Disclaimer!

The science of DNA is very complex, and its use is constantly evolving in science, medicine, pharmaceuticals, and policework, to name just a few areas.

We will cover some high-level basics as DNA relates to genealogy and some commercially available tests.

Exercise caution and pause before taking (or asking someone to take) a DNA test. DNA can reveal emotionally sensitive information about family and ancestors. In addition, some DNA tests could disclose health information that could create unwarranted concerns. Privacy for DNA test-takers is paramount.

Even if you arrange and pay for a DNA test for someone else, the results still belong to them.

In this class, we will cover:

- **What is DNA Testing?**

- **Autosomal DNA**

- **Autosomal DNA Matches**
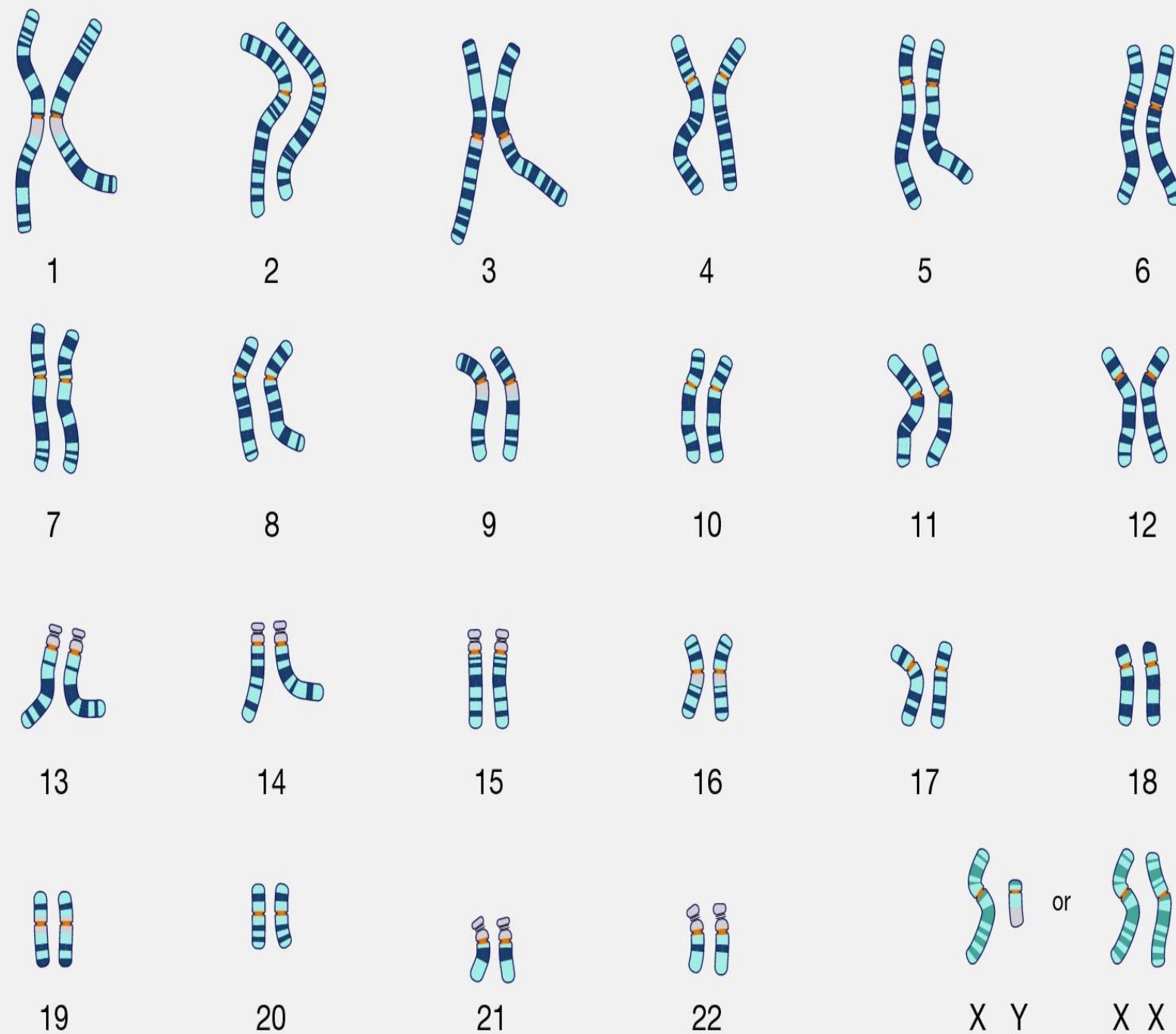
- **Ethnicity Estimates**

- **Other Features**

DNA
Testing

What is DNA?

Deoxyribonucleic Acid

Shown here are human chromosomes

Courtesy: National Human Genome Research Institute (https://www.genome.gov/)

- DNA controls most aspects of human cellular biology. DNA is organized into 22 chromosome pairs and a single pair of sex chromosomes.

- Our chromosomes comprise about 3 billion DNA base pairs (6 billion altogether).

- DNA Strands of varying lengths make up genes (between 20,000 and 25,000 genes).

- DNA is made up of repeating sequences of adenine (A), thymine (T), guanine (G), and cytosine (C). The sequencing of A, T, G, and C is the specific code for the Gene.

- The complete set of DNA is called a Genome.

- Humans share 99.9% identical DNA.

- Genealogically speaking, we are interested in the .1% that may not be identical

Types of DNA Tests

Autosomal DNA (atDNA): Tests the 22 non-sex chromosomes and is the primary type used in genealogy. Each chromosome is inherited in pairs—one from each parent—allowing for broad ancestry and relationship matching across recent generations.

Y-chromosomal DNA (Y-DNA): Useful for tracing direct paternal lineage, as it is found only in males and passed from father to son. This test is ideal for surname research and tracking ancestry along the male line.

Mitochondrial DNA (mtDNA): A small circular DNA structure located outside the cell nucleus, mtDNA is passed down unchanged from mother to child. Only females pass mtDNA to the next generation, making it useful for tracing direct maternal ancestry over many generations.

X-chromosomal DNA (X-DNA): Inherited differently by men and women, with women receiving two X chromosomes (one from each parent) and men inheriting a single X chromosome from their mother. X-DNA can sometimes help identify specific ancestral lines, though it is less frequently used in general genealogy.

How DNA Tests are Used

Autosomal DNA (atDNA): The primary test for identifying genealogical matches in commercial DNA testing. It provides the broadest connections across recent family lines and can reveal relationships up to 5-8 generations back. This test will be our main focus.

Y-chromosomal DNA (Y-DNA): Helps determine if two testers share the same paternal line, making it valuable for tracing direct male ancestry and surname studies. The mutation rate of Y-DNA allows for an estimate of the generational distance between matches, but it only applies to male lineage.

Mitochondrial DNA (mtDNA): mtDNA is useful for confirming maternal relationships, as it is passed down unchanged from mother to child. However, it does not provide information on the specific age of the relationship, which limits its usefulness in recent genealogical research.

X-chromosomal DNA (X-DNA): When matches are found, X-DNA can sometimes indicate maternal relationships. However, due to its complex inheritance pattern and limited applicability to specific lines, it is challenging to interpret without other supporting matches, making it less reliable as a primary genealogical tool.

