Intro to DNA and Genetic Genealogy
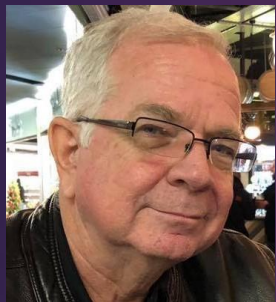
April 10, 2021

KEN WATERS

@FAMILYTREEAZ

HTTP://FAMILYTREEAZ.COM/PRESENTATIONS

KEN@FAMILYTREEAZ.COM

All slides and handouts can be found at:
http://www.familytreeaz.com/Presentations/

Outline

▶ Some Questions to Start

▶ Types of DNA Tests

▶ The 5 Testing Companies

▶ Testing Strategies

▶ Ken's 10 Tips

What is genealogy?

Genealogy, the study of family origins and history. Genealogists compile lists of ancestors, which they arrange in pedigree charts or other written forms. The word *genealogy* comes from two Greek words—one meaning "race" or "family" and the other "theory" or "science." Thus is derived "to trace ancestry," the science of studying family history. The term *pedigree* comes from the Latin *pes* ("foot") and *grus* ("crane") and is derived from a sign resembling a crane's foot, used to indicate lines of descent in early west European genealogies. Chart pedigrees, familiar to most people from school history books, include arrow shapes, parallel lines, a crinkled line denoting birth to unmarried parents, and the sign = denoting marriage.

What is genetic genealogy?

+
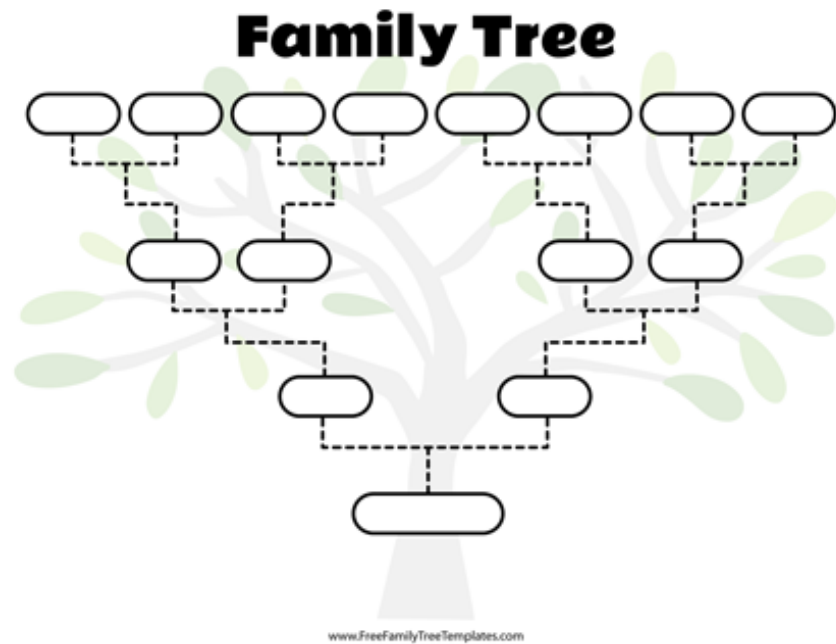
First step: answer some questions

▶ [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
   1. E.g., Am I part Native American?
2. Curious about health aspects
   1. E.g., Do I carry the BRCA gene?
3. **Curious about relationships, i.e., Genealogy**
   1. Unknown parentage (adoption, misattributed parentage, donor conceived)
   2. Find living cousins
   3. 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 so mystery
- ► What it MAY do:
  - ► **WARNING!!!!**
  - ► Uncover dark secret(s) that may or may not greatly upset your family
- ► What it will NOT do:
  - ► Absolutely confirm ethnic relationships except in perhaps limited circumst
  - ► Fill in all the missing persons (brick walls, etc.) in your family tree
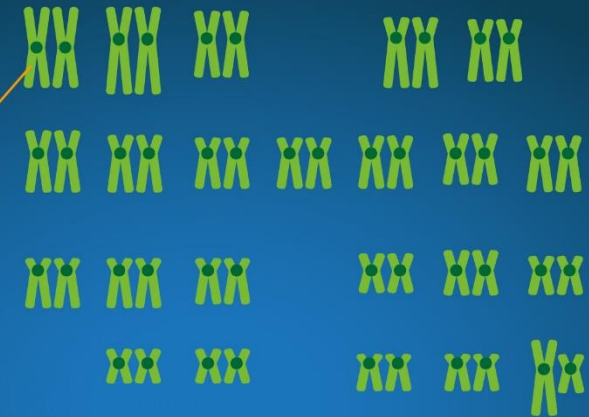
What is DNA? -- chromosomes

