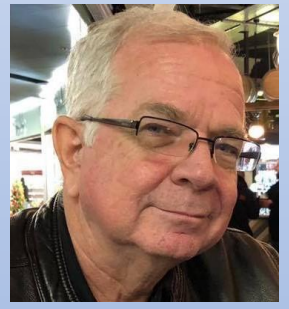
Intro to DNA and Genetic Genealogy



April 14, 2025
Mesa Red Mountain Library

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All slides and handouts can be found at:

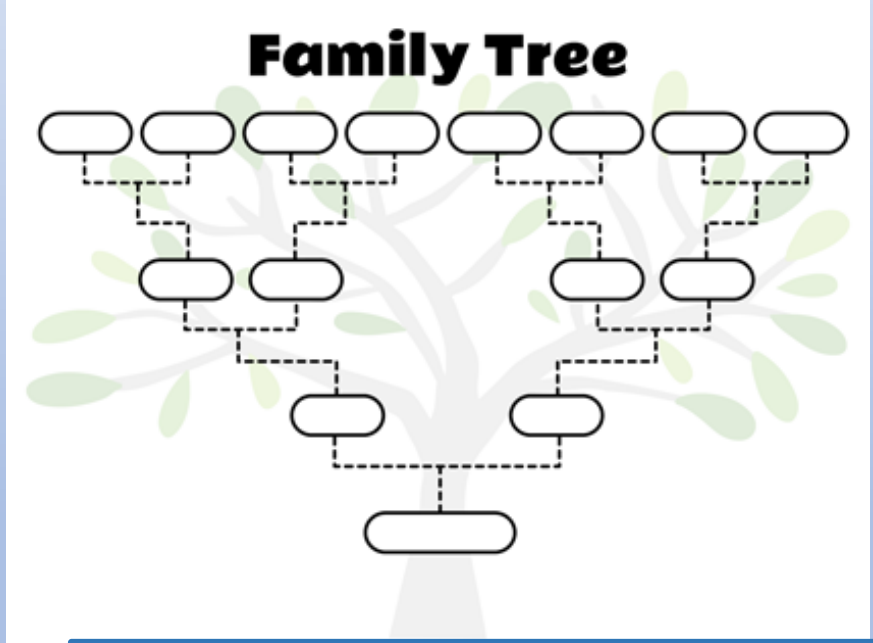
http://www.familytreeaz.com/Presentations/

QR Code: take photo to open to presentations

Topics

- What is DNA?
- Why take a DNA test?
- What are the types of DNA?
- Where can I get a DNA test – what are the testing companies?
- What will I get once the test is completed?
- What 3rd party sites should I consider?

What is genetic genealogy?



Combined Together --- A greater chance of success to solve your family tree mysteries.

https://freefamilytreetemplates.com/blank-family-tree-template/

https://www.freepnglogos.com/pics/dna

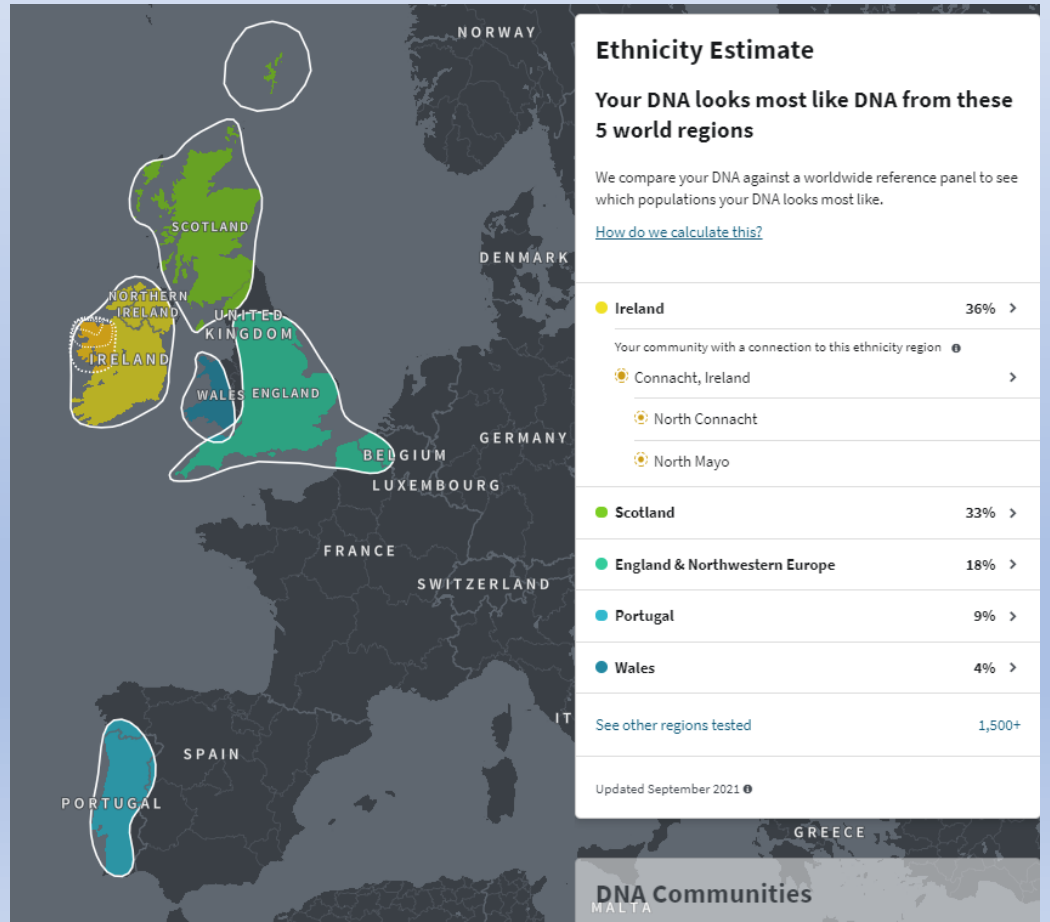
First step: answer some questions

1. Why am I interested in taking a DNA test?
2. What do I hope to get out of it? (any very specific goals?)
3. Do I understand there could be unsettling discoveries that come out?
4. Do I have the time and interest to pursue the genealogy aspect?

Why do we take DNA tests??

1. Curious about ethnicity

   E.g., Am I part Native American?



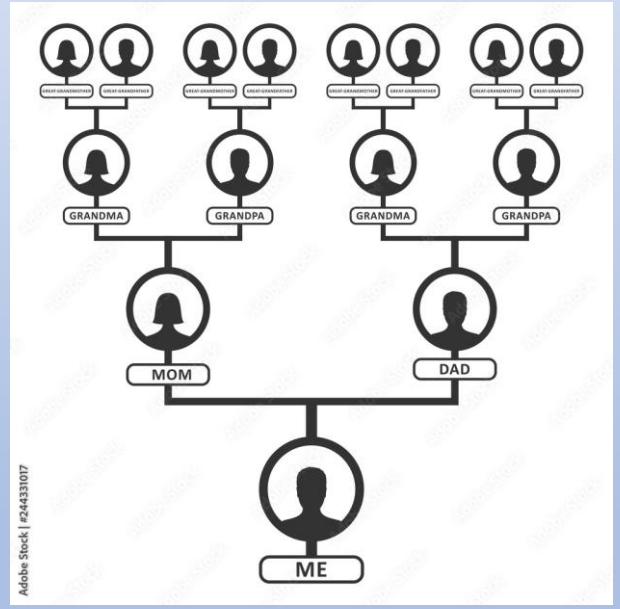
Why do we take DNA tests??

2. Curious about health aspects
   E.g., Do I carry the BRCA gene?

Why do we take DNA tests??

3. Curious about relationships, i.e., Genealogy

- Unknown parentage (adoption, misattributed parentage, donor conceived)
- Find living cousins
- Help fill in (or confirm) family tree



Assuming it’s to learn about family history or solve unknown parentage case…

- What it WILL do:
  - Confirm close relative relationships (e.g., parent/child, full vs. half sibling, etc.) if both individuals take test
  - Introduce you to an amazingly long list of potential cousins (especially for those with strong North American origins such as colonial roots)
  - For unknown parentage cases it’s likely to provide valuable hints to help solve the mystery

Assuming it’s to learn about family history or solve unknown parentage case…

- What it MAY do:
  - **WARNING!!!!**
  - Uncover dark secret(s) that may or may not greatly upset your family

Assuming it’s to learn about family history or solve unknown parentage case…

- What it will NOT do:
  - Absolutely confirm ethnic relationships except in perhaps limited circumstances
  - Fill in all the missing persons (brick walls, etc.) in your family tree

The Time Aspect

- It’s fine to take a test just out of curiosity – no real time commitment
  - Might answer a few basic questions for you
  - It really helps others who are using DNA to solve family tree mysteries
- Once you explore the results you just might get *hooked* !!!
  - Can often encourage you to spend more time exploring, especially in identifying those DNA matches and how that can help fill in your tree
- All in all, DNA testing is a wonderful tool to complement your family tree research

https://giphy.com/explore/wonder

Basics --- What You Need to Know About DNA

3 Types of DNA

- **Autosomal**

Most DNA tests are autosomal

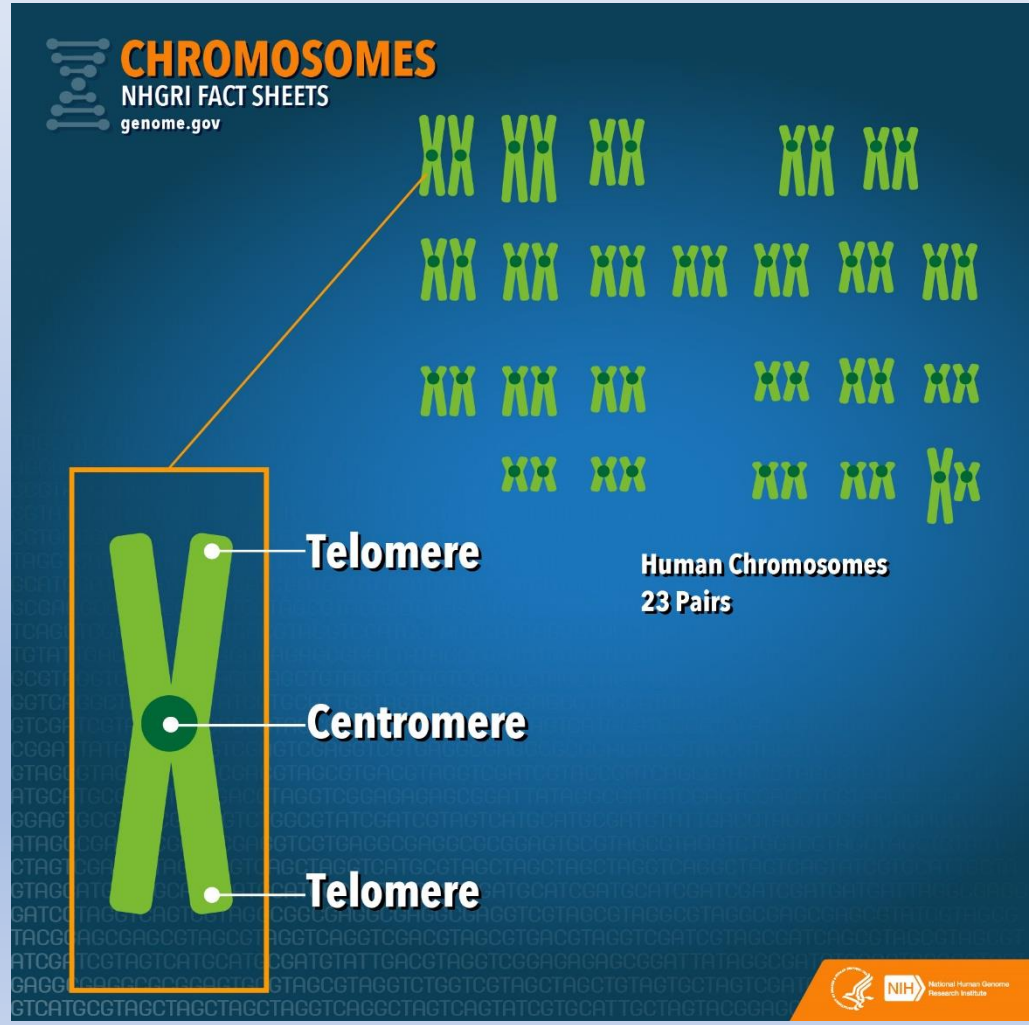
  - 22 chromosomes
  - + 1 sex chromosome “X/Y”

- **Y-DNA**

- **Mitochondrial DNA (mtDNA)**

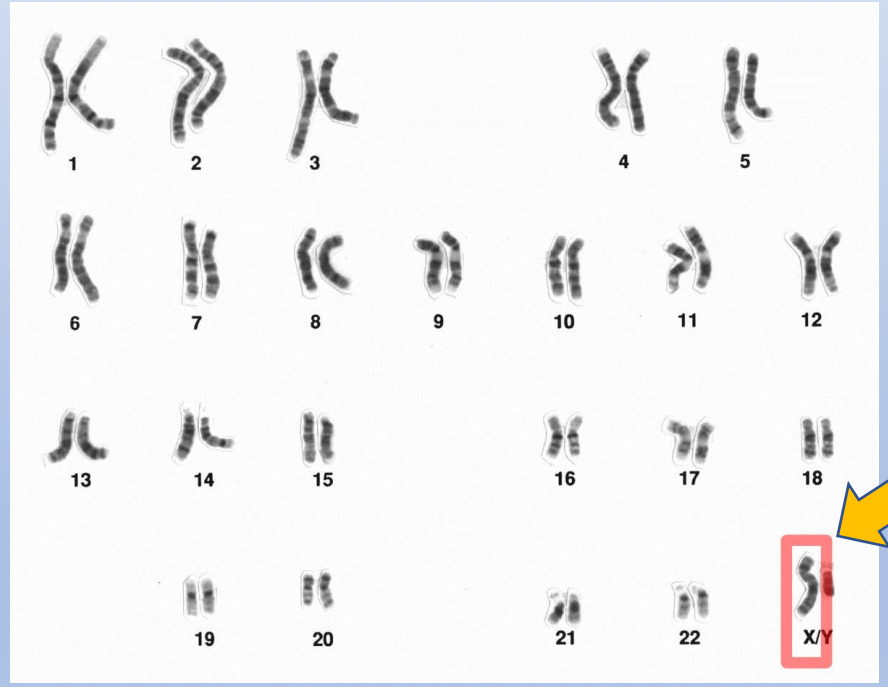
What is DNA? -- chromosomes

- We all have 23 pairs of chromosomes
  - The last pair, 23rd, chromosome is considered the sex chromosome
    - Women have two “X” chromosomes for this whereas men have one “X” and one “Y”
  - Chromosomes 1 through 22 are known as autosomes
    - Foundation of autosomal DNA, or “atDNA” which is the primary DNA used now by DNA testing services



What is X-DNA?