Choosing a Test Company

ancestry
- Pros: Large database; family tree integration.
- Cons: No Y-DNA/mtDNA tests; subscription fees.
- Accepts DNA Uploads: No.

FamilyTreeDNA
- Pros: Comprehensive tests; advanced tools.
- Cons: Complex interface; smaller database.
- Accepts DNA Uploads: Yes.

23andMe
- Pros: Health insights; user-friendly interface.
- Cons: Privacy concerns; limited genealogical tools.
- Accepts DNA Uploads: No.

MyHeritage
- Pros: Global reach; innovative tools.
- Cons: Smaller database; subscription model.
- Accepts DNA Uploads: Yes

Ancestry only does Autosomal DNA Testing.*

Eye color is just the beginning.

ancestryDNA
DNA Activation Kit
+ TRAITS

Get AncestryDNA® + Traits

1
2
3
COLLECTION BAG
4

Activate Your DNA Kit

Would you like to continue signed in as **Hannah**

Yes   No

Enter the 15-digit activation code located on your collection tube to link your test results to your Ancestry account.

Helping activate a DNA kit for another adult? Activate here.

A1A-1A1A-1A1A-1A1A

A1A-1A1A-1A1A-1A1A

Next

FamilyTreeDNA

*Does Y-DNA testing

What Your Ancestry Test Gives You

Matches
- **What:** Connects you with relatives who share common DNA.
- **Use:** Explore family connections, build family trees, and verify family lines.

Ethnicity
- **What:** Breaks down your ancestral origins by geographic regions.
- **Use:** Discover the regions your ancestors came from, helping to trace roots and cultural history.
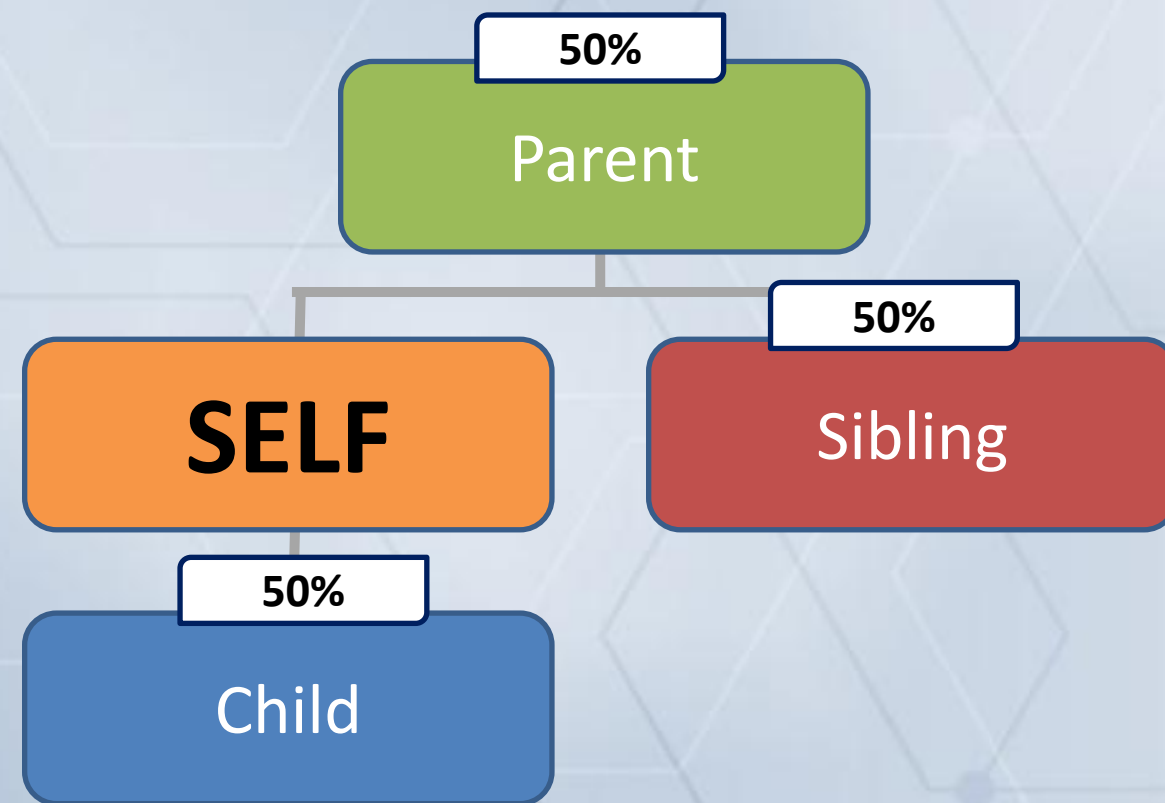
Traits
- **What:** Provides insights into personal characteristics influenced by genetics (e.g., eye color, taste preferences).
- **Use:** Understand how genetics play a role in individual traits

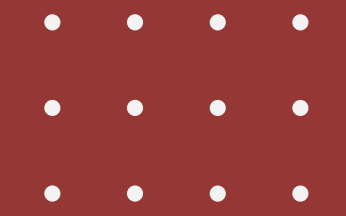# DNA & Genealogy

50%

Parent

50%

SELF

Sibling

50%

Child

- Everyone inherits about 50% of their DNA from each parent
- Apart from identical twins, siblings do not share the same DNA

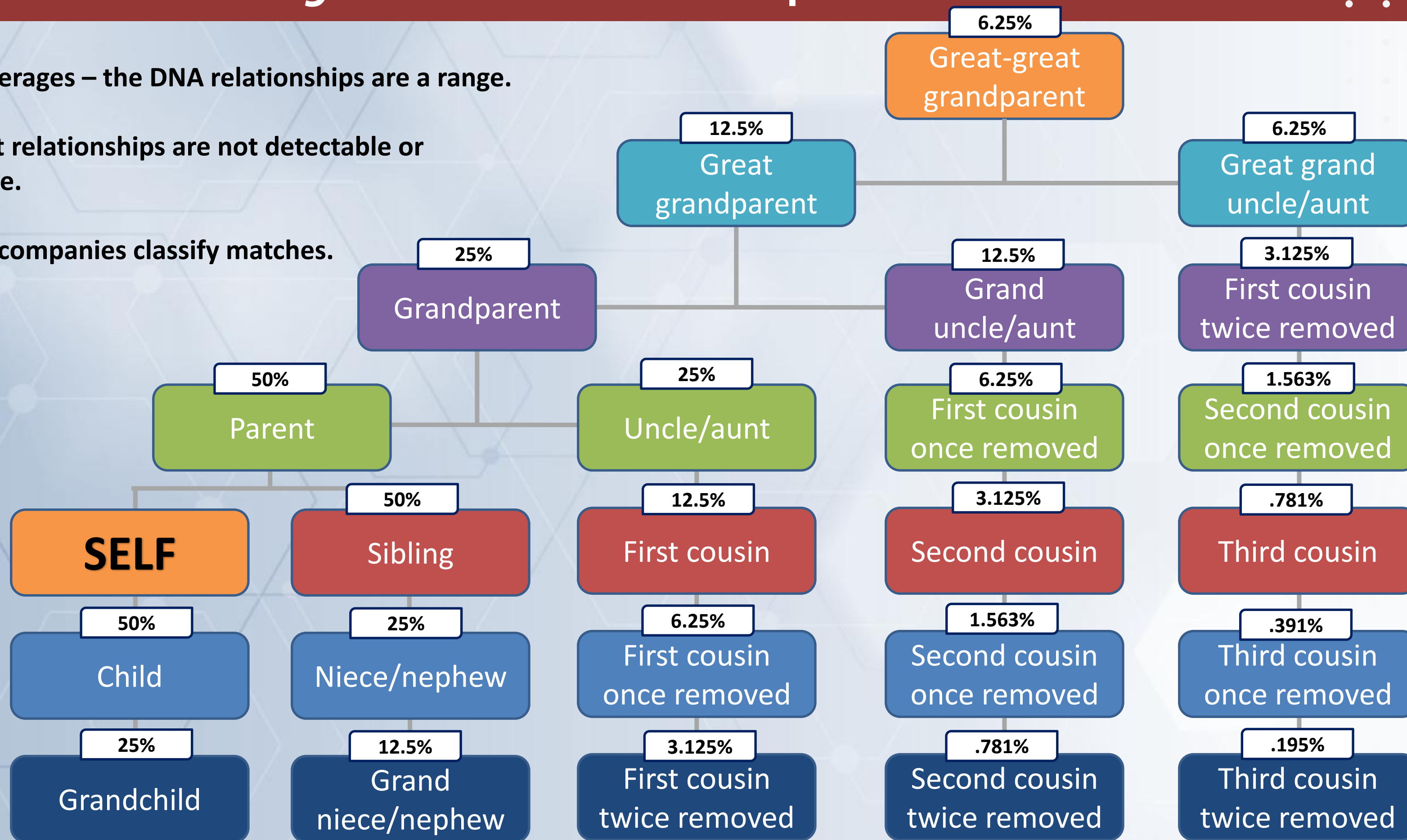Data from The International Society of Genetic Genealogy (ISOGG) Wiki (https://isogg.org/wiki/International_Society_of_Genetic_Genealogy)