- 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

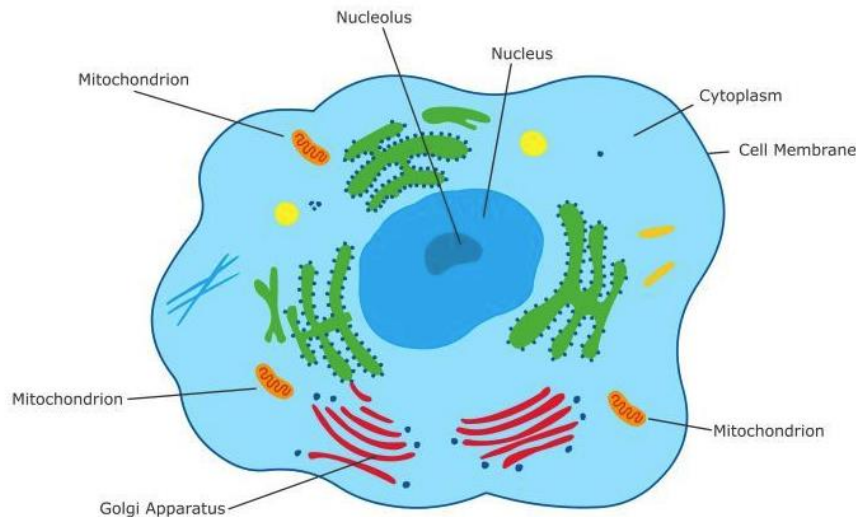**CHROMOSOMES**
NHGRI FACT SHEETS
genome.gov

Telomere

Centromere

Telomere
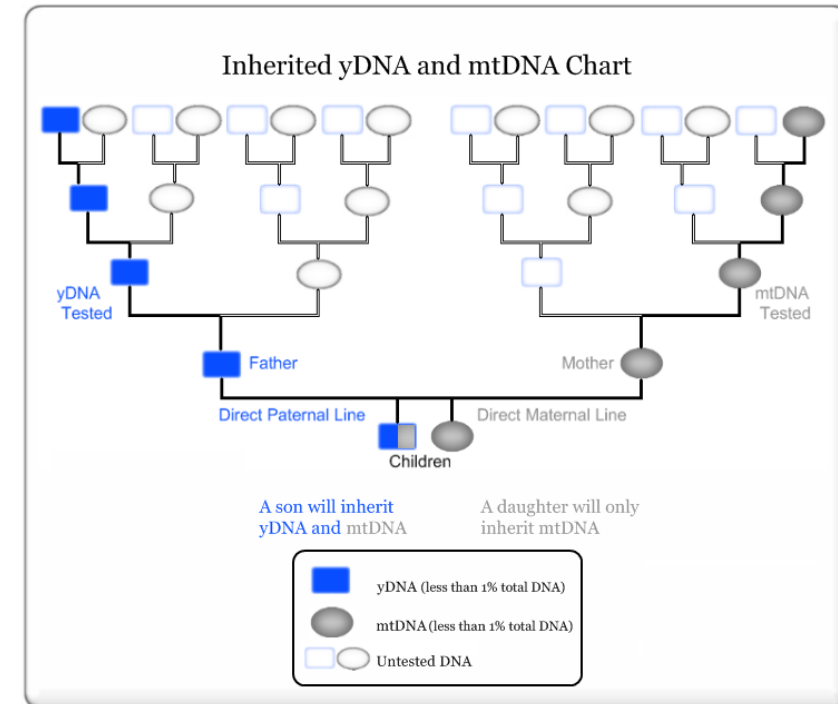
Human Chromosomes
23 Pairs

What is DNA? -- mitochondrial

Cell diagram showing mitochondria

- 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.]