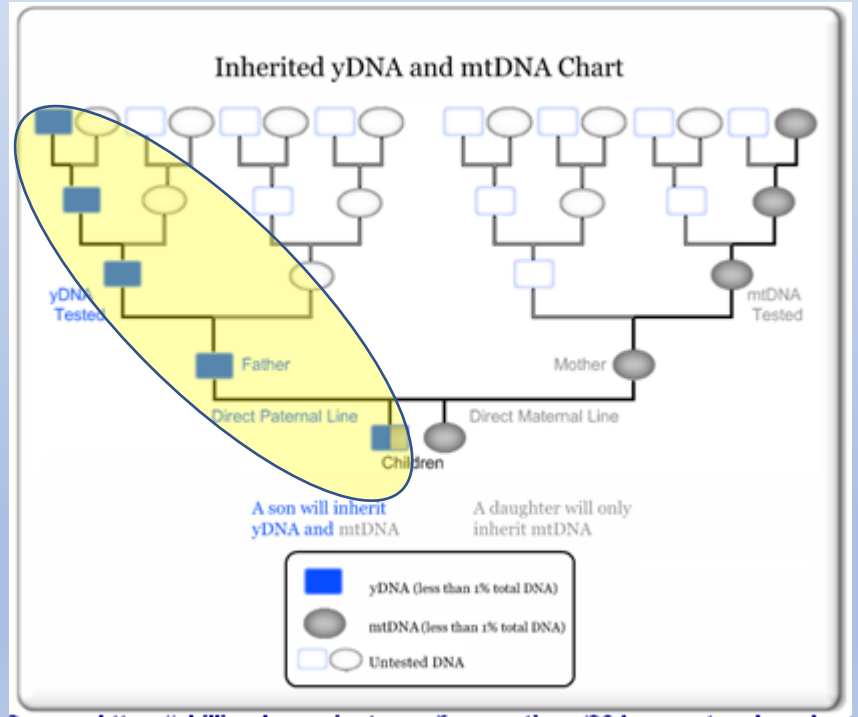
- We all have 22 pairs of autosomal chromosomes
- One additional, the 23rd chromosome, is known as the "sex" chromosome and can at times be useful in evaluating a match.
- Females have two 'X' chromosomes (XX)
- Males have one 'X' chromosome (from mother) and one 'Y' chromosome (from father) (XY)
- **Important Note**: not all testing companies report X-DNA matches



Source https://en.wikipedia.org/wiki/X_chromosome

What is DNA? – Y-DNA

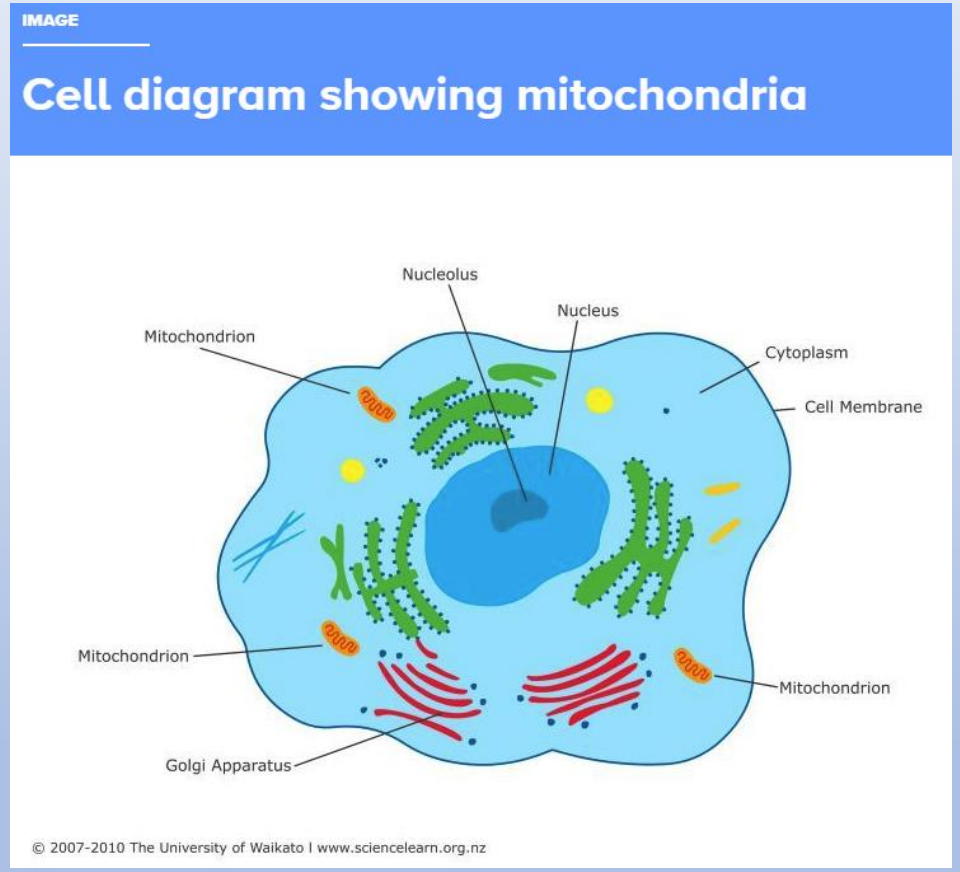
- *ONLY* found in males
- Only passed along the patrilineal line
  - Father's father's father's….[etc.]
- Females wanting to test Y-DNA should find a male in the line that they want to test (e.g., an uncle, brother, father, 1st cousin)



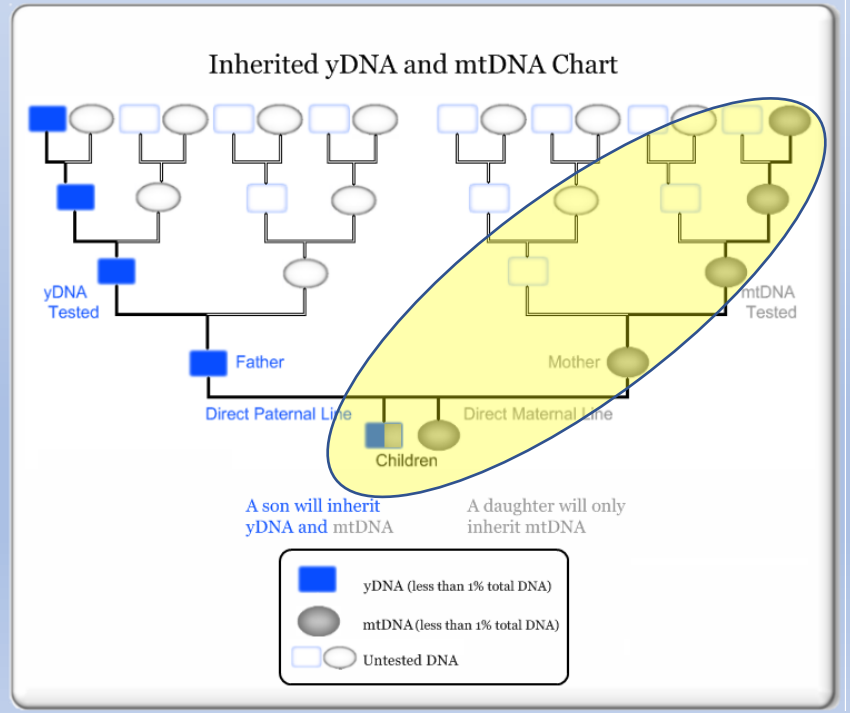
Source: https://phillipsdnaproject.com/faq-sections/304-ancestor-dna-chart

What is DNA? -- mitochondrial

- Located outside the nucleus of cells as part of mitochondria
- Males and Females both have
- Has unique characteristic of carrying deep ancestral heritage of matrilineal line
  - Mother's mother's mother's…..[etc.]



Tip: Mitochondrial DNA is often abbreviated to mtDNA



Testing Companies

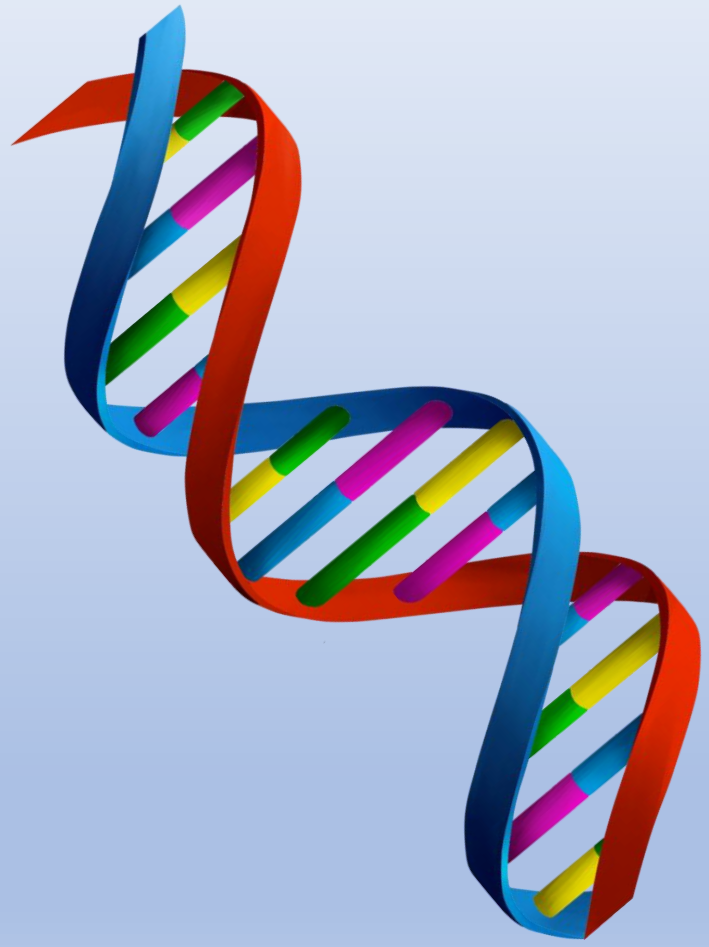
Types of DNA tests

- Autosomal
  - The vast majority of DNA tests are this type
  - Relatively inexpensive ($49-$99)
  - **FOCUS of this presentation is on Autosomal**

- Y-DNA
  - Only used for male subjects and can find matches along the same patrilineal line
  - Can be expensive (up to $300 for more precision/markers)

- mtDNA (Mitochondrial)
  - Can be used to solve matrilineal line questions
  - Expensive (~ $200)

- Full Genome Sequencing (FGS)
  - New kid on the block!
  - More expensive (~$1000) but cost is going down



Testing company options -- Autosomal

- There are 5 known and recommended companies at this time:
  - **Ancestry**
  - **Family Tree DNA**
  - **MyHeritage**
  - **LivingDNA**
  - ~~**23andMe**~~ **(currently in bankruptcy)**

- There are others out there but not recommended for a variety of reasons

What to look for with testing companies

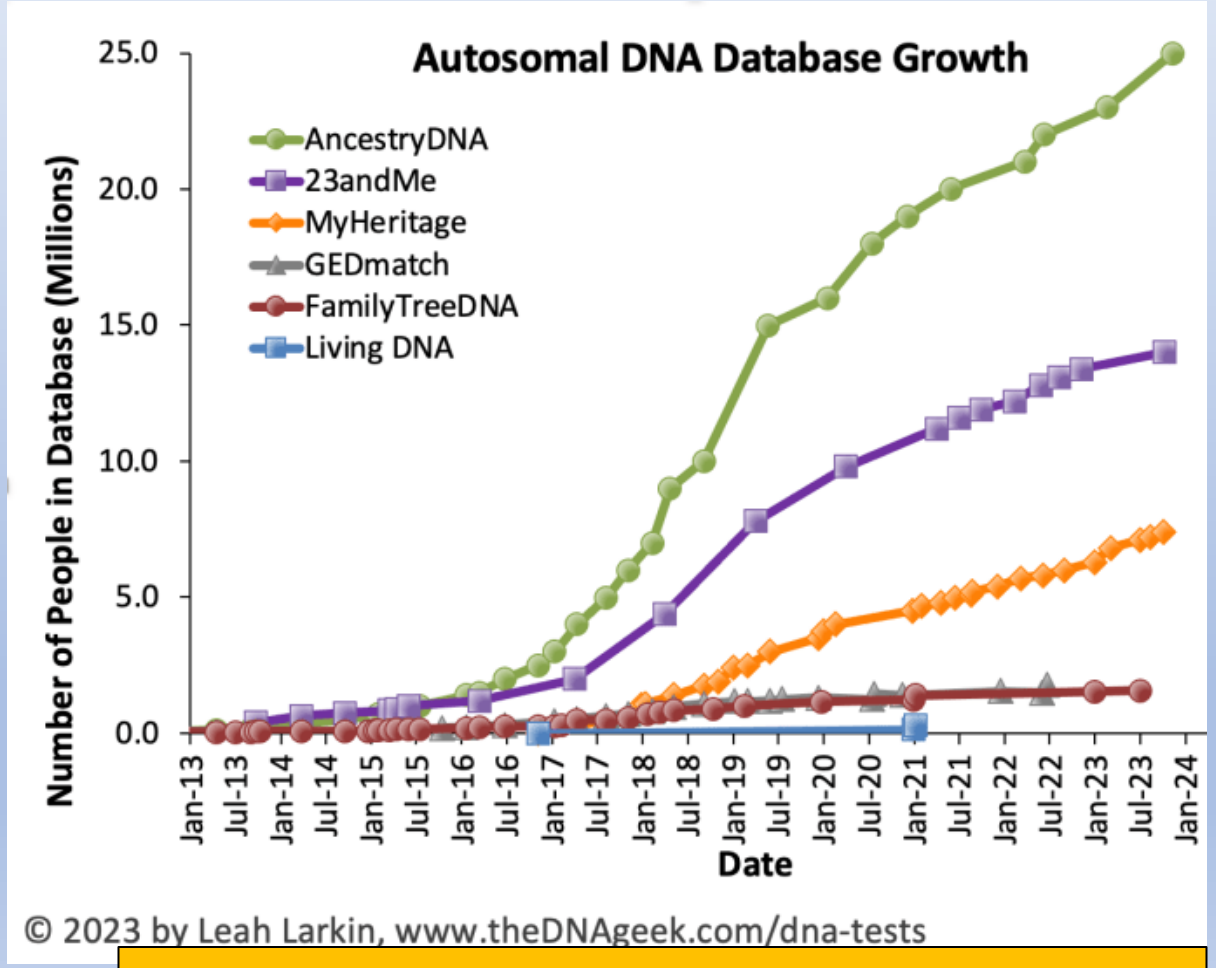
- What all 4 companies have:
  - Provide ethnicity estimates (emphasis on "estimates")
  - Provide a list of others who match the tester's DNA
  - Ability to download raw DNA data file
  - Test autosomal chromosomes (1-22)

- What some of them have:
  - Provide family trees for your matches
  - Provide health information
  - Ability to group matches that are common to each other
  - Ability to upload raw DNA data file from other companies
  - Test other aspects of DNA such as X-DNA, Y-DNA, and mitochondrial (mtDNA)

Comparative Database Sizes (autosomal kits)

- This chart shows the change over time of the number of DNA kits with each service
- The top 2 services do *not* allow uploads of kits from the other companies

TIP: your chances of finding matches will increase with companies that have more matches



Note: this is the latest available version of this graph

Deeper Dive into the Testing Companies

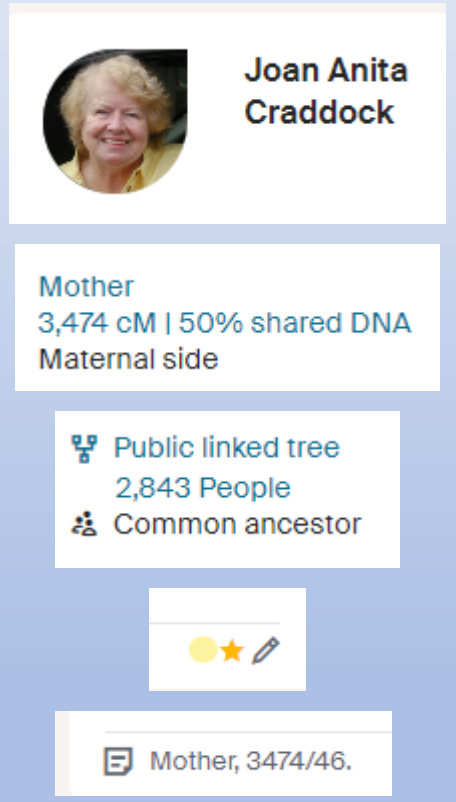
For each company I will highlight pros and cons including one primary pro and con for each company