Family Relationships & atDNA

Data from The International Society of Genetic Genealogy (ISOGG) Wiki (https://isogg.org/wiki/International_Society_of_Genetic_Genealogy)
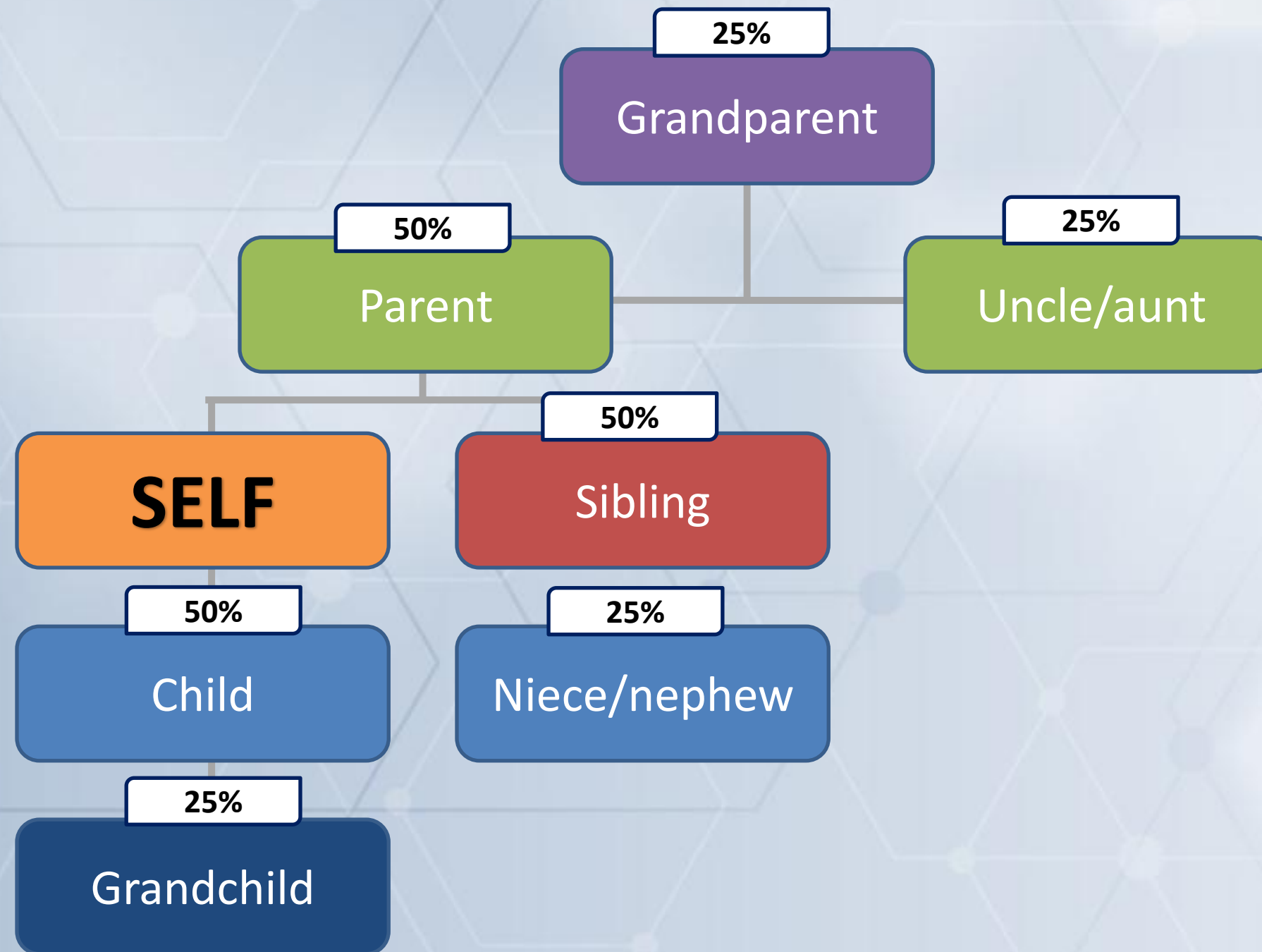
Family Relationships & atDNA

- **These are averages – the DNA relationships are a range.**

- **Some distant relationships are not detectable or are unreliable.**

- **DNA testing companies classify matches.**

Relationship chart (left to right, top to bottom):

- **6.25%** — Great-great grandparent
- **12.5%** — Great grandparent
- **6.25%** — Great grand uncle/aunt
- **25%** — Grandparent
- **12.5%** — Grand uncle/aunt
- **3.125%** — First cousin twice removed
- **50%** — Parent
- **25%** — Uncle/aunt
- **6.25%** — First cousin once removed
- **1.563%** — Second cousin once removed
- **SELF**
- **50%** — Sibling
- **12.5%** — First cousin
- **3.125%** — Second cousin
- **.781%** — Third cousin
- **50%** — Child
- **25%** — Niece/nephew
- **6.25%** — First cousin once removed
- **1.563%** — Second cousin once removed
- **.391%** — Third cousin once removed
- **25%** — Grandchild
- **12.5%** — Grand niece/nephew
- **3.125%** — First cousin twice removed
- **.781%** — Second cousin twice removed
- **.195%** — Third cousin twice removed