Nucleolus

Nucleus

Mitochondrion

Cytoplasm

Cell Membrane

Mitochondrion

Mitochondrion

Golgi Apparatus

© 2007-2010 The University of Waikato I www.sciencelearn.org.nz

Inherited yDNA and mtDNA Chart

yDNA Tested

mtDNA Tested

Father

Mother

Direct Paternal Line

Direct Maternal Line

Children

A son will inherit yDNA and mtDNA

A daughter will only inherit mtDNA

yDNA (less than 1% total DNA)

mtDNA (less than 1% total DNA)

Untested DNA

What is DNA? – Y-DNA

- One of the two "sex" chromosomes
- *ONLY* found in males
- Similar to mtDNA inheritance Y-DNA is only passed along the patrilineal line
  - Father's father's father's….[etc.]

Source: https://phillipsdnaproject.com/faq-sections/304-ancestor-dna-chart
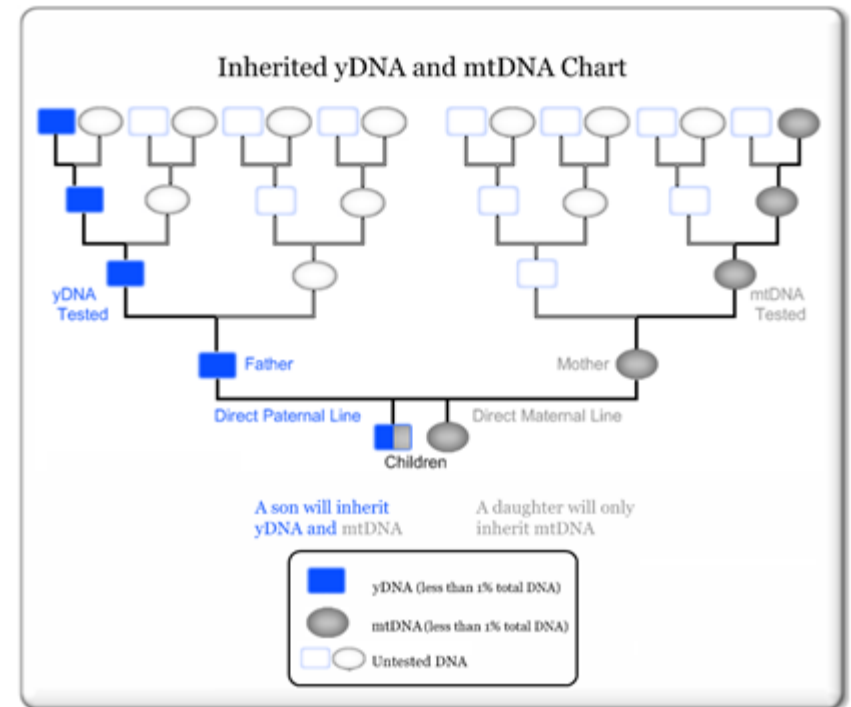
What is X-DNA?

- 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

- Males have one 'X' chromosome (from mother) and one 'Y' chromosome (from father)

Types of DNA tests

- Autosomal
  - The vast majority of DNA tests are this type
  - Relatively inexpensive ($49-$99)
- 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
  - New kid on the block!
  - More expensive (~$1000) but cost is going down
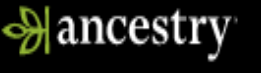
Testing company options

▶ There are 5 known, reputable, and trusted companies at this time:

