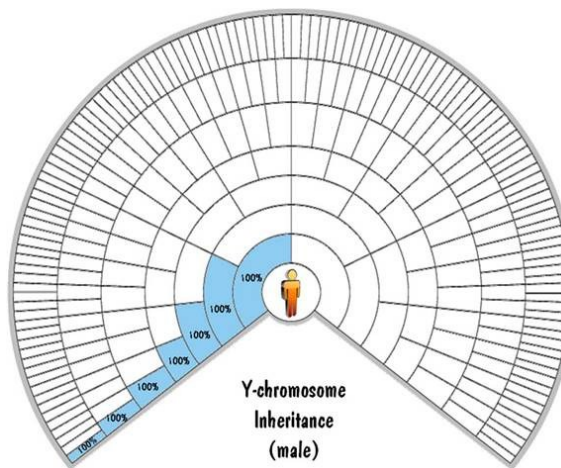
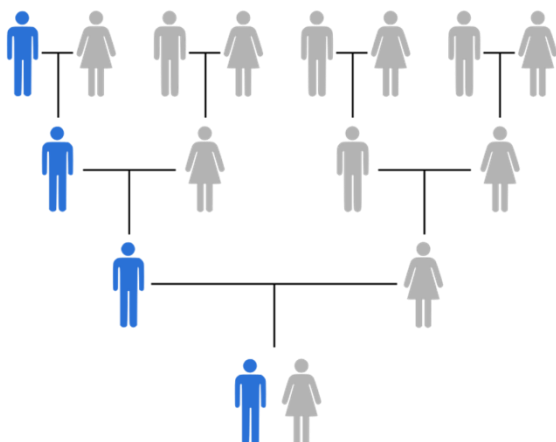
Generation	Average % DNA inherited from each ancestor
Parents	50%
Grandparents	25%
Great-grandparents	12.5%
2 nd great-grandparents	6.25%
3 rd great-grandparents	3.13%
4 th great-grandparents	1.56%
5 th great-grandparents	0.78%

DNA inheritance

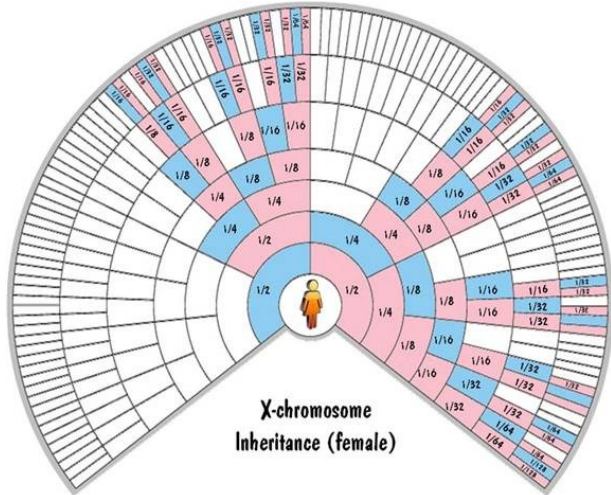
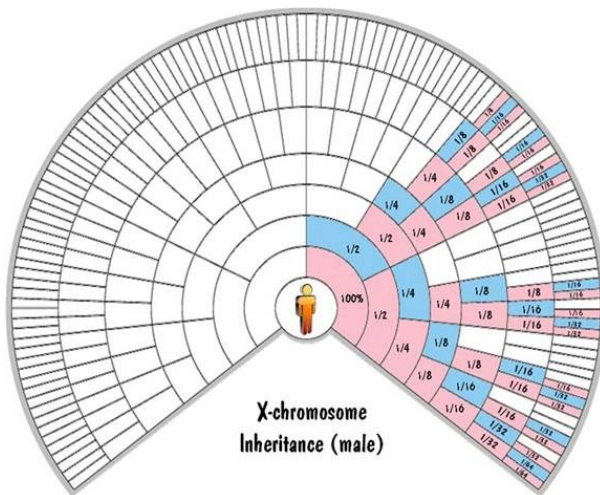
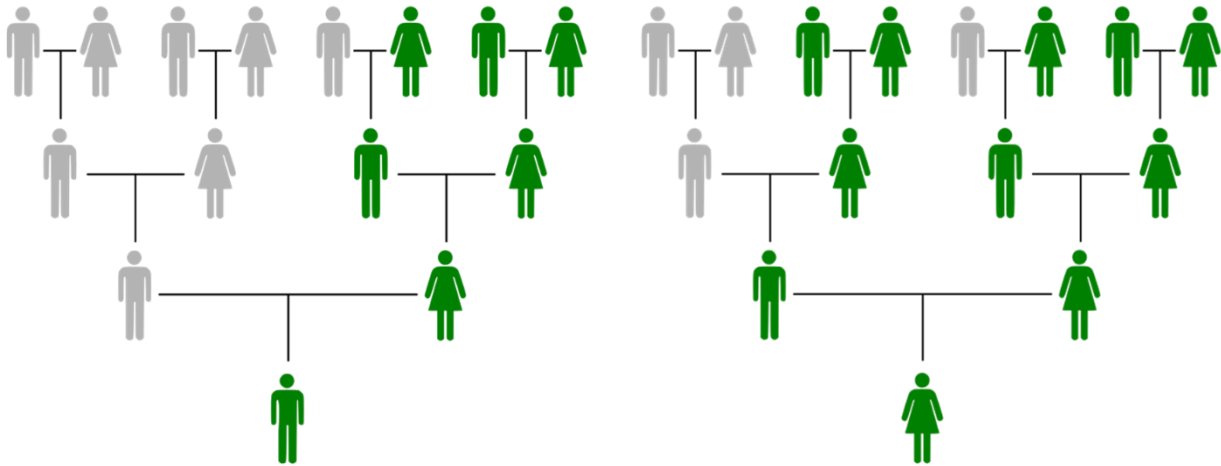
- Nuclear DNA
 - One chromosome from each chromosomal pair is passed along to offspring
 - Recombination (cross-over) of autosome pairs during reproduction produces entirely different chromosome make-up from the original chromosomes