The Shared cM Project – **Version 4.0** (March 2020)
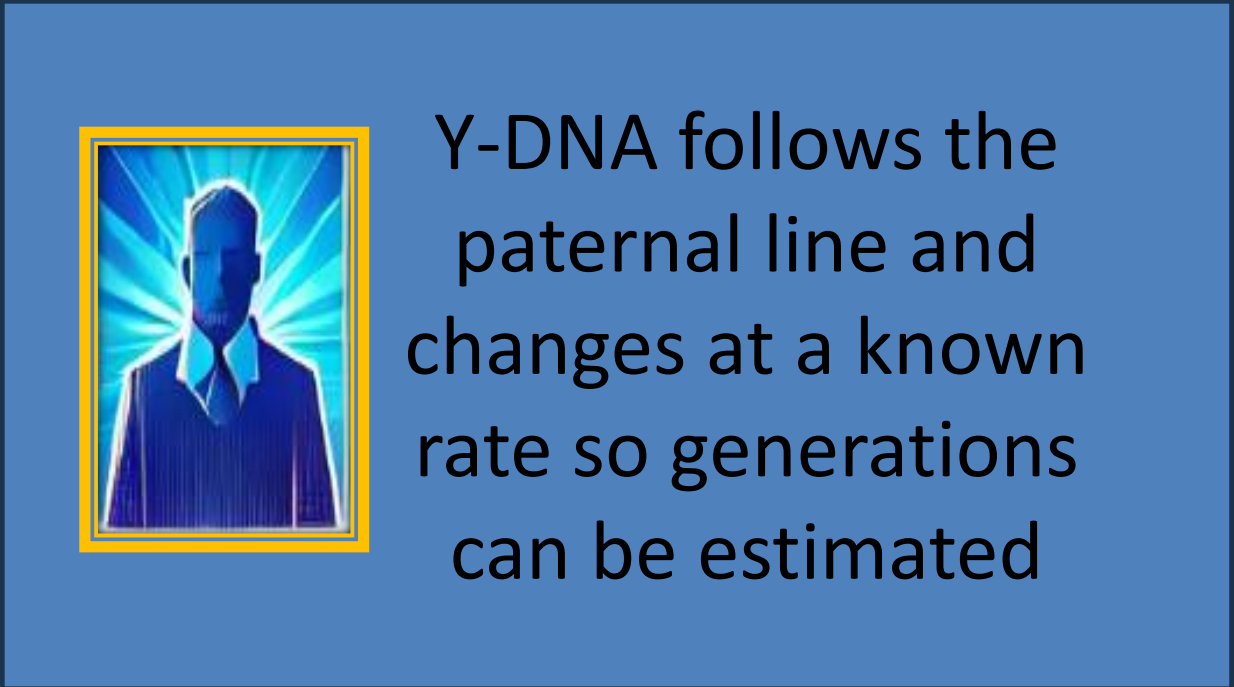
Blaine T. Bettinger
www.TheGeneticGenealogist.com
CC 4.0 Attribution License

How to read this chart:

Aunt/Uncle → Relationship
1741 → Average
1201 - 2282 → Range (min-max)

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

Additional upper relationships:

| Great-Great-Great-Grandparent | GGGG-Aunt/Uncle |
| Great-Great-Grandparent | GGG-Aunt/Uncle |

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
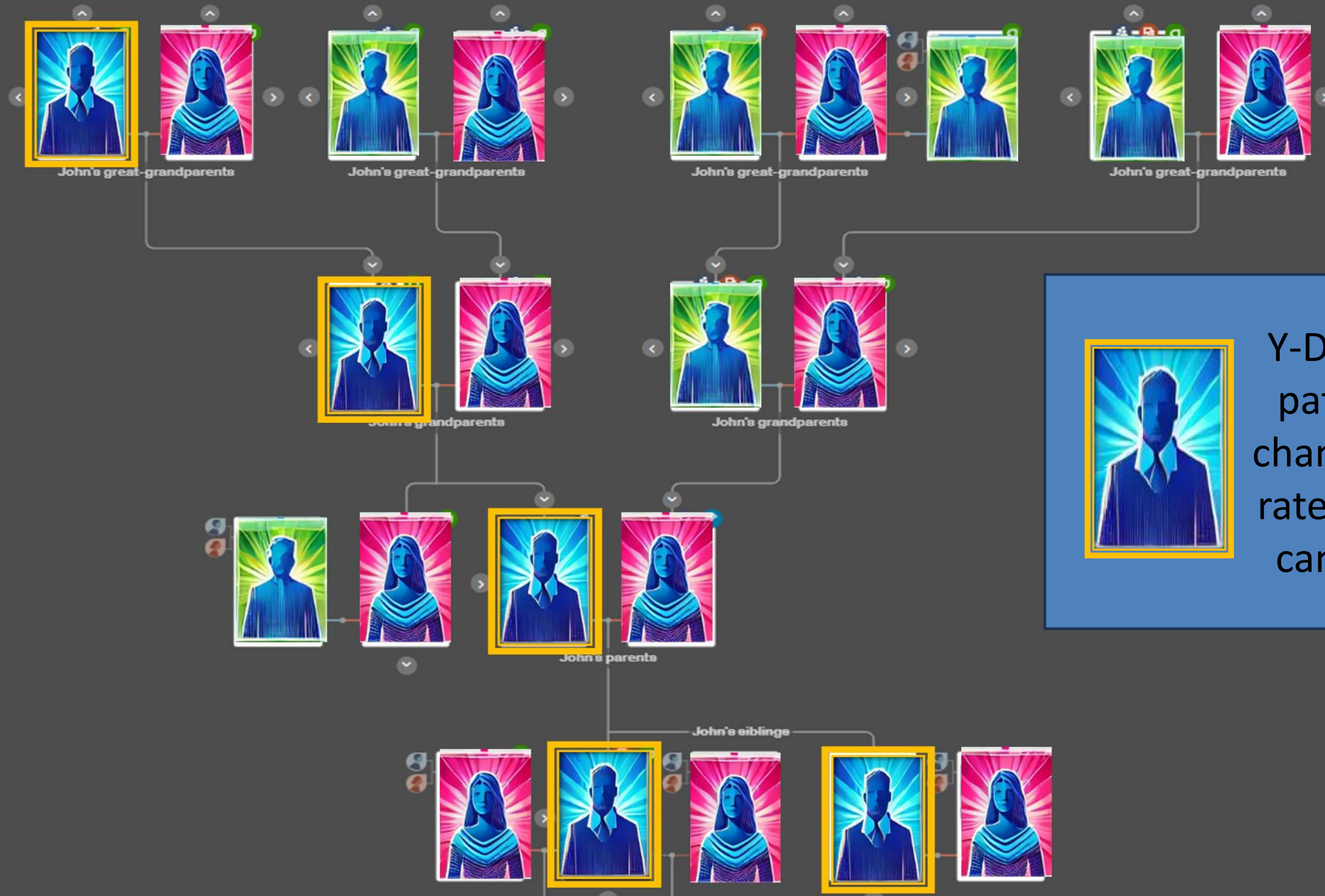
Y-DNA follows the paternal line and changes at a known rate so generations can be estimated

Autosomal DNA Matches

MyHeritage

Home   Family tree   Discoveries   Photos   DNA   Research

A **centimorgan (cM)** is a unit used to measure the probability that a section of DNA will be passed on to a descendant intact (rather than being split into separate segments).