   ▶ **Ancestry**

   ▶ **Family Tree DNA**

   ▶ **MyHeritage**

   ▶ **23andMe**

   ▶ **Living DNA**

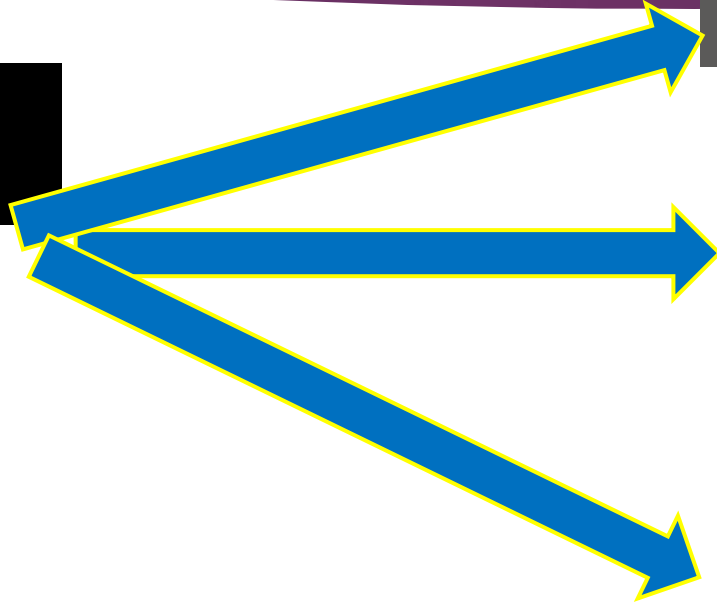▶ There are others out there but not recommended for a variety of reasons

What to look for with testing companies

- What all 5 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)

Comparison of Testing companies

	Allow Uploads	Trees	Chromosome Browser	Research Databases	Est. Database Size	Matching	Y-DNA mtDNA
FamilyTreeDNA	X	X	X		1.5M	X	X
ancestry		X		X	18M	X	
MyHeritage	X	X	X	X	5M	X	
23andMe		X	X		13M	X	
Living DNA YOUR ANCESTRY	X				< 1M	Very limited	X

3 of the 5 testing companies allow uploading

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

Testing strategies

- First, ask yourself a few questions:
  - Why do you want to test? (recall the reasons brought up earlier)
  - How much can you spend or are you willing to spend?
  - Are you searching for a specific answer that may require looking for matches in many places?
- Based on the answers to those questions you can begin to devise a testing plan

Testing strategy #1

- General questions on family tree

- Willing/able to spend maybe $200 or so

- Testing Plan:

  - Wait for good sales and then test with the 2 companies that don't allow uploads: Ancestry and 23andMe

  - Download the results from one or both of them and then upload to sites that do allow uploads (MyHeritage, FamilyTreeDNA, LivingDNA, GedMatch)

    - Pay small upgrade fees to get full tools

Testing strategy #2

- Limited budget: $50

- Testing Plan:

  - Wait for good sale and then test with Ancestry

  - Download the and then upload to sites that do allow uploads (MyHeritage, FamilyTreeDNA, LivingDNA, GedMatch)

    - Skip the upgrades as at least you will get matches for free

Testing strategy #3

- Special situation---trying to solve unknown parentage

- Willing to spend whatever it takes (anywhere from $200 up)

- Testing Plan:

  - Test with both Ancestry and 23andMe

  - Upload to sites that do allow uploads (MyHeritage, FamilyTreeDNA, LivingDNA, GedMatch)

    - Pay for upgrades on all sites

  - **Buy additional kits when on sale (recommend Ancestry) to use to test known family members or suspected family relations who may help solve the mystery**

Testing at ancestry.com

▶ For simplicity, all of the following slides assume a test was taken at Ancestry

▶ If you test at one of the other companies you will see some similar results but also some differences

▶ Cost of kit: varies, as low as $49 on limited sales, up to $99

Testing at ancestry.com

- Test is saliva "spit" test
- Don't eat or drink within one hour before testing
- Be careful with the test (clean hands, no contamination)
- Pack up and mail it back
- Results can take anywhere from 2 weeks (ideal) to 14 weeks (worst case); currently running about 3-4 weeks

http://www.businessinsider.com/ancestrydna-genetic-test-review-2016-3

Testing at ancestry.com

- Set up an account on Ancestry to hold your results
  - **FREE Account is okay**, NOT required to pay subscription cost in order to process your DNA record and view matches
  - You only need to pay for a subscription if you want to do research on your tree

- Please note:
  - Ancestry now requires a unique e-mail address for each account tied to a DNA kit
  - Only a big deal if you're like me, administering a lot of different accounts

Help Another Adult Activate

Protecting personal data is important to us.