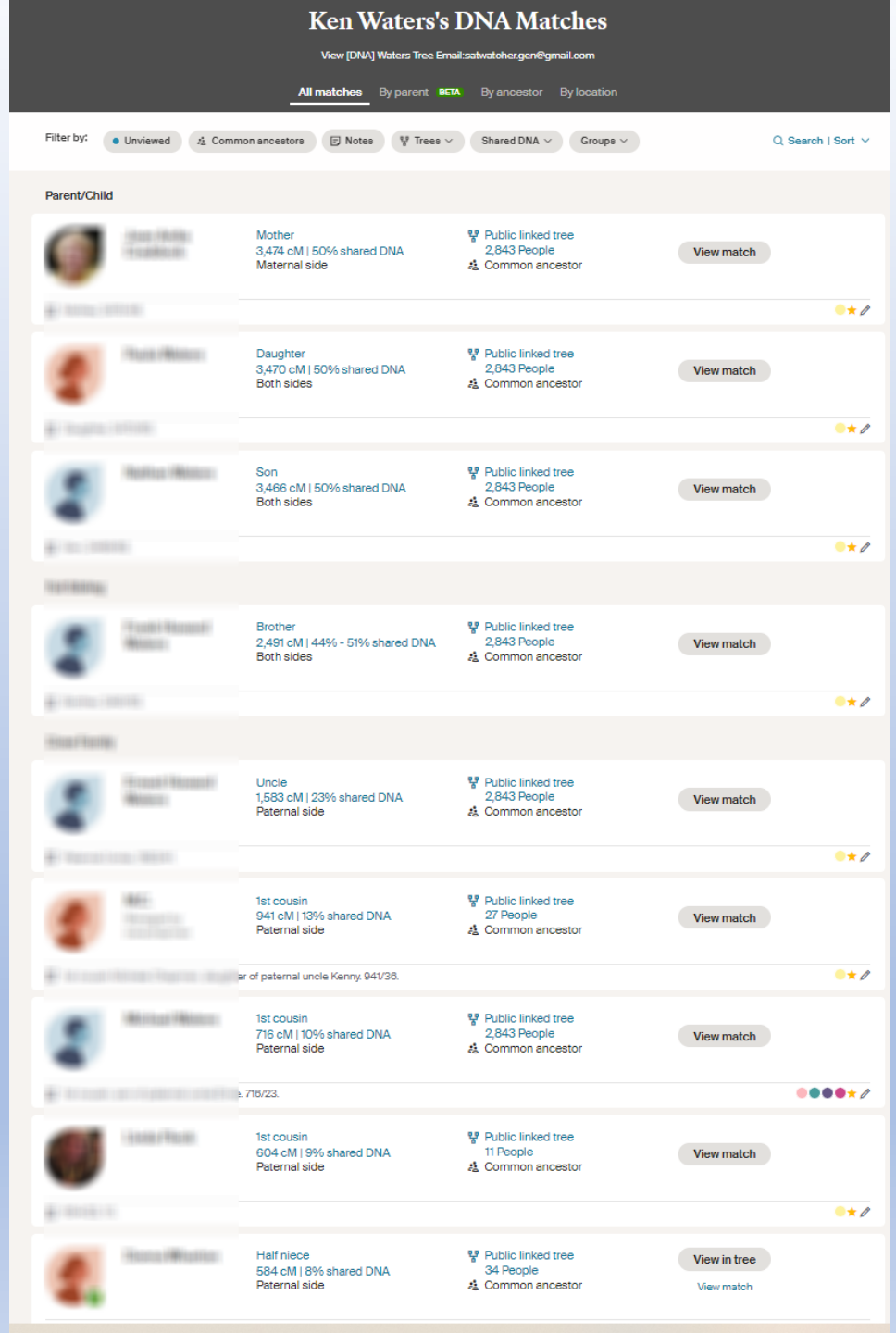
Aspects of Each Testing Company

- Ancestry
  - Pluses:
    - **Largest database of testers, over 23 million**
    - Excellent linkage to a wide array of family trees
    - Useful common ancestor hints
    - Good tools for sorting matches and viewing shared matches
    - Good detailed ethnicity estimates for some
  - Negatives:
    - **No chromosome browser for advanced work**
    - No display of X-DNA matches
    - Will not accept DNA kits from other companies
    - Tester database is mostly composed of U.S. and Canada test-takers

Ancestry DNA Matches

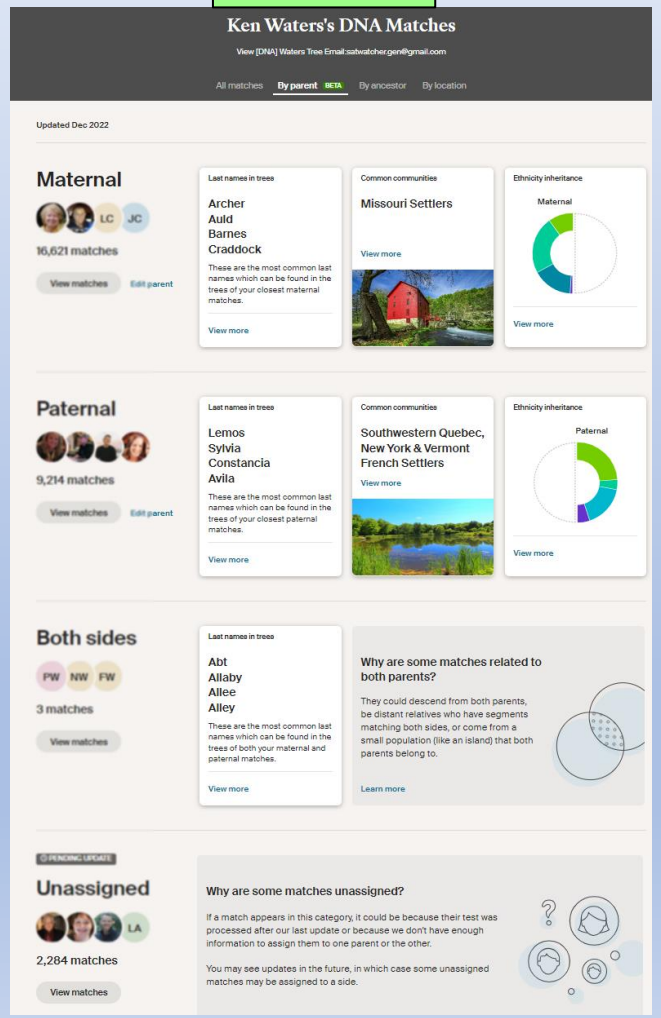
- Each match includes:
  - Name
  - Relationship estimate
  - Amount of shared DNA
  - SideView estimate (maternal/paternal)
  - Tree, if available
  - Common Ancestor hint, if applicable
  - Tag Group designations (user controlled)
  - User entered Notes



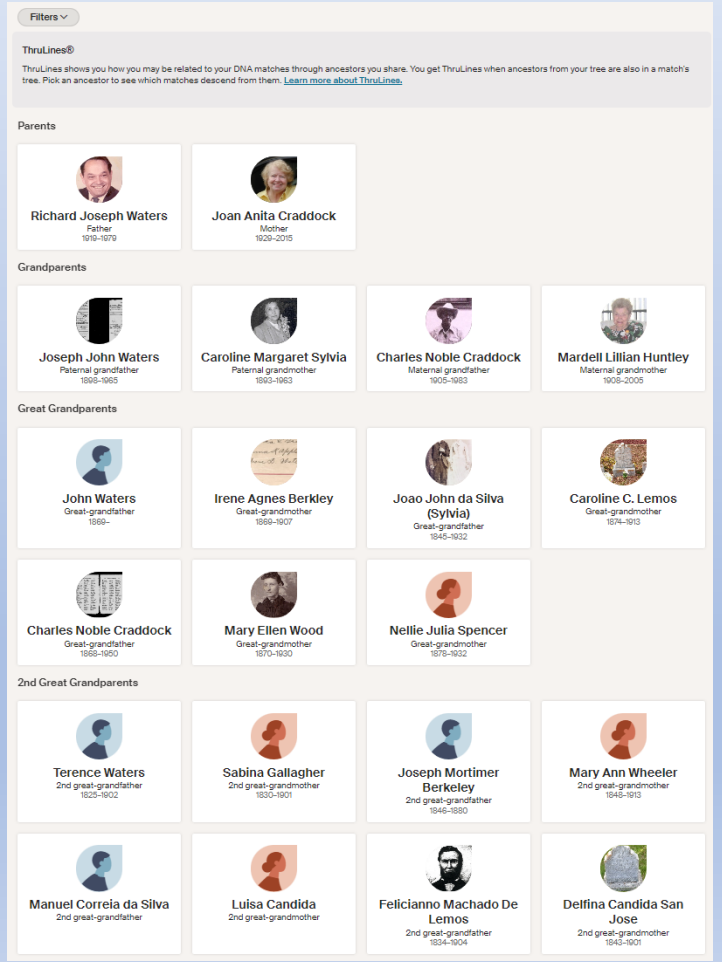


Useful Features of Ancestry DNA

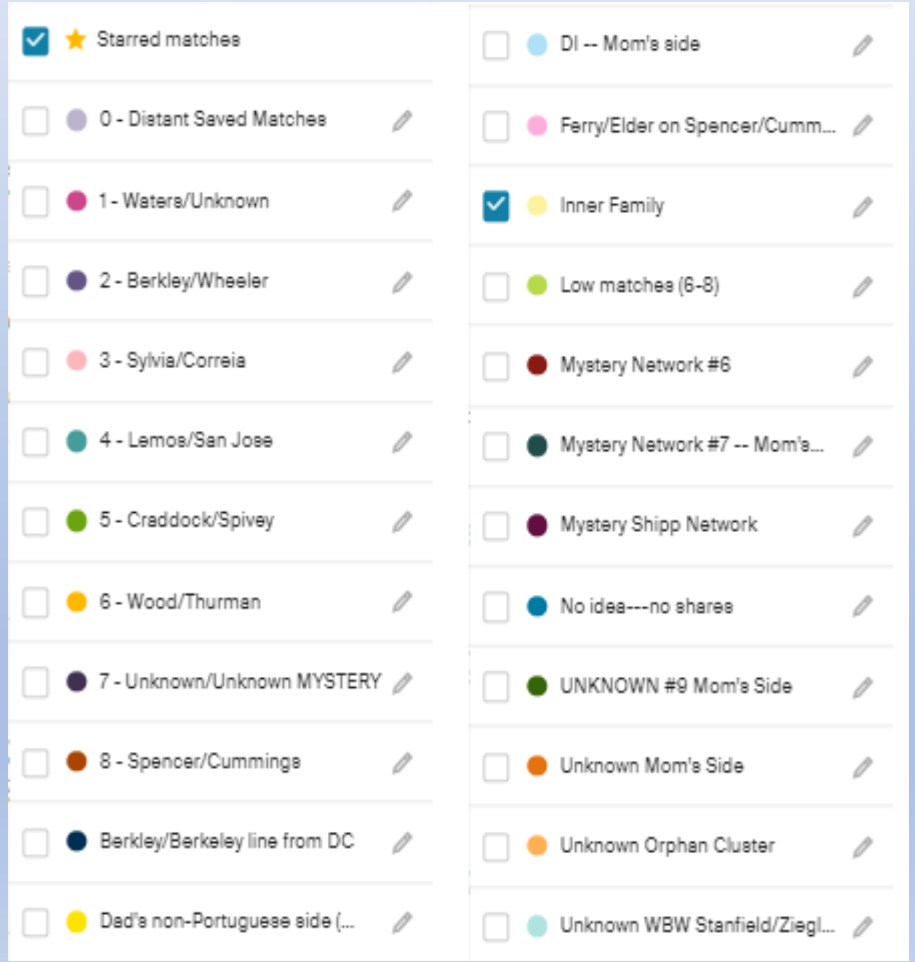
SideView



ThruLines

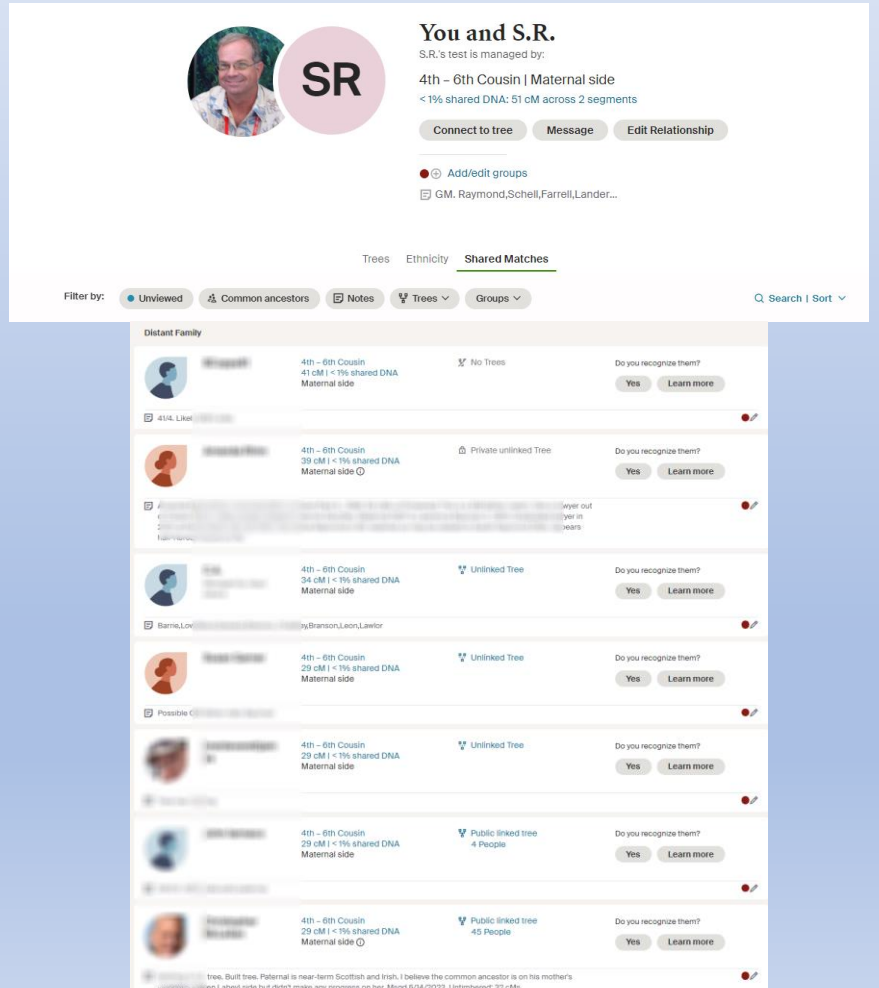


Tag groups



Shared Matches in Ancestry DNA

- This, in my opinion, is by far the **MOST USEFUL** tool in Ancestry DNA
- Can help to quickly determine which line a DNA match falls into



23andMe has declared bankruptcy as of March 2025. Its future is unknown and it still holds previously completed DNA tests. At this time I do not recommend purchasing a kit from them due to the uncertainty.

- 23andMe
  - Pluses:
    - **Large database of testers (> 12 million), many not available at other testing companies**
    - Chromosome browser
    - Upgrade to health aspects for those interested
  - Negatives:
    - **Complicated process to share data with DNA matches**
    - No genealogy research database
    - Most kits will be limited to 1,500 closest matches, thus not revealing more distant matches
    - Will not accept DNA kits from other companies

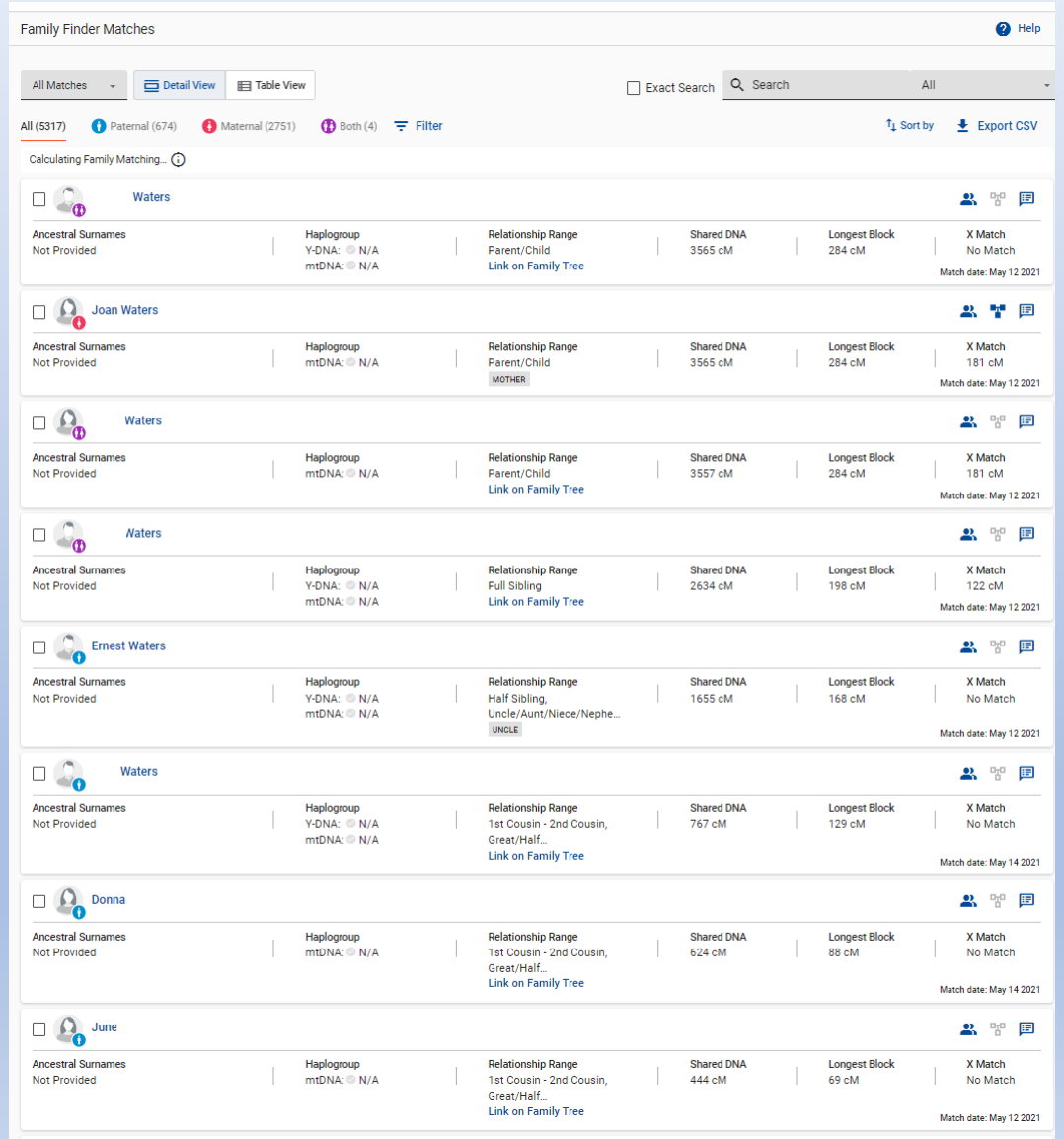
TIP: I found 3 unknown 2nd cousins on 23andMe! 2 of them were adoptees with unknown parentage which I helped them solve