Thomas Charles

Age: 70's
DNA managed by Sandra

Contact Sandra

Estimated relationships
1st cousin once removed - 2nd cousin ❓

DNA Match quality ❓
Shared DNA: 5.0% (354.9 cM)
Shared segments: 15
Largest segment: 72.2 cM

Review DNA Match

View tree

Appears in a family tree with 249 people, managed by S⬛⬛⬛⬛⬛ from United Kingdom
Your family tree has 4 Smart Matches™ with this tree. View Smart Matches

Centimorgans are not units of physical distance, but rather, units of probability. Generally, the more centimorgans two people share, the more closely related they are. (Ancestry.com – "*How We Measure Relationships between AncestryDNA® Matches*")

Lesley ⬛⬛⬛

Age: 40's
From: United Kingdom 🇬🇧

Contact Lesley

Estimated relationships
1st cousin twice removed - 2nd cousin once removed ❓

DNA Match quality ❓
Shared DNA: 2.2% (157.7 cM)
Shared segments: 9
Largest segment: 39.2 cM

Review DNA Match

View tree

Appears in a family tree with 249 people, managed by S⬛⬛⬛⬛⬛ from United Kingdom
Your family tree has 4 Smart Matches™ with this tree. View Smart Matches

Typically, the larger the largest **segment** the closer the relationship.

Steve ⬛⬛⬛

Age: 60's
From: United Kingdom 🇬🇧

Contact Steve

Estimated relationships
2nd cousin - 2nd cousin once removed ❓

DNA Match quality ❓
Shared DNA: 2.0% (144.7 cM)
Shared segments: 7
Largest segment: 37.5 cM

Review DNA Match

View tree

Appears in a family tree with 7 people that he manages
Ancestral surnames common to you and ⬛⬛⬛⬛ include Morley.

DNA Matches : Ancestry Example

List   Map

Filter by: ● Unviewed   ⚙ Common ancestors   ✉ Messaged   ▤ Notes   ⑂ Trees ⌄   Shared DNA ⌄   Groups ⌄   ⌕ Search | Sort ⌄

Parent/Child

Betty Beaumont
Mother
3,473 cM | 50% shared DNA
Mother's side

⑂ Public linked tree
3,337 People
⚙ Common ancestor

View match   ⊕

Close Family

John L▨
1st cousin 1x removed
457 cM | 7% shared DNA
Father's side

⑂ Unlinked Tree

View in tree

View match

▤ Tidmas/Worman - no response to messages. Not logged in for a while   ● ● ● ✎

John B▨
2nd – 3rd Cousin
215 cM | 3% shared DNA

⑂ No Trees

Do you recognize them?

Yes   Learn more

▤ sent message on 24Jan21 - not logged in for a year   ● ✎

Primrose
▨
2nd cousin
208 cM | 3% shared DNA
Father's side

⑂ Public linked tree
117 People
⚙ Common ancestor

View in tree

View match

▤ Contacted 4 Jan 2021 - Alfred Worman (1847)/Sarah Hunt (1846)   ● ● ★ ✎

Notice that I have
different matches with
the different testing
companies

DNA Shared Matches : Ancestry
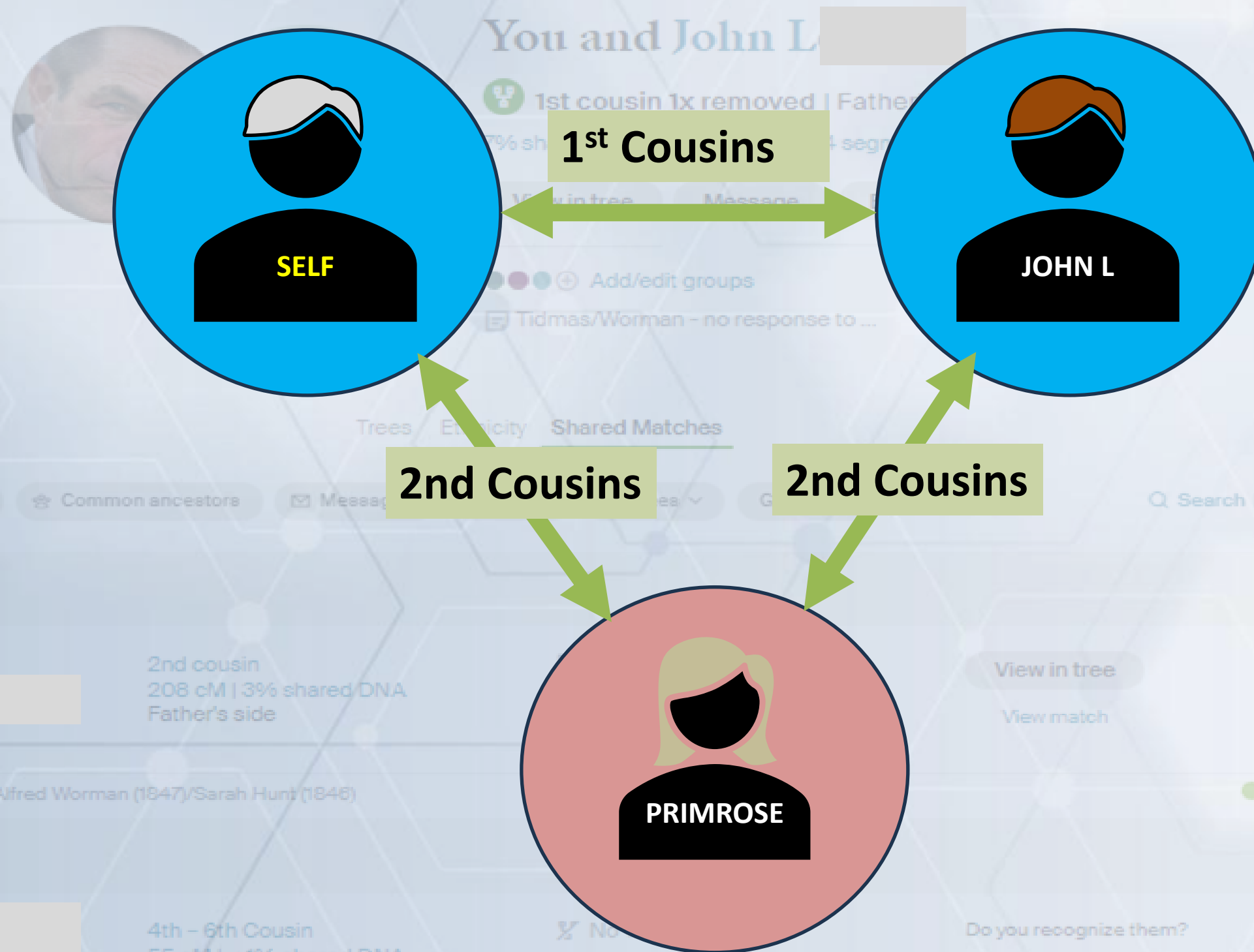
John L and I both share Primrose as a match and Primrose has both a shared tree and a common ancestor

- **Shared matches are matches that you and your match both share**

- **Shared matches are a powerful tool to triangulate where this person belongs in your tree**

- **In this example, the primary match does not have a family tree uploaded to Ancestry, but the shared match allows me to start resolving the relationship**

John L and I both share Primrose as a match and Primrose has both a shared tree and a common ancestor

- **Shared matches are matches that you and your match both share**

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DNA & Ethnicity

Ethnicity Estimates

- Your DNA testing company compares your DNA with that of worldwide reference populations.