We require that a DNA kit be activated by the person providing the DNA sample, or their parent or legal guardian if they are under the age of 18.

Once the person providing the DNA sample activates their kit, they can give you full access to view and manage their test results through your Ancestry account.

Enter their email to help them get started.

| Enter email address |

SEND ACTIVATION INVITATION

Alternately, the person may sign in to their Ancestry account or create a new account for free.

Frequently Asked Questions

Why can't I activate the kit?

How do I activate the kit?

Why should I send an activation invitation?
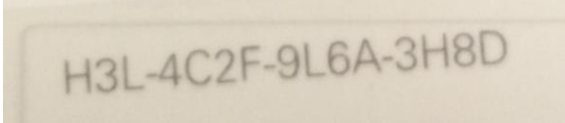
How do I become a test manager?

What can a test manager do?

Testing at ancestry.com

▶ When you send the kit in be sure to log in to "register" it

▶ Important item is the Activation Key found on the sample container and in the box   H3L-4C2F-9L6A-3H8D

▶ This is the ONE THING Linking YOU to the SAMPLE

▶ Enter minimal information to register:

  ▶ Name, Sex, Age

▶ **Start building a family tree – this is free**

▶ **Make the tree PUBLIC, not PRIVATE**

Results arrive!

► You'll get an e-mail notifying you that your results are in

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?

- If using Ancestry:
  - Enter notes about what you know about them
  - Use Tag Groups to identify them

Concept of "relatedness"
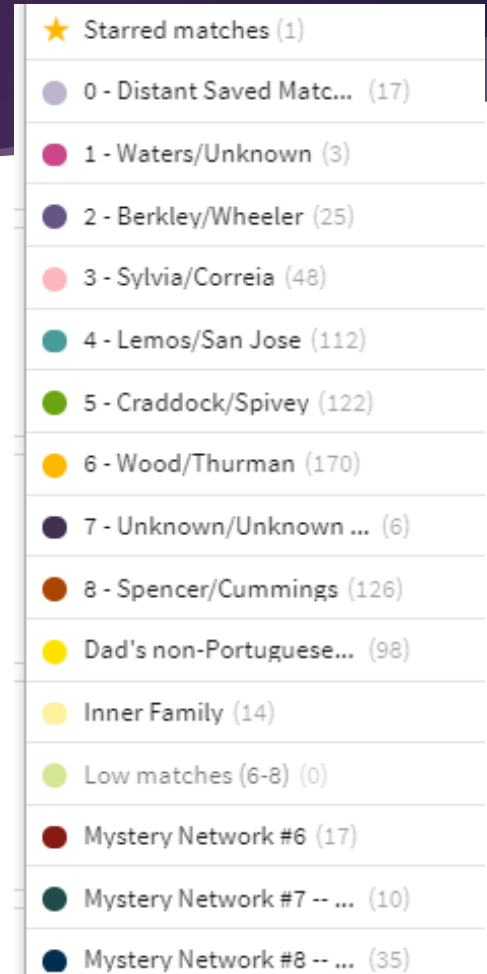
From:
https://dnapainter.com/tools/sharedcmv4

- Measured by **CentiMorgans** (abbreviated "cMs")

- Range from 0 to ~ 3500

- Higher numbers indicate closer relationships

- Top number in each box is average (mean)

- Bottom is range of numbers that could exist for that relationship

Divide and conquer

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

⭐ Starred matches (1)

● 0 - Distant Saved Matc... (17)

● 1 - Waters/Unknown (3)

● 2 - Berkley/Wheeler (25)