Aspects of Each Testing Company

- FamilyTreeDNA
  - Pluses:
    - **Ability to re-use DNA sample on other types of test**
    - Rich, long history of working with DNA
    - The “go to” site for testing Y-DNA and mtDNA
    - Chromosome browser
    - Allows uploads from other testing companies
  - Negatives:
    - **Relatively small database**
    - No genealogy research facilities
    - No capability to manage more than one kit in a single account

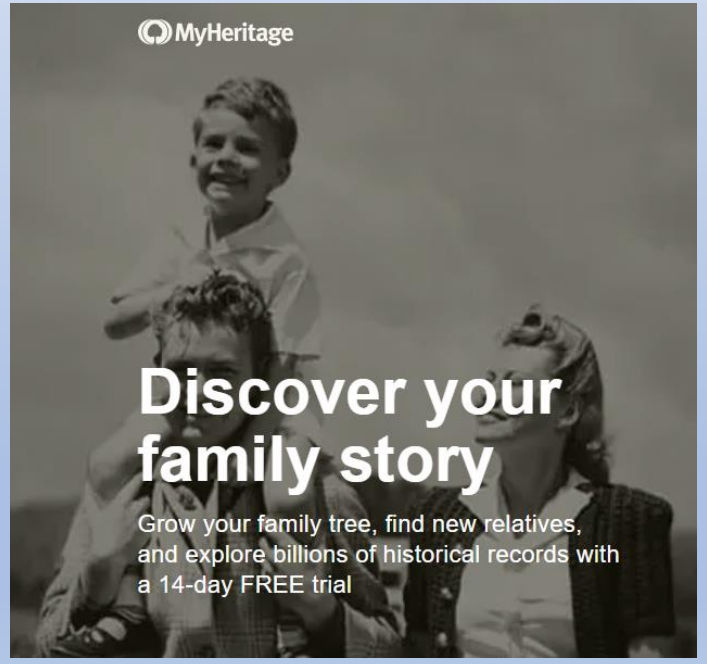
Matches in FamilyTreeDNA

- Names
- Estimated relationship
- Shared DNA
- If an “X” match



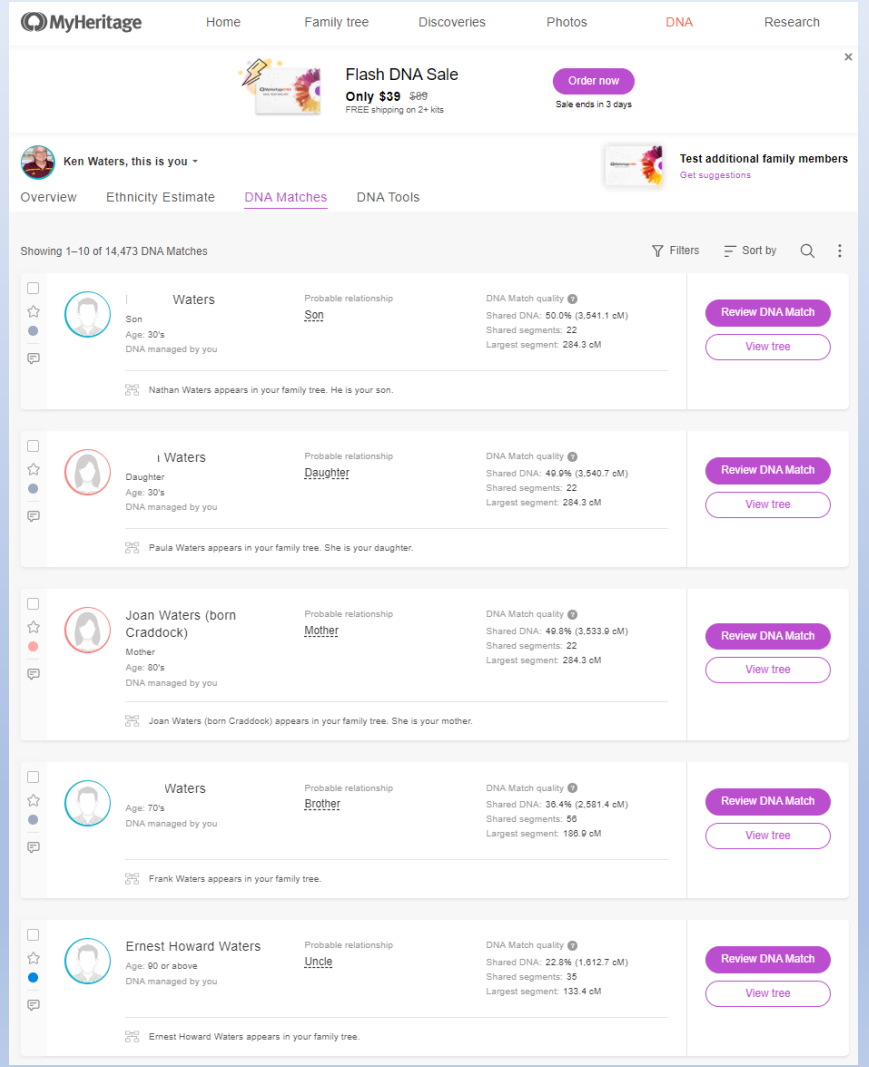
Aspects of Each Testing Company

- MyHeritage
  - Pluses:
    - **Powerful shared matches capabilities**
    - Best chance to find European DNA test takers
    - Robust tools such as auto-cluster available with upgrade
    - Excellent Chromosome browser
    - Genealogy research facilities
    - Allows uploads from other testing companies
  - Negatives:
    - **Smaller database compared to Ancestry and 23andMe**



My Heritage Matches

- Very useful capability to not only see how much DNA you share with the match but also how much your match shares with other matches (can often help to discern parent-child or aunt-uncle relationships)



Aspects of Each Testing Company

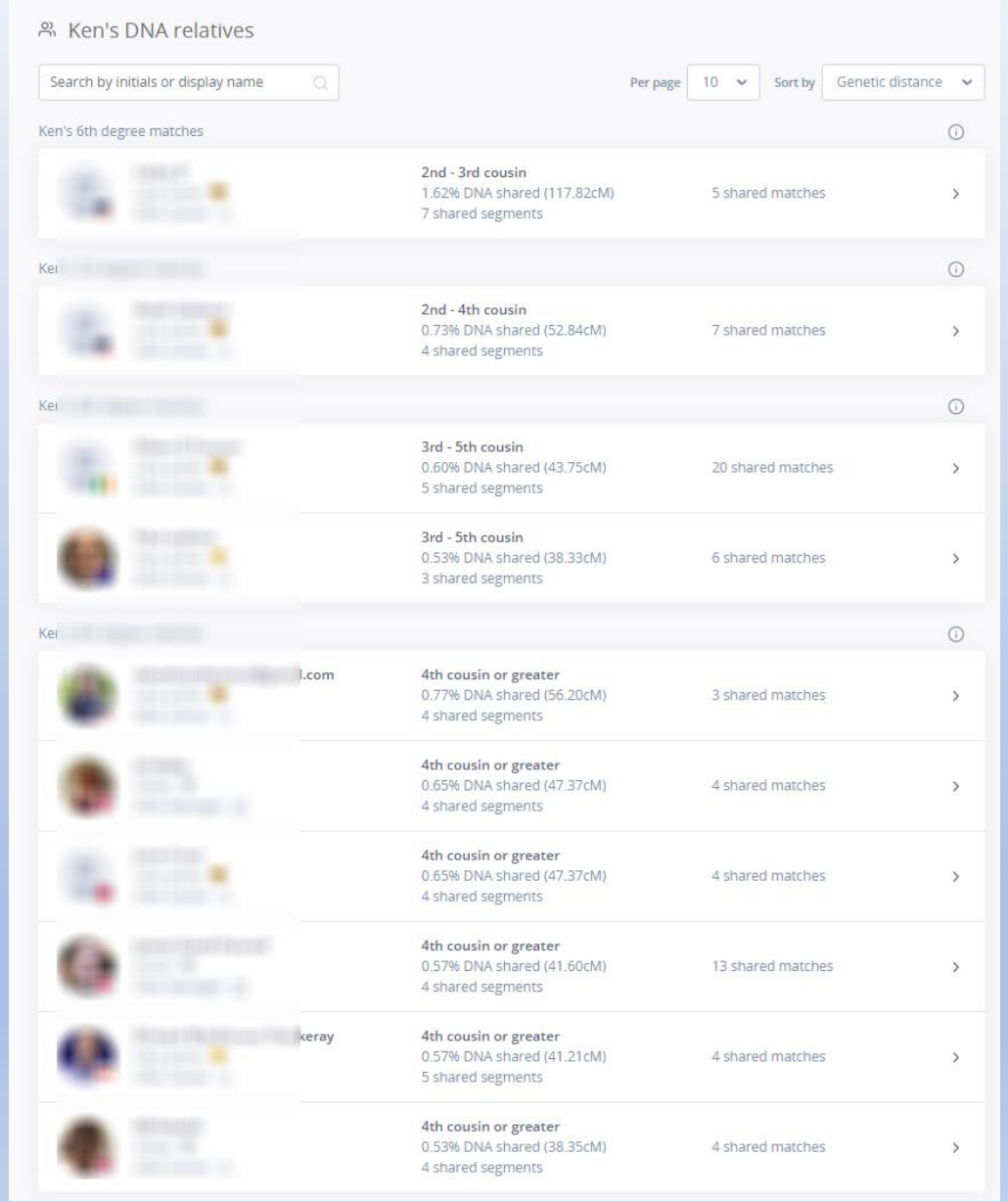
- LivingDNA
  - Pluses:
    - **Some emphasis on British Isles**
    - 3-in-1, single kit includes Y-DNA and mtDNA
    - Allows uploads from other testing companies
    - Chromosome browser (added July 2023)
  - Negatives:
    - **Very, very small database**
    - No family trees
    - No research database
    - Wacky ethnicity estimates
    - Worst analysis tools of all the companies
    - No matching of Y-DNA or mtDNA
    - History of trying to sell irrelevant add-ons (e.g., supplements, Viking ancestry)

NOTE: I no longer recommend testing with Living DNA due to a lack of tools and matches. If you're interested in trying them then you may want to just try a free upload of your DNA to see what you come up with.

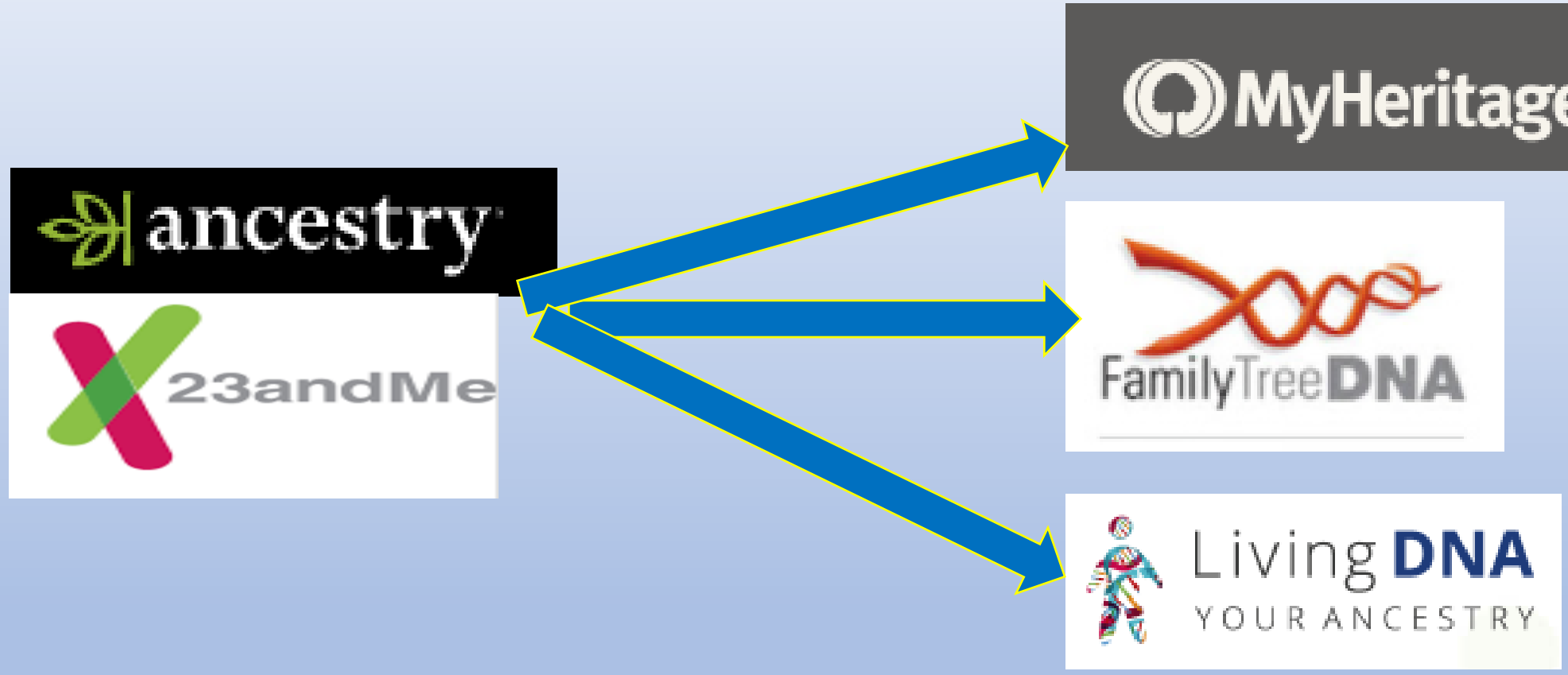
Living DNA Matches

- Very small database
- For me, Living DNA has only 1 kit above 100 centiMorgans whereas I have 47 on Ancestry!

Do not recommend purchasing a kit from Living DNA---instead upload for free



3 of the 5 testing companies allow uploading



Allows you to use test results from one company to compare to other databases --- more matches!