- Your percentage match indicates a shared heritage with the reference DNA pool.

- Each DNA testing company has different reference populations, which they constantly refine and update so that your ethnicity can change over time.

- Ethnicity is not nationality or race.

- Ethnicity does not necessarily show immigration history.

- Because of the way we inherit DNA from our family (recombination), family members can have different DNA ethnicity results.

- Equally, because we don't inherit all of our parent's DNA, ethnicity markers may be missing from the results.

Regions | Journeys | By parent

john's 8 ancestral regions

■	64%	**England & Northwestern Europe**		→
■	10%	**Germanic Europe**		→
■	8%	**Denmark**	New	→
■	8%	**Ireland**		→
		▪ Connacht ›	New	
■	4%	**Cornwall**	New	→
■	3%	**Scotland**		→
■	2%	**Iceland**	New	→
■	1%	**Wales**		→

ICELAND

SWEDE

NORWAY

UNITED KINGDOM

IRELAND

DENMARK

NETHERLANDS

BELGIUM

GERMANY

FRANCE

CZECHIA

AUSTRIA

SWITZERLAND

CROATIA

PO

SLO

HU

mapbox
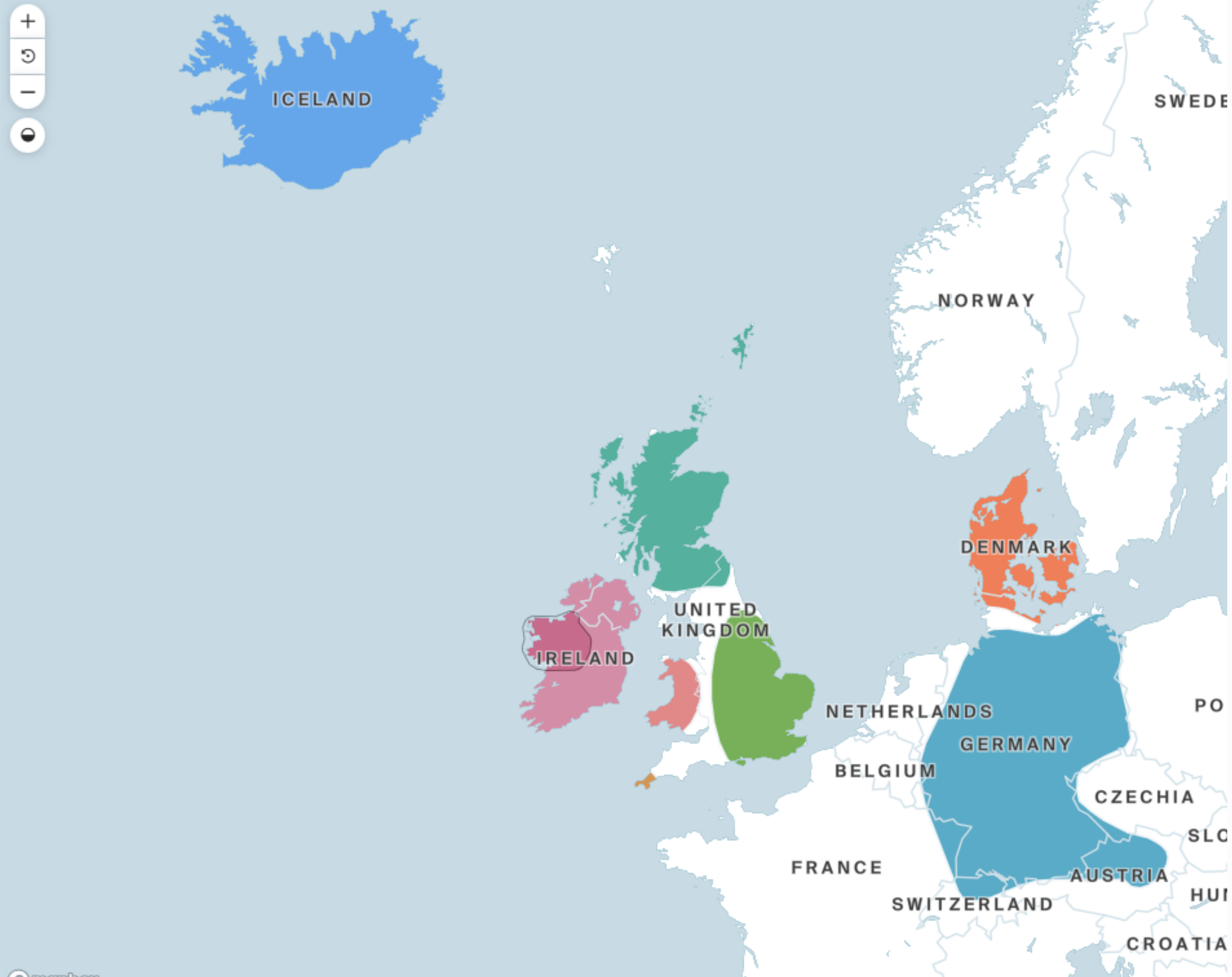
My Results Show The History Of England
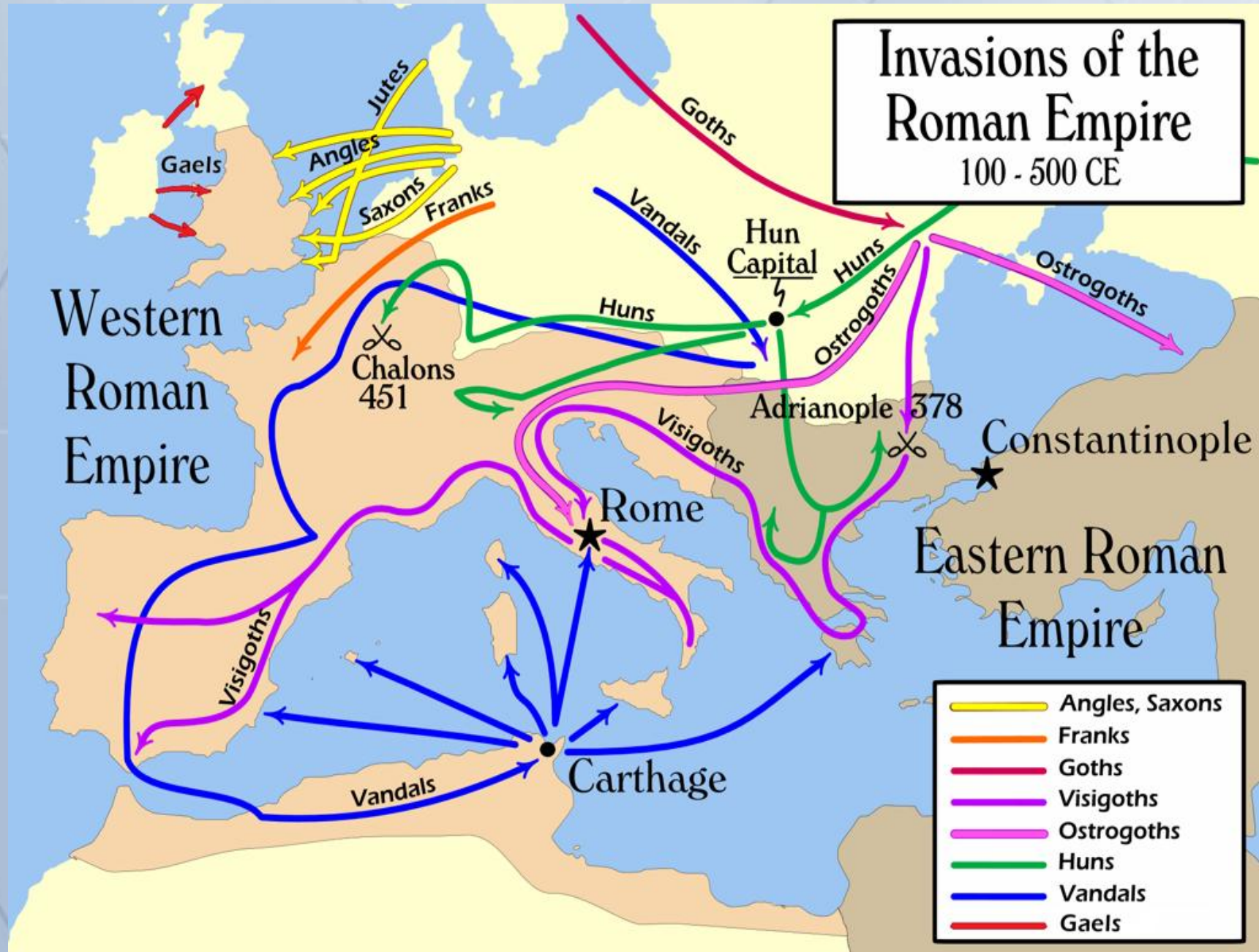
Regions | Journeys | By parent