● 3 - Sylvia/Correia (48)

● 4 - Lemos/San Jose (112)

● 5 - Craddock/Spivey (122)

● 6 - Wood/Thurman (170)

● 7 - Unknown/Unknown ... (6)

● 8 - Spencer/Cummings (126)

● Dad's non-Portuguese... (98)

● Inner Family (14)

● Low matches (6-8) (0)

● Mystery Network #6 (17)

● Mystery Network #7 -- ... (10)

● Mystery Network #8 -- ... (35)

The goal: sort your matches into common groups
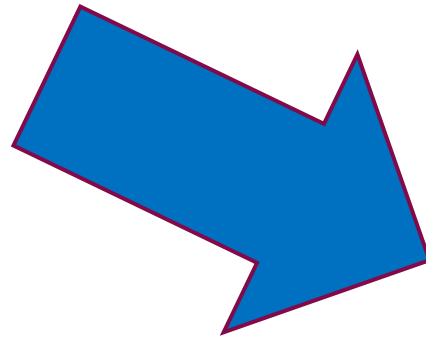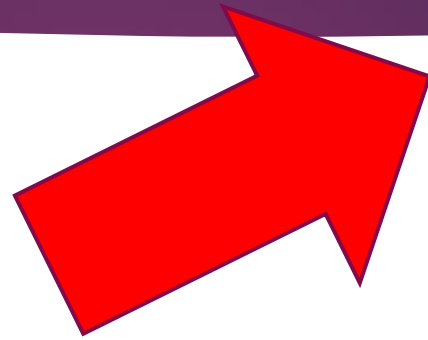
Next steps

- Build your online tree
  - Increases chances to match other test takers
- 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
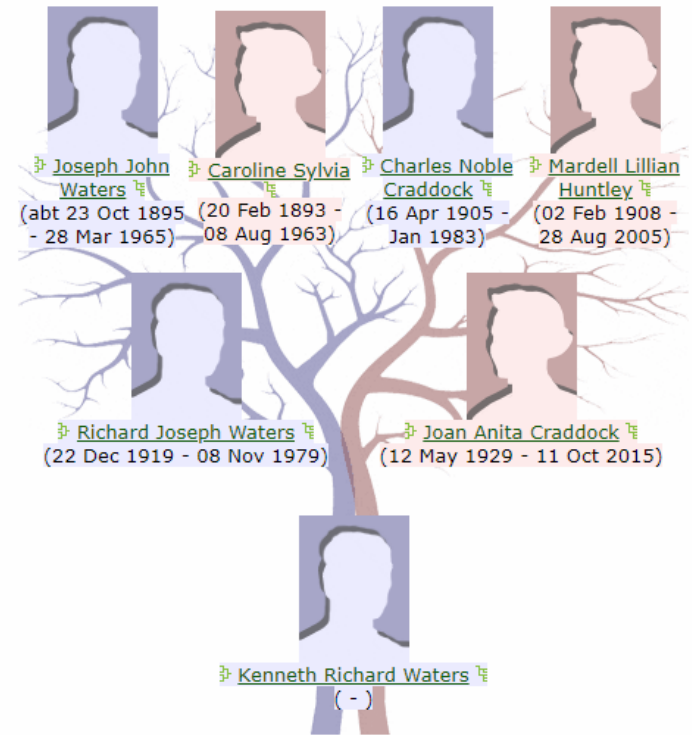 - Facebook Groups – Genetic Techniques

Message

Joined
22 Mar 2009

Last signed in
Last month

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

- DNA comparisons are great but mean nothing without genealogical context
- This means:
  - FAMILY TREES!
- 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 format
- Upload your tree (GEDCOM file) to GedMatch and WikiTree

My WikiTree: Navigation Home Page

You can customize wha[t]

Joseph John Waters (abt 23 Oct 1895 - 28 Mar 1965)

Caroline Sylvia (20 Feb 1893 - 08 Aug 1963)

Charles Noble Craddock (16 Apr 1905 - Jan 1983)

Mardell Lillian Huntley (02 Feb 