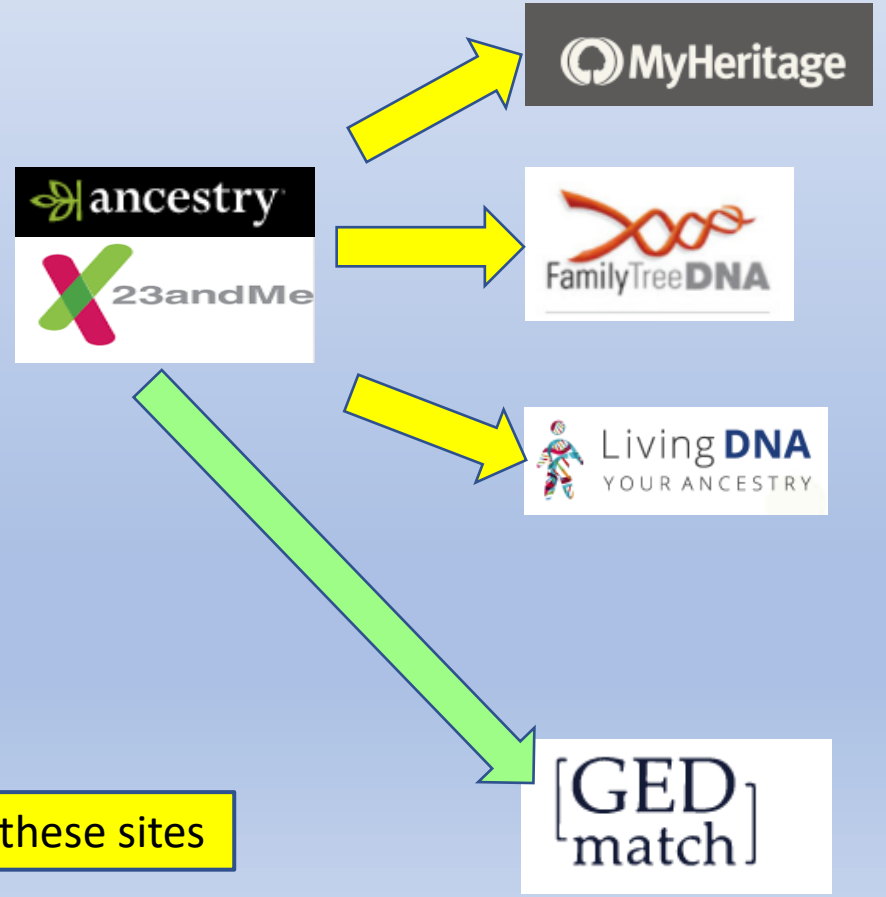
FREE to upload (nominal cost to use extra analysis tools)

Recommended Strategy

- Test with Ancestry first (largest database, excellent family tree tools)
- After Ancestry, test with 23andMe
- Download your DNA from either Ancestry or 23andMe
- Upload to:
  - My Heritage
  - Family Tree DNA
  - Living DNA

  - GEDMatch (not a testing company)

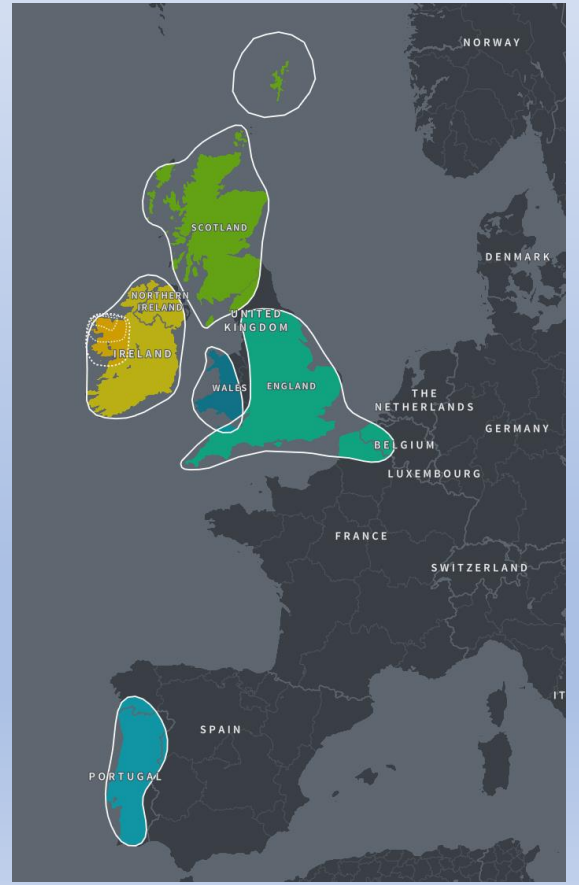
- The key here is to have your DNA in all 5 testing companies plus GEDMatch



No cost to upload to these sites

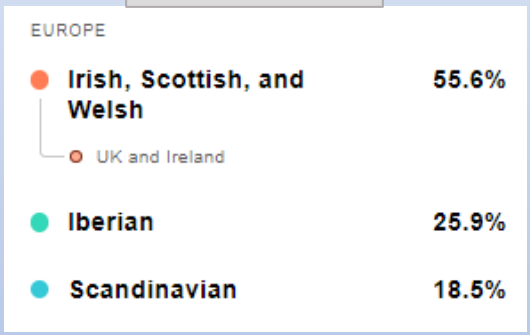
What About Ethnicity Estimates?

- These are purely estimates and should not be relied on to any great extent
- May be interesting to view but of little use for genealogy
- **Wide** variation between companies
- Frequent updates can lead to confusing results



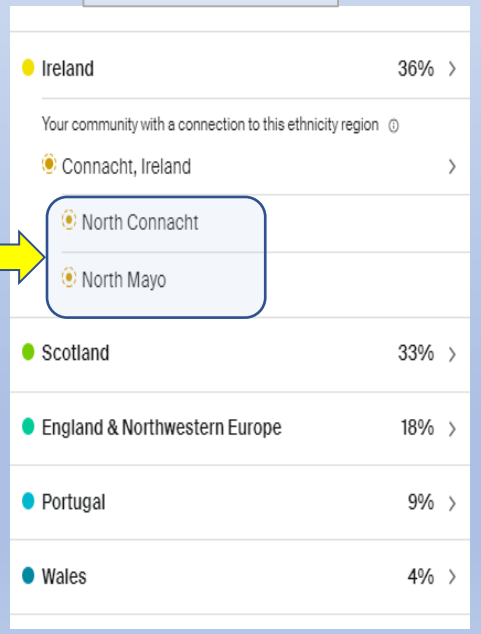
What About Ethnicity Estimates?

MyHeritage



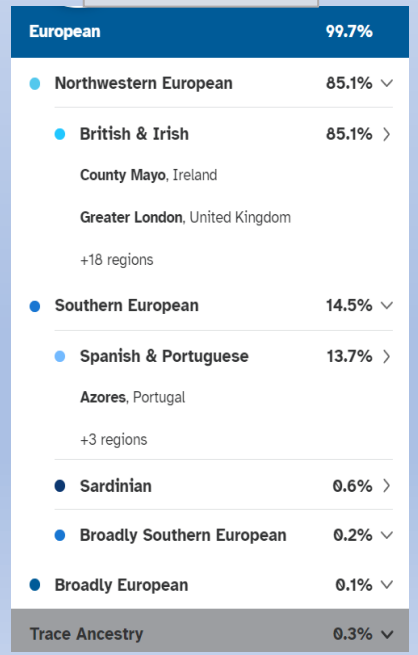
Nice sub-county detail!

Ancestry

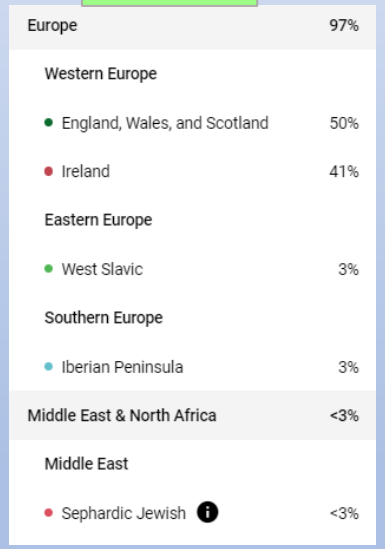


LivingDNA

23andMe



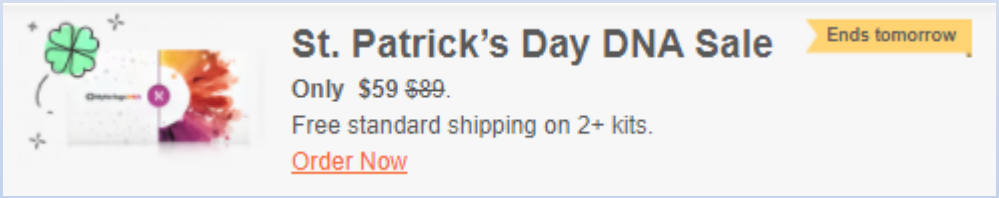
FTDNA

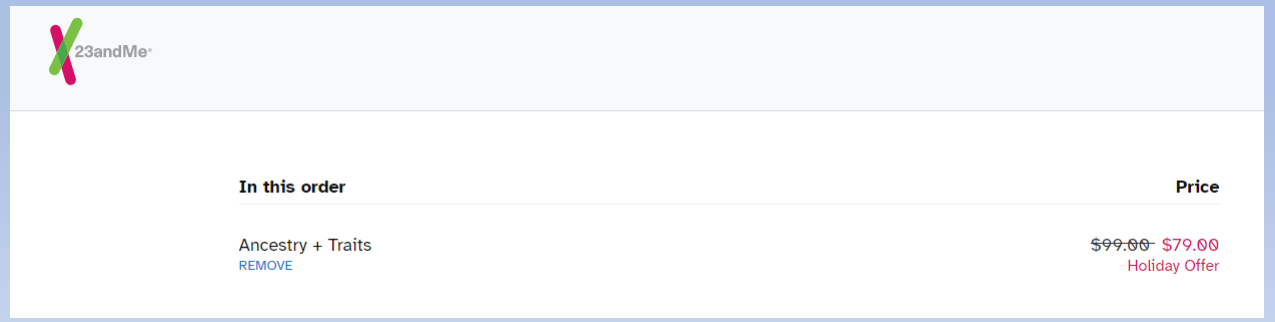


These are the ethnicity estimates for me as collected, March 16, 2022

Sales!

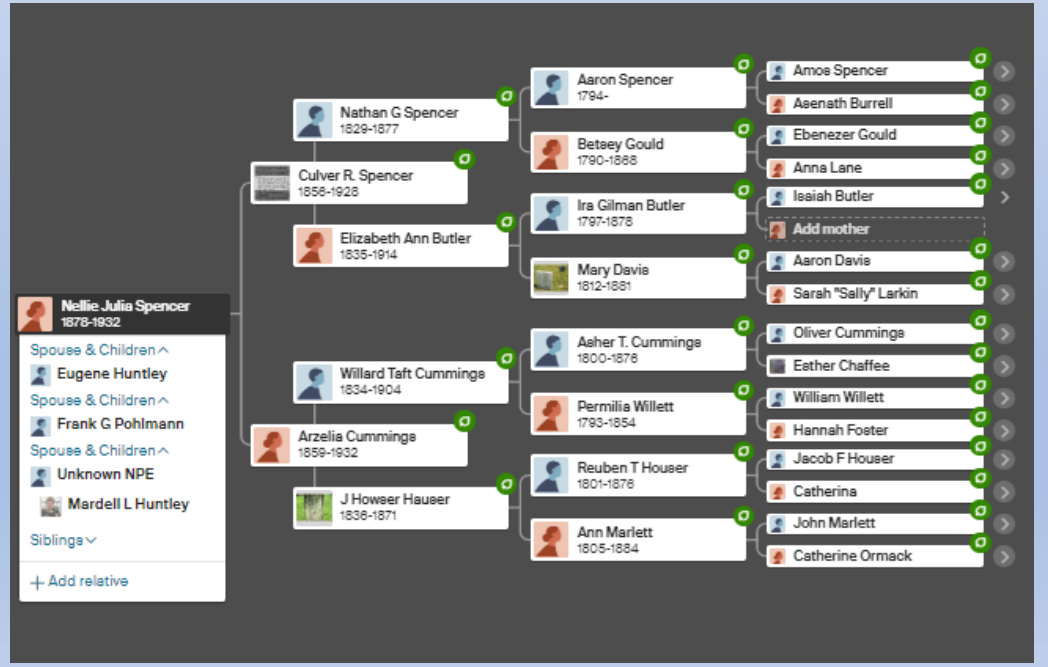
- Try to take advantage of frequent sales with the testing companies
- Typical regular price is $99 often discounted to $59, $49, even $39
- For example:
  - DNA Day
  - St Patrick's Day
  - Fathers Day
  - Mothers Day
  - Thanksgiving
  - Black Friday
  - Christmas





DNA kits and Family Trees

- Most powerful way to match other test-takers and know how you are related is through the use of trees
- 4 of the companies (Ancestry, FTDNA, MyHeritage, 23andMe) have capability to store trees
- 1 company (23andMe) can link to FamilySearch tree
- Ancestry has arguably the best provision for family trees

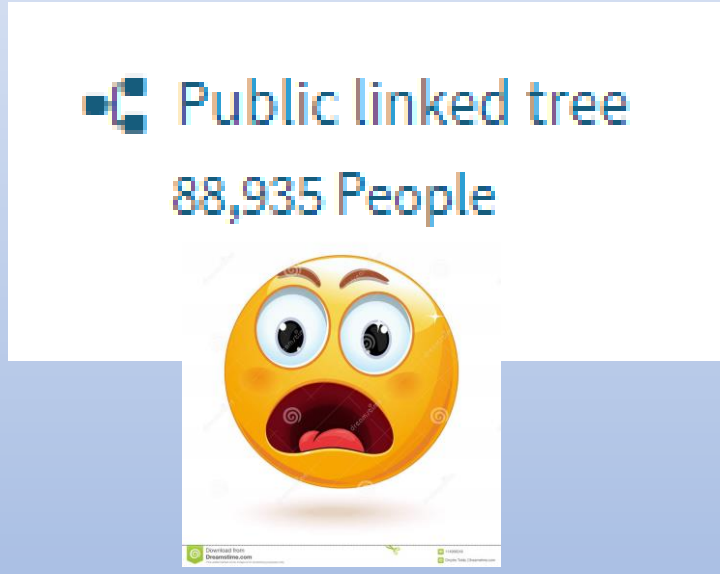


My Suggestions for Family Trees

- For the Family Tree to link to your DNA account I strongly encourage:
  - Make sure it's a PUBLIC tree and searchable
  - Keep it relatively small (50-1,000 people)

TIP: It's fine to have large trees but well-advised to use smaller trees for attaching to your DNA kit

  - Focus on direct ancestors
    - Include Birth-Marriage-Death information
    - Try to go back 5-7 generations (remember autosomal only goes back this far)
  - Use maiden names
  - Use biological lines (not adoptee)
  - If you don't know the identity of an ancestor then don't enter anything for that person

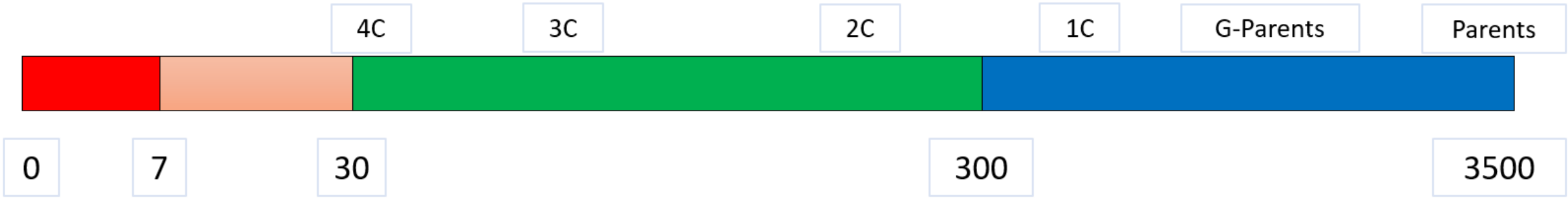


DNA Test Interpretation

First of all --- What is a “CentiMorgan”??