Maggie's 9 ancestral regions

60%	Spain	→
18%	Portugal	→
7%	Indigenous Cuba	→
5%	Northern Africa	→
5%	Basque	→
2%	Senegal	→
1%	Western Bantu Peoples	New →
1%	Germanic Europe	→
1%	Cornwall	New →

Updated July 2024. ⓘ See what changed and FAQs

We compare your DNA against a worldwide reference panel to see which populations your DNA looks most like.
How do we calculate this?

Share
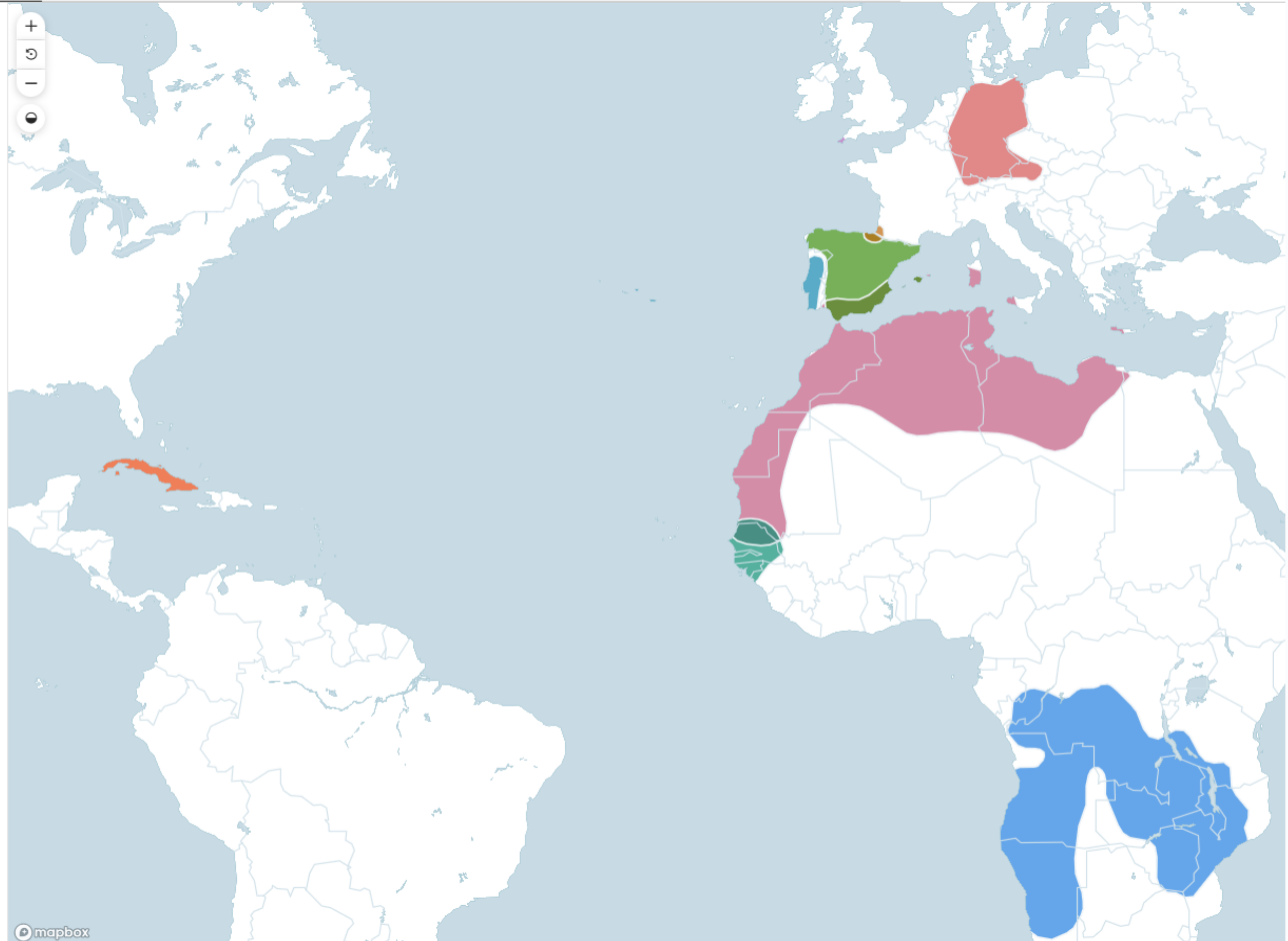
Ethnicity

My Wife's Results Show The History Of Spain/Cuba