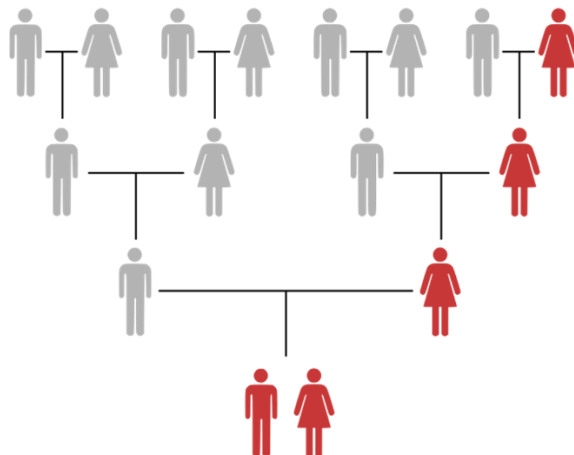
- Y-DNA – ONLY passed from father-to-son



- X-DNA
 - Men always receive their one-and-only X-chromosome from their mother
 - Women receive an X-chromosome from each parent



- mtDNA – ONLY passed from mother to all her offspring. Men do not pass mtDNA to offspring.



Why do DNA testing?

- Learn about your ethnic heritage
- Discover your geographic origins
- Find biological relatives (DNA Fishing)
 - Help break down genealogical brick walls
 - Help prove relationships
- Predict risks of disease
- Guide best treatment options for health problems

DNA Testing Companies

Features	AncestryDNA	23andMe	FamilyTree DNA	MyHeritage DNA	LivingDNA	CRI Genetics
atDNA testing	Yes	Yes	Yes	Yes	Yes	Yes
Y-DNA testing	No	Yes ¹	Yes	No	Yes ¹	Yes ¹
mtDNA testing	No	Yes ¹	Yes	No	Yes ¹	Yes ¹
Health screening	No	Yes	Yes	Yes	Yes	Yes
DNA collection	Saliva	Saliva	Cheek swab	Cheek swab	Cheek swab	Cheek swab
Upload to GEDmatch	Yes	Yes	Yes	Yes	Yes	No
Create a Family Tree	Yes	No	Yes	Yes	No	No
Upload test results	No	No	Yes	Yes	Yes	No
Subscription required	Yes ²	No	No	Yes ²	Yes ²	No
# Profiles in Database	> 20 M	> 14 M	> 2 M	> 2.5 M	Not Reported	Not Reported
Cost (Ancestry) (as of 21 Sep 2024)	\$99	\$99	\$79 (atDNA) \$159 (mtDNA) \$119 (Y-37) \$249 (Y-111)	\$79	\$90	\$89 (Ancestry) \$109 (+ Health) \$129 (+ Rel Find)

¹ Limited testing (haplogroups) for Y-DNA and mtDNA. No matching provided

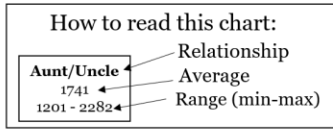
² For use of some analysis tools offered by this site.

DNA in Action

- Ethnicity Estimation
- DNA Matches
 - IMPORTANT: LINK YOUR DNA RESULTS TO YOUR FAMILY TREE**
 - Try to determine your relationship to matches with > 30 cM shared DNA
 - 95% likelihood these matches share a common ancestor within 6 generations

The Shared cM Project – Version 4.0 (March 2020)

Blaine T. Bettinger
www.TheGeneticGenealogist.com
CC 4.0 Attribution License



								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 1C1R 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 60 0 – 120	Half 2c3R 60 0 – 120	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

Source: Blaine Bettinger, "Shared cM Project, version 4.0 (March 2020), image, *The Genetic Genealogist* (<https://thegeneticgenealogist.com/wp-content/uploads/2020/03/Shared-cM-Project-Relationship-Chart.png> : 2 Dec 2024).

- Shared Matches – Match Triangulation
- Chromosome browser – Segment Triangulation (not available on AncestryDNA)
- Build family trees for each match to find **Most Recent Common Ancestor (MRCA)** – Tree Triangulation
- Find additional matches on other sites: Upload DNA results to other DNA test sites **and** GEDmatch (<https://www.gedmatch.com/>)

Resources

1. International Society of Genetic Genealogy (ISOGG): <https://isogg.org>
 - ISOGG Wiki: https://isogg.org/wiki/Wiki_Welcome_Page
 - ISOGG Blogs: https://isogg.org/wiki/Genetic_genealogy_blogs
 - ISOGG Facebook groups & mailing lists: https://isogg.org/wiki/Genetic_genealogy_mailing_lists
2. References
 - Blaine Bettinger, Debbie Parker Wayne. *Genetic Genealogy in Practice*. Arlington, VA: National Genealogical Society, 2016.
 - Blaine Bettinger. *The Family Tree Guide to DNA Testing and Genetic Genealogy, 2nd edition*. Family Tree Books, 2019.
 - Diana Elder, Nicole Dyer, Robin Wirthlin. *Research Like a Pro with DNA*. Highland, UT: Family Locket Books, 2021.