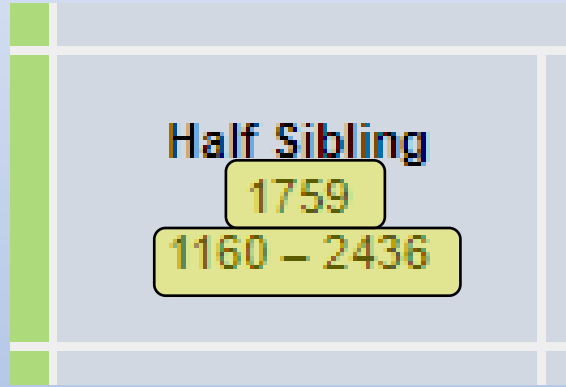
- Numeric measure of “relatedness”
- From 0 to 3500
- 3500 indicates parent/child
- 0 indicates no DNA shared

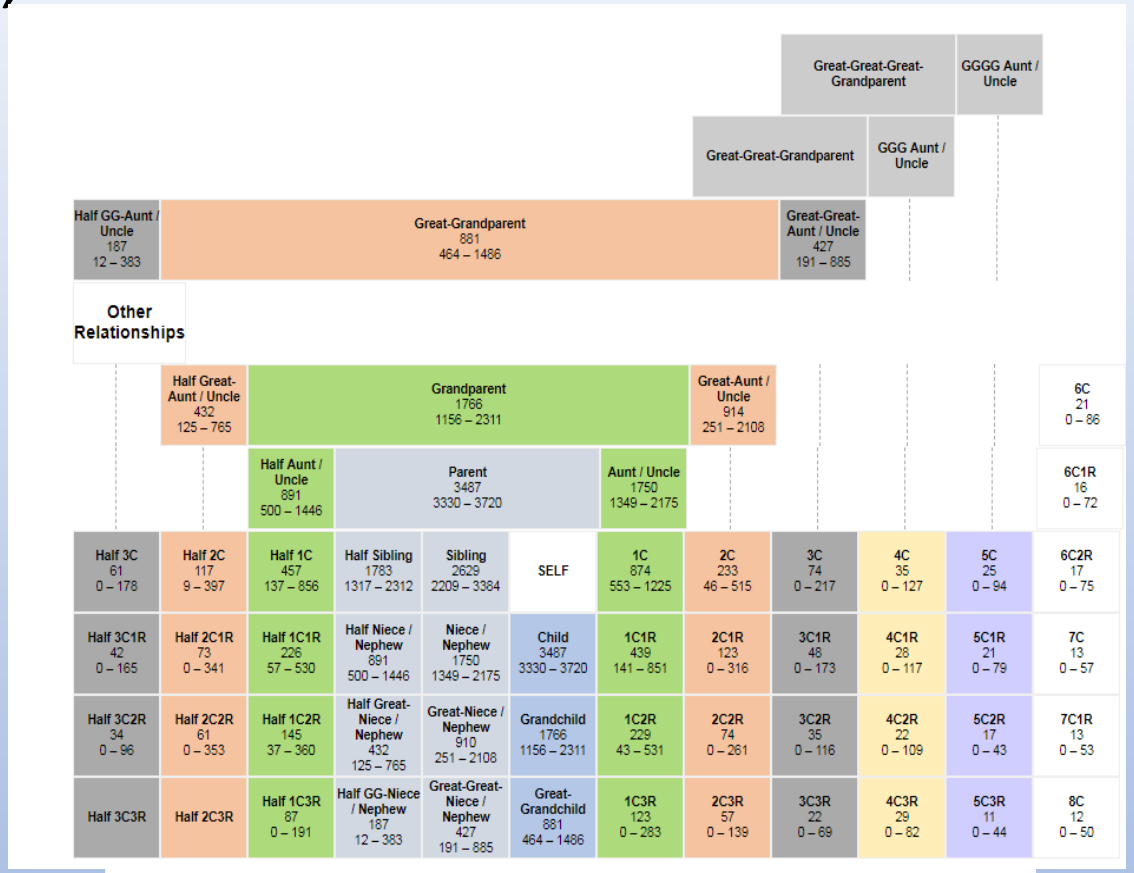
TIP: Just because you may not share any DNA with someone does not necessarily mean you are not related



Concept of “relatedness”

- Shared cM Project table showing possible DNA shared values
- Higher numbers indicate closer relationships
- Top number in each box is average (mean)
- Bottom is range of numbers that could exist for that relationship





https://dnapainter.com/tools/sharedcmv4

Goal: Find the Most Recent Common Ancestor (MRCA)

- Finding common ancestors allows determination of exact relationship
- Once this is found then we can compare to other matches to help see how they are related as well

What is a Chromosome Browser?

- Comparison of 2 DNA kits showing shared DNA by chromosome

- Available on:
  - Family Tree DNA
  - My Heritage DNA
  - 23 and Me
  - Living DNA
  - GEDMatch

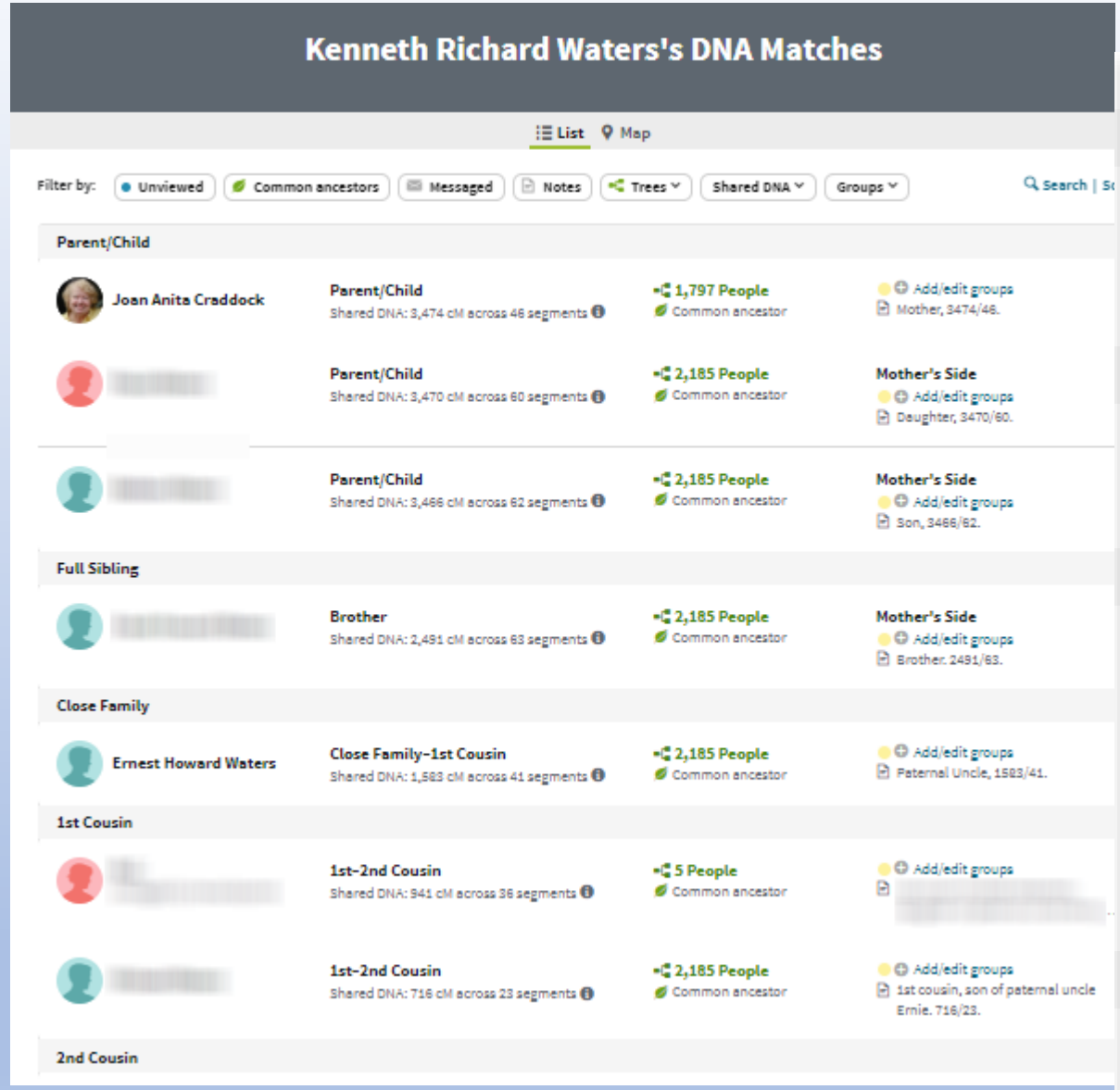
Example of my DNA compared to a 1st cousin once removed showing shared segments

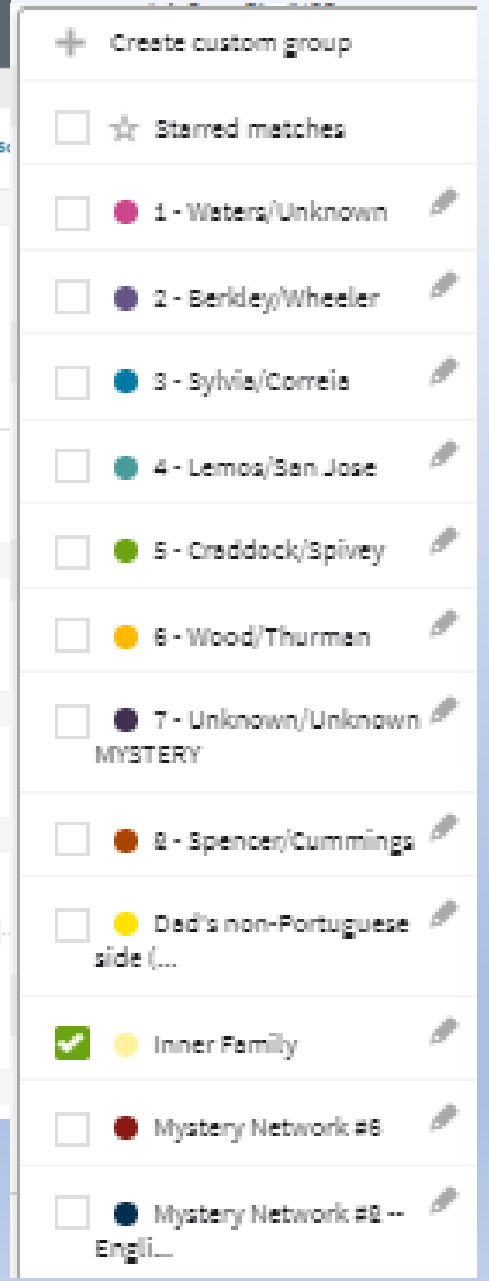
TIP: chromosome browsers can be useful for more advanced and detailed comparisons of DNA matches

First steps

- Review your matches, strongest (highest centimorgans) first
- Try to identify the closest matches
  - Do you know them?
  - How are you related to them?
- Enter notes about what you know about them

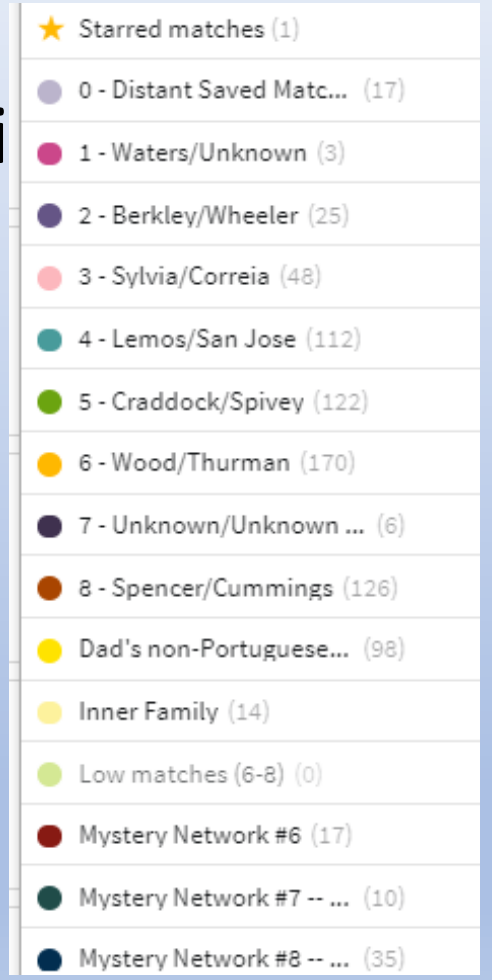
- Use Tag Groups (available on Ancestry and My Heritage) to identify them





Divide and conquer

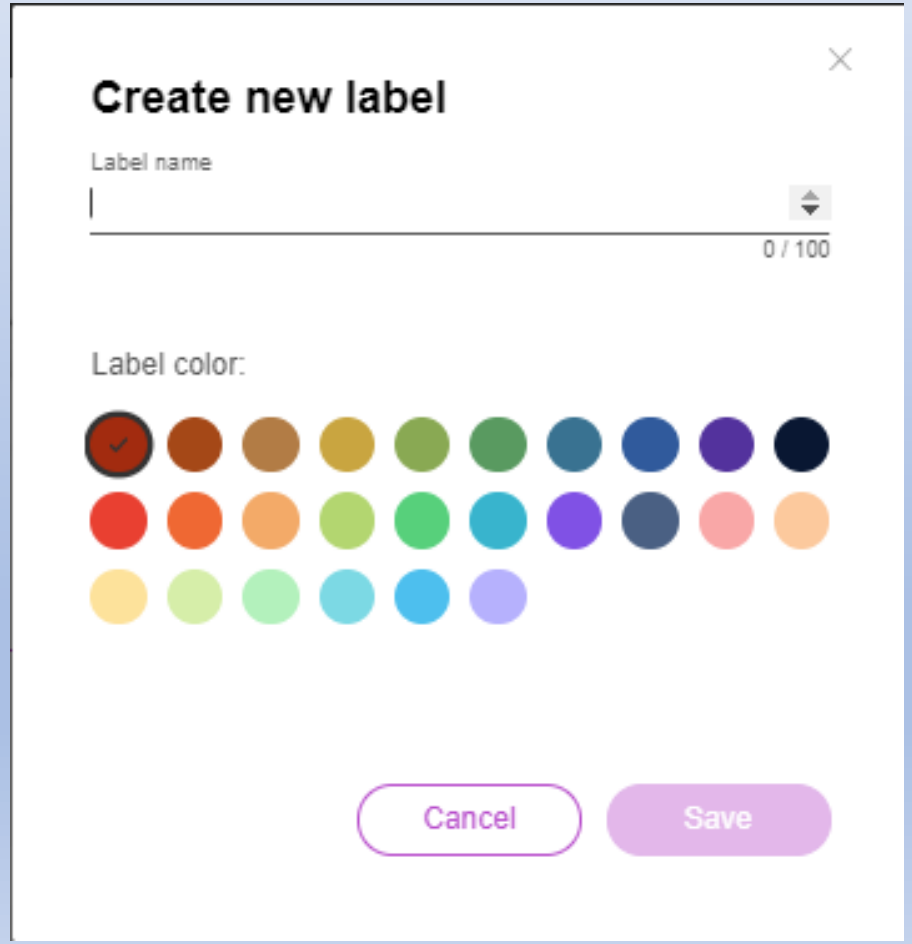
- On Ancestry, Using Tag Groups in combination wi and Shared Matches:
  - Group your matches by dividing them
    - First, Paternal vs. Maternal side
    - Then, work on Grandparents
    - Continue to divide matches



The goal: sort your matches into common groups

My Heritage Labels

- My Heritage also has feature similar to Ancestry Tag Groups
- 30 “dots” versus 24 on Ancestry

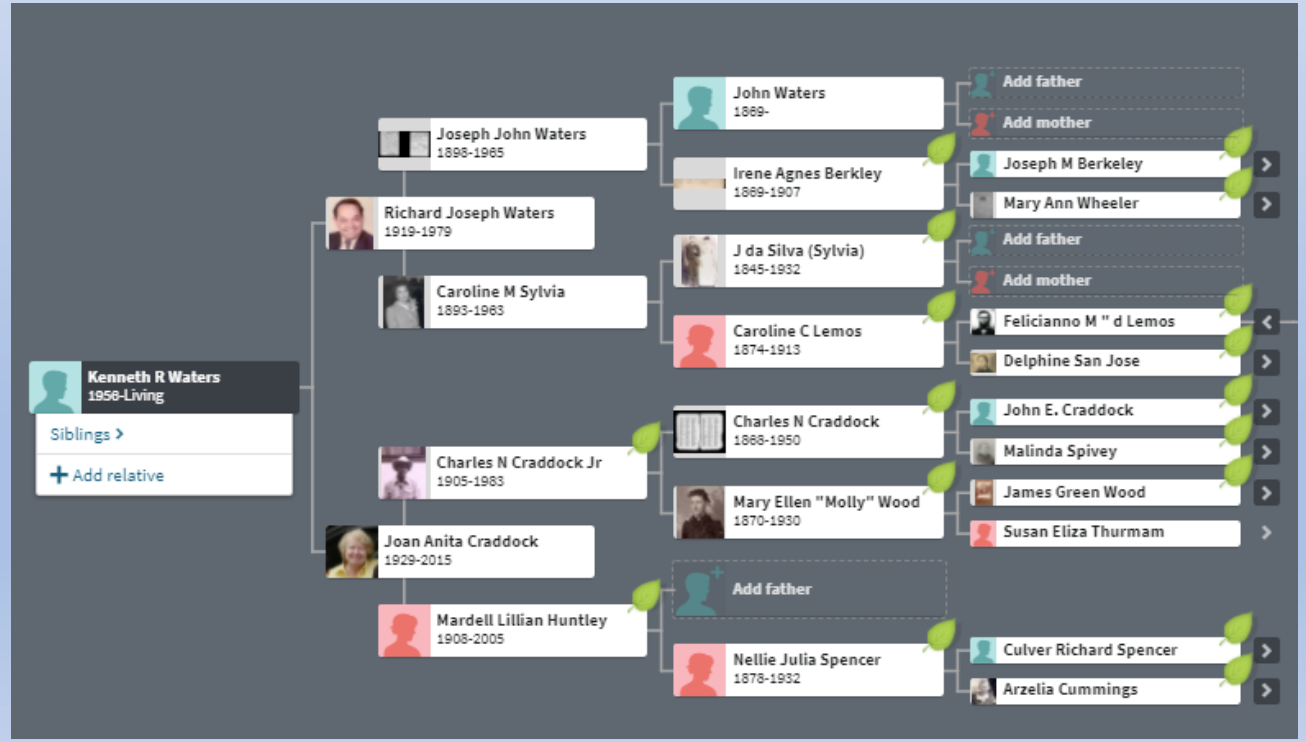


Next steps

- Build your online tree
  - Increases chances to match other test takers---remember, keep it lean
- Upload to other services including GedMatch (basic services are free)
- Start going through your matches, one-by-one
  - “Divide and Conquer” --- sort your matches into the bins of your family tree (start with dividing mother vs. father matches then build back up the tree)
- Communicate with your matches --- email, messaging --- there’s power in sharing
- Learn more
  - Free classes, online and at the library
  - Facebook Groups – Genetic Techniques