DNA: Other Features

Traits

Ancestry Results Show "possible" traits (for an extra fee!)
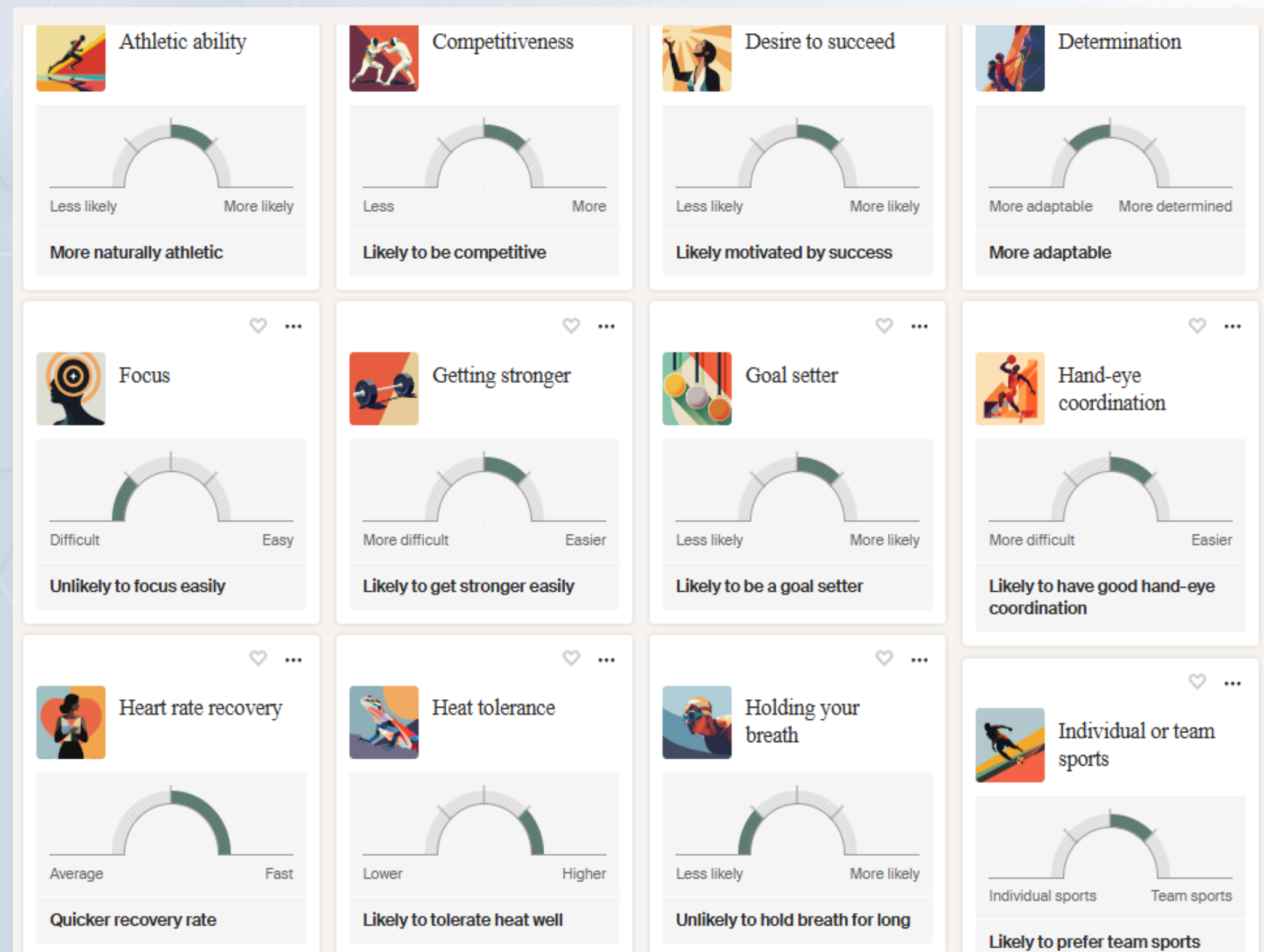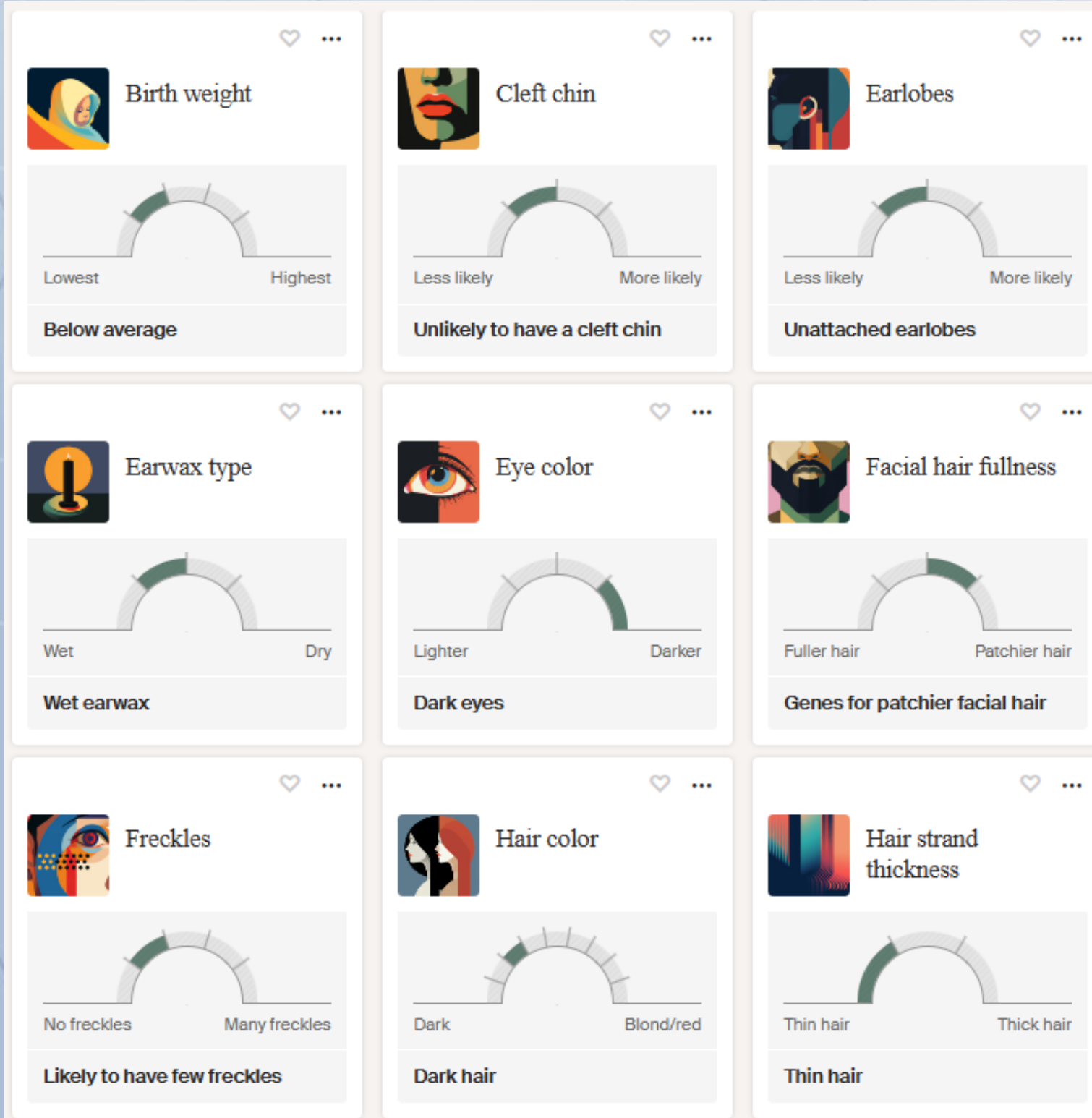
ThruLines

Ancestry's ThruLines map matches to shared family trees

Thank you for Attending

My YouTube Channel:
https://www.youtube.com/@Beaumont-Genealogy/videos

My Genealogy Website: **(for this Presentation)**
https://www.beaumont-genealogy.com/classes

My Email:
John.Beaumont@Outlook.com