It’s not genetic genealogy---without the genealogy

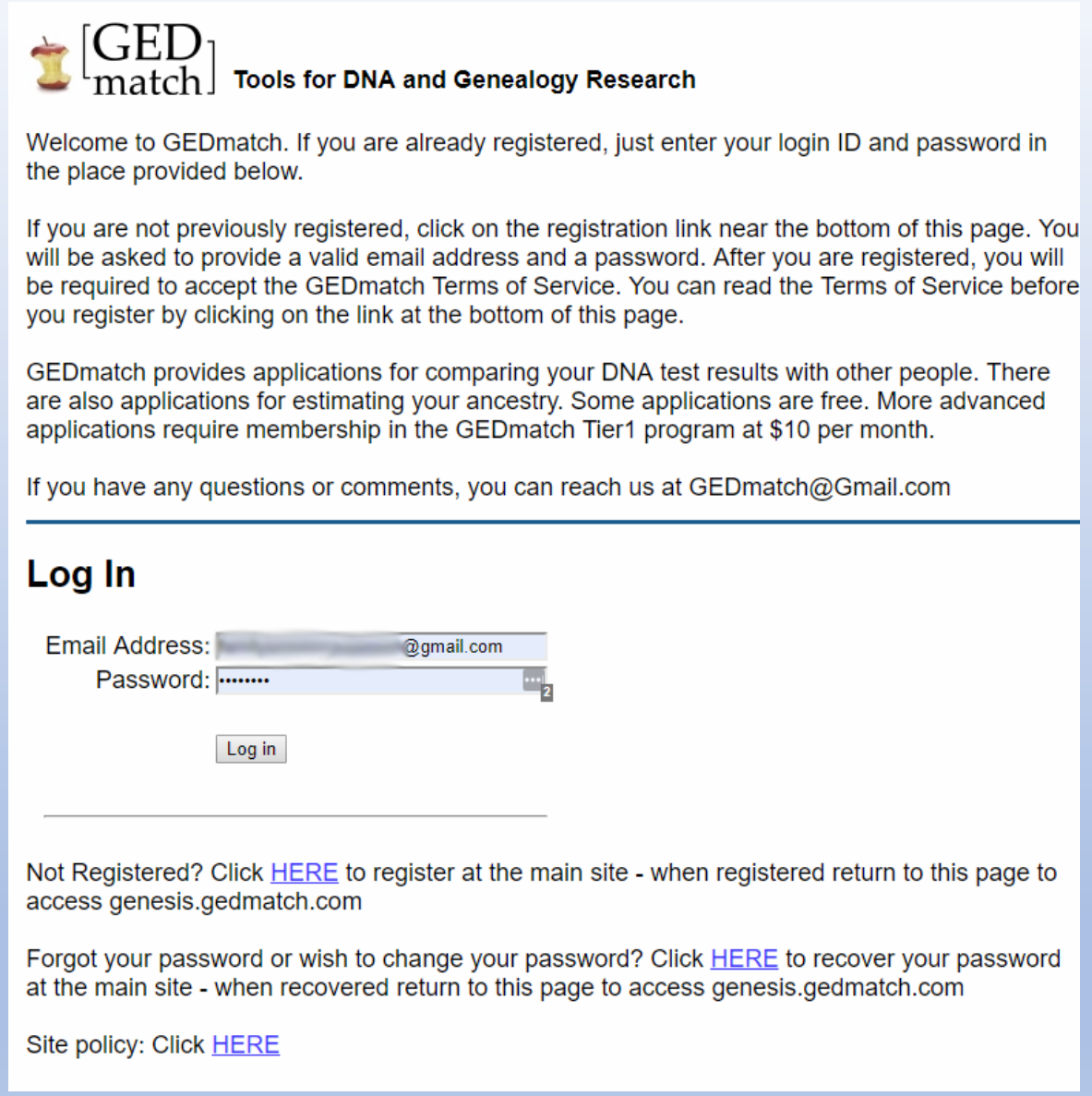
- DNA comparisons are great but mean nothing without genealogical context
- This means:
  - FAMILY TREES!
- Suggestions:
  - Be sure to always have a good tree, 5+ generations if possible
  - Keep it public and attached to your DNA kit (you can always have other trees private)
  - Backup your tree (store on local software)
  - Export your tree in GEDCOM formatUpload your tree (GEDCOM file) to GedMatch and WikiTree



Other Useful Tools

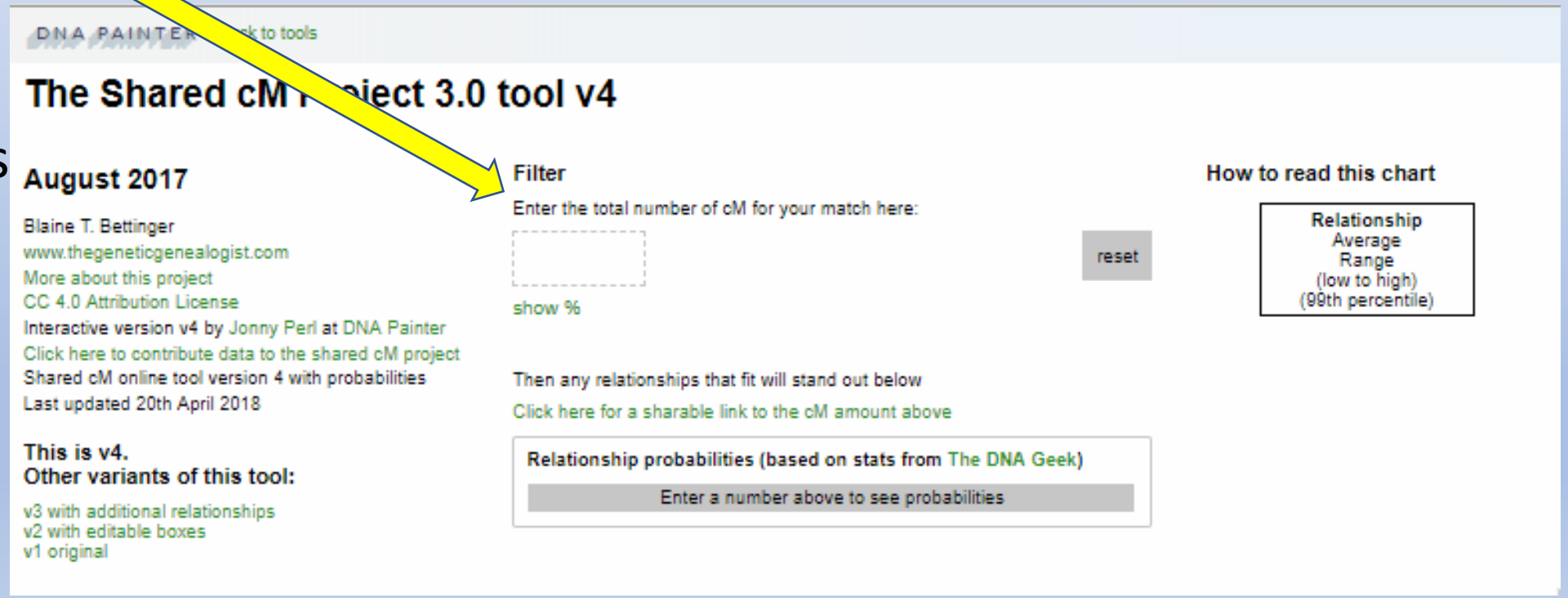
GEDmatch

- A mostly-free public website which accepts DNA data from all 5 testing companies
- http://gedmatch.com
- Has more DNA match analytical tools than any of the 5 testing companies
  - Including triangulation
  - Auto-clustering



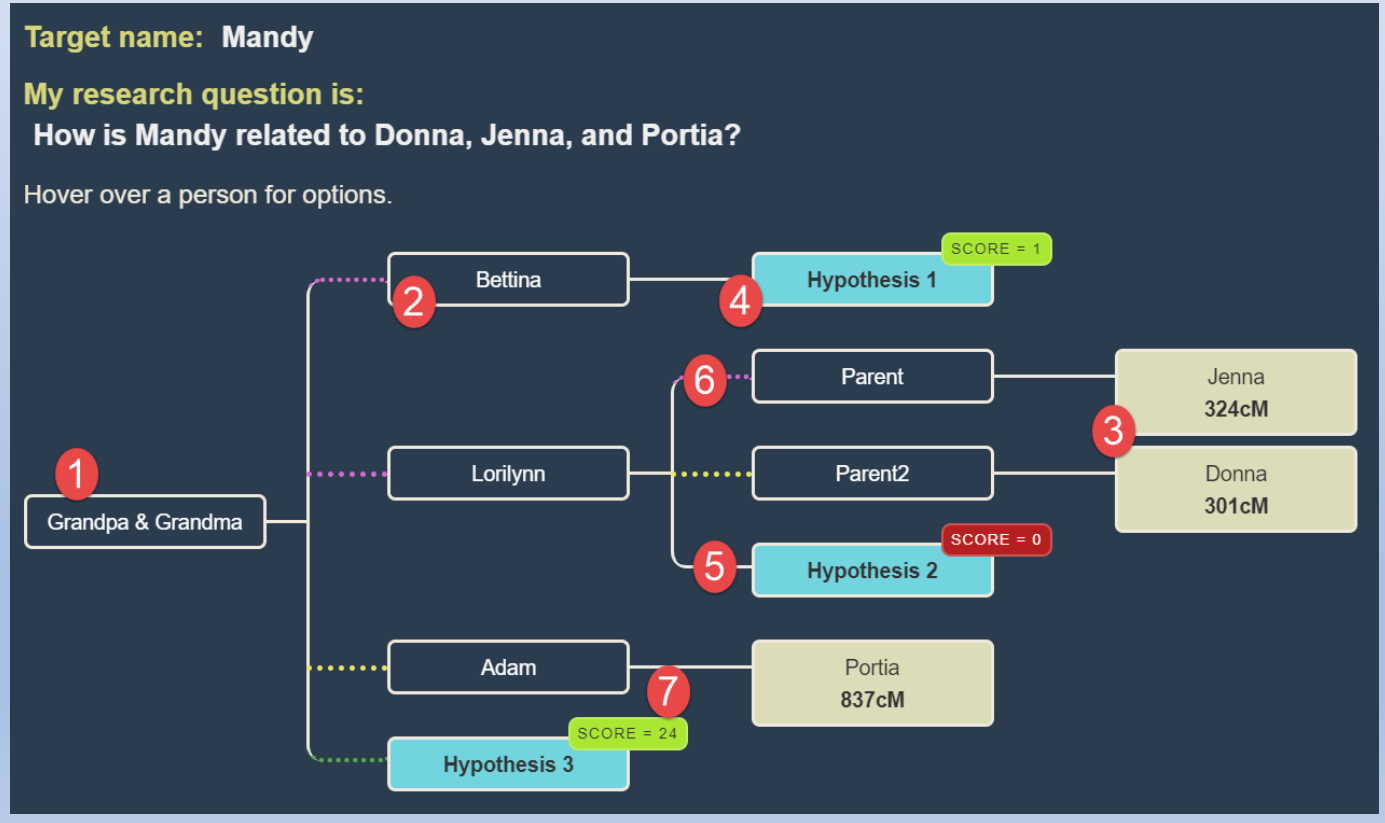
Dnapainter's shared cm project

- Enter cM value
- See all the possibilities



DNAPainters “WATO” Tool

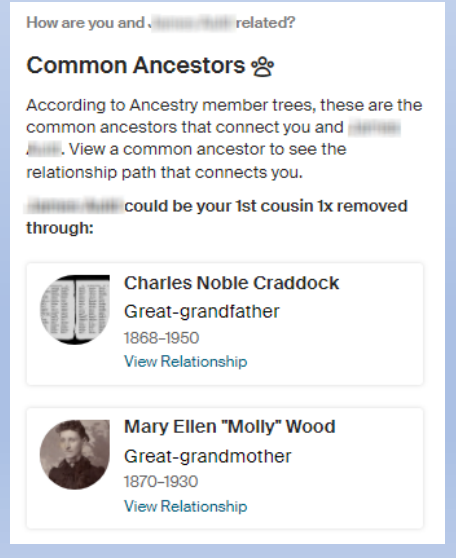
- WATO=What Are The Odds?
- Test hypotheses using DNA test strength levels (measured in cMs)

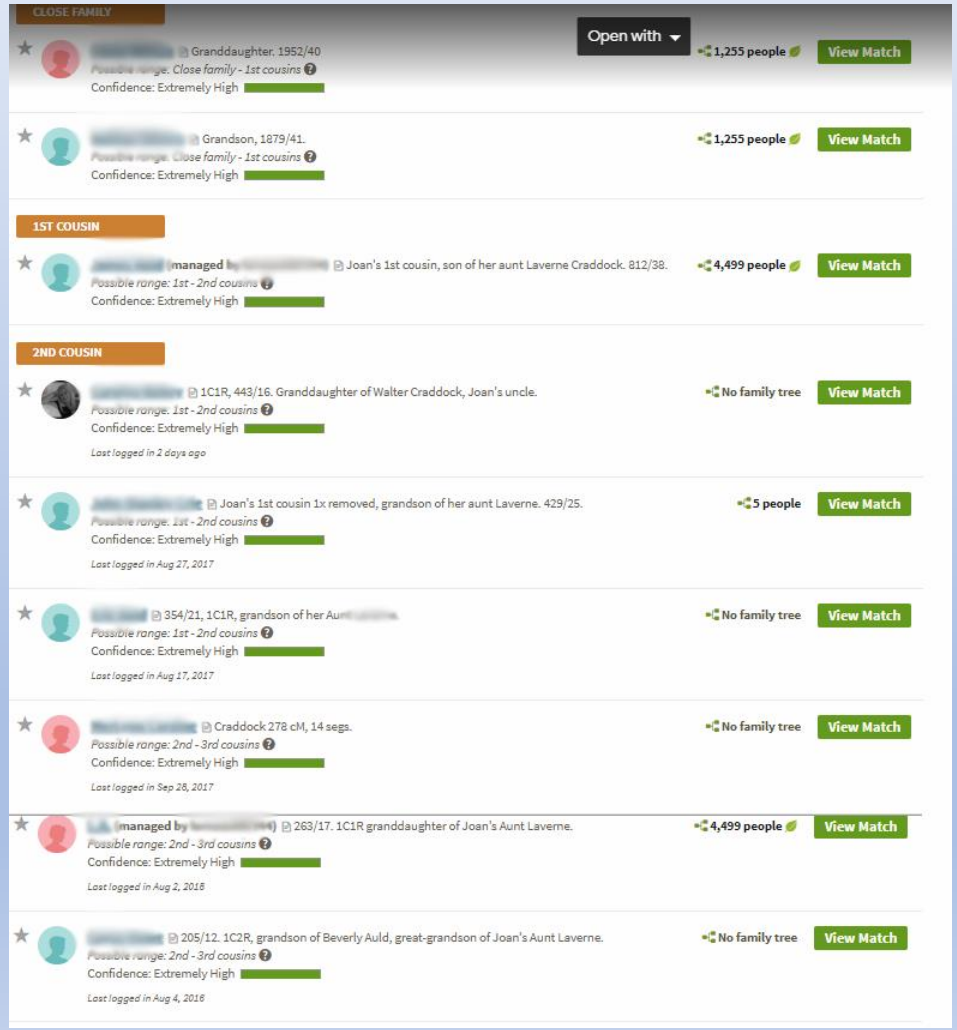


https://www.yourdnaguide.com/ydgblog/wato-what-are-the-odds

Get what you can get from shared matches

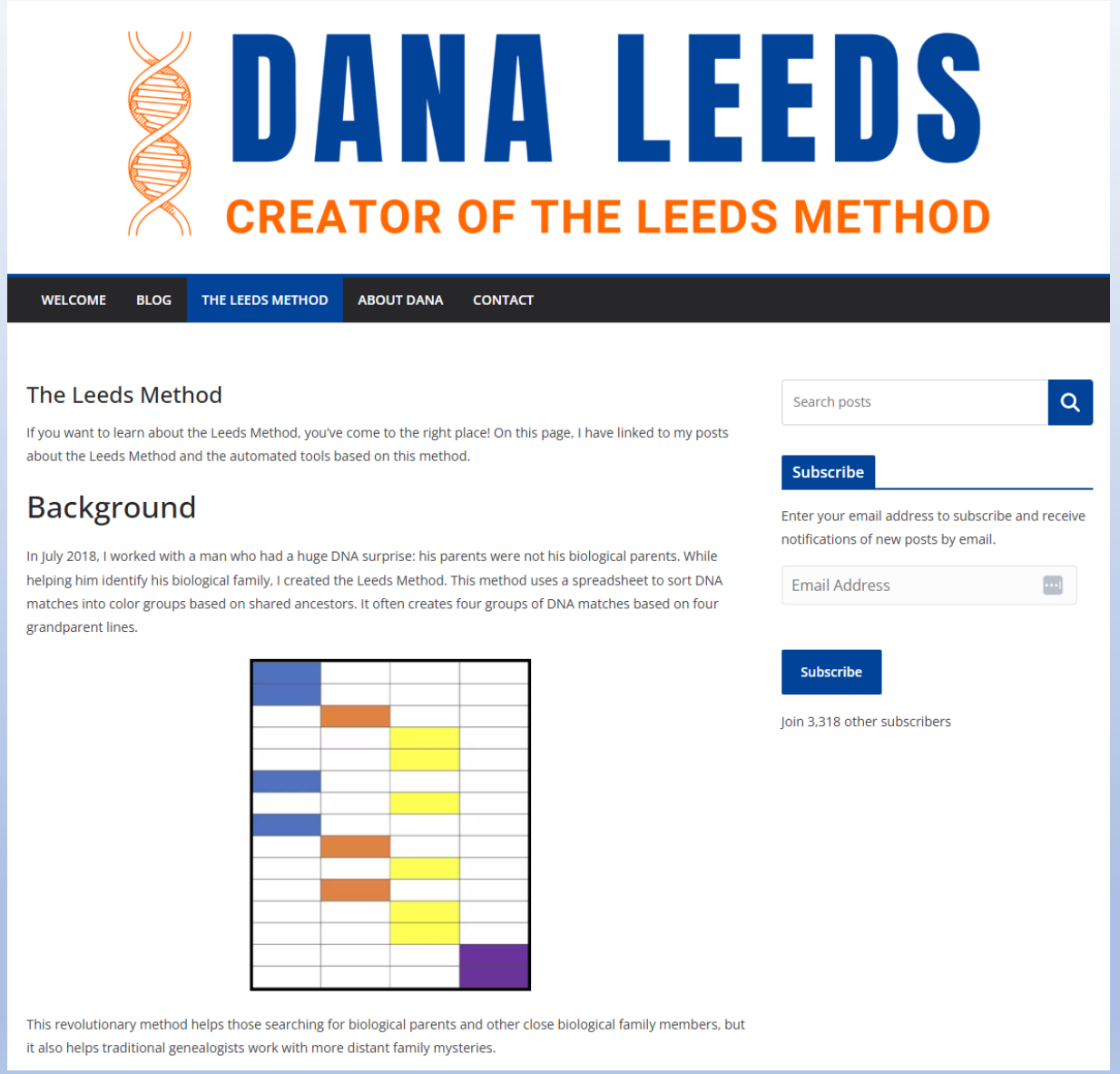
- In this case due to good sampling of shared matches I was able to isolate the match to my maternal grandfather
- Some of these are 1st and 2nd cousins to Joan and use the cM values for each match help narrow down the precise line





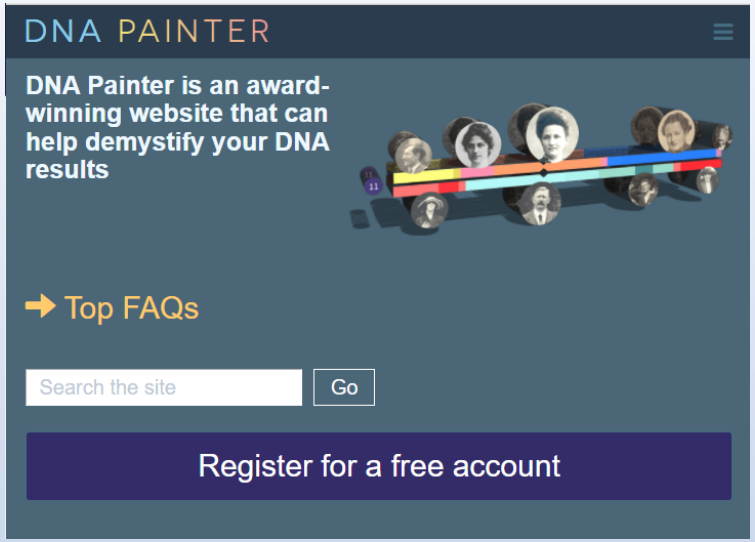
Resources

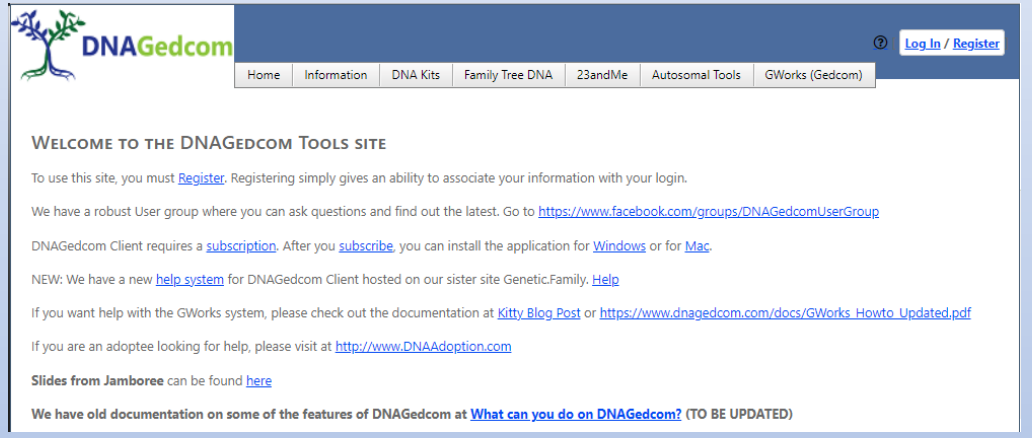
- Leeds Method (use a spreadsheet to divide your matches into the 4 grandparent groups
- https://www.danaleeds.com/the-leeds-method/

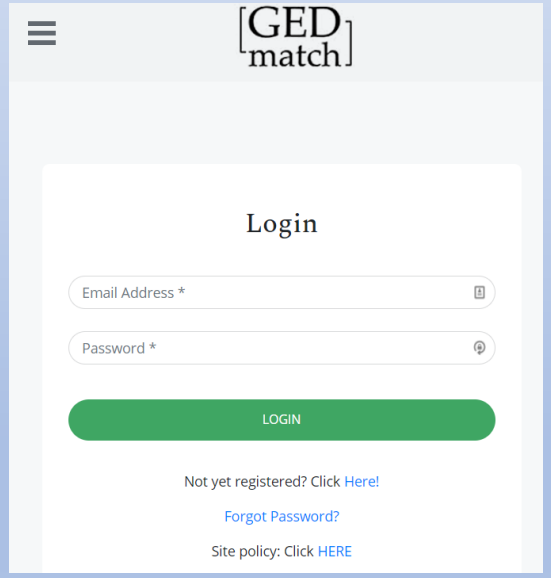


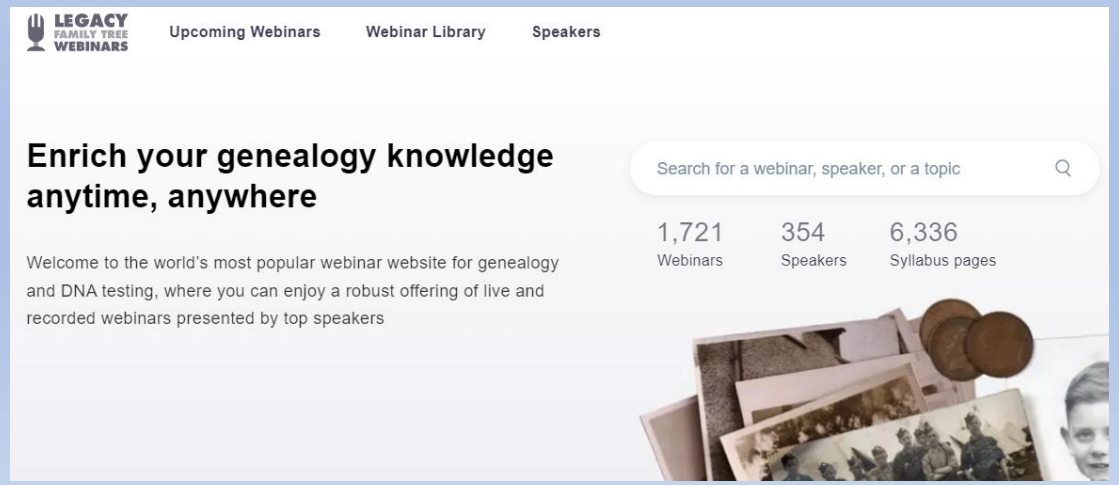
Resources

- GEDMatch.com
- DNAPainter.com
- DNAGedcom
- Familysearch.com (to research sources)
- Legacy Family Tree webinars (free for 7 days)
- FindAGrave.com
- ISOGG.org Wiki
- WikiTree.com
- Facebook Group: Genetic Genealogy Tips & Techniques
- Local groups: (for example) Phoenix East Valley DNA Group [on Facebook]



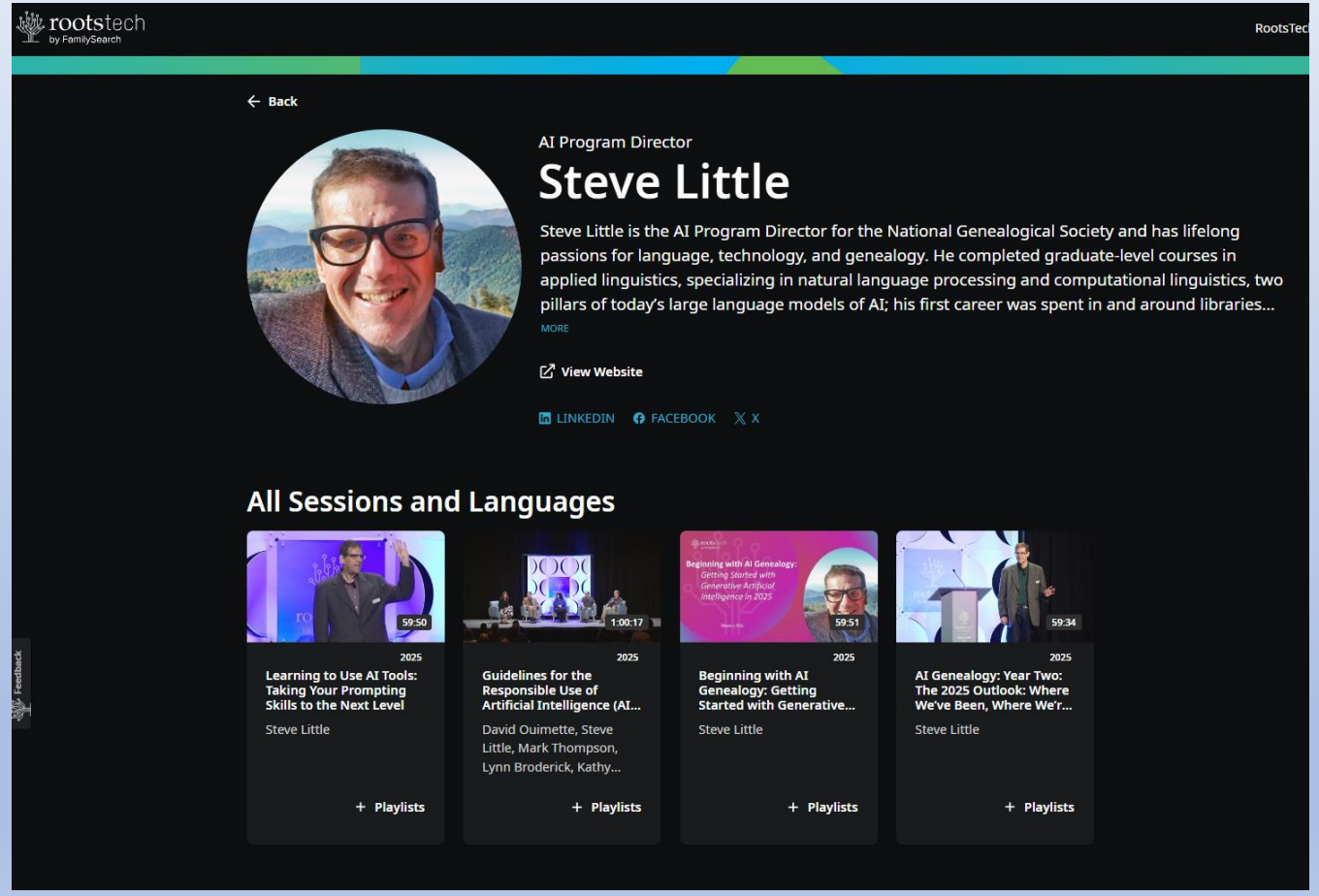






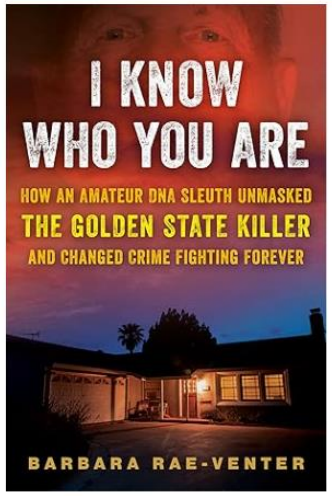
What about….

- Artificial Intelligence (AI)
  - AI is becoming increasingly useful to use with analyzing DNA results
  - ChatGPT is one of the main tools
  - This field is changing rapidly and users are exploring ways to creatively use AI to help with DNA analysis
  - Follow Steve Little (https://aigenealogyinsights.com/blog/) or Dana Leeds (https://www.danaleeds.com/aigenealogy/) for more info.



What about…

- Investigative Genetic Genealogy (IGG)
  - Used with DNA samples for the past few years to identify scores of:
    - Deceased individuals
    - Criminal suspects
  - Lots of news coverage (starting with the Golden State Killer case)
  - More: https://isogg.org/wiki/Investigative_genetic_genealogy_FAQs



I Know Who You Are: How an Amateur DNA Sleuth Unmasked the Golden State Killer and Changed Crime Fighting Forever Hardcover – February 7, 2023

by Barbara Rae-Venter (Author)

4.4 ★★★★½ (363) 4.0 on Goodreads 1,979 ratings

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"Barbara Rae-Venter isn't just the genealogy expert who helped capture the Golden State Killer—she's an unsung hero who has given murdered women and children their faces and names back."—Maureen Callahan, *New York Times* bestselling author of *American Predator*

"Echoes the dedication displayed by such fictional police detectives as California novelist Michael Connelly's Harry Bosch."—*The Wall Street Journal*

For twelve years the Golden State Killer terrorized California, stalking victims and killing without remorse. Then he simply disappeared, for the next *forty-four years,* until an amateur DNA sleuth opened her laptop. In *I Know Who You Are,* Barbara Rae-Venter reveals how she went from researching her family history as a retiree to hunting for a notorious serial killer—

Quote of the Day

"DNA doesn't lie. But it sure can be misinterpreted."

– Ken Waters

FamilyTreeAZ.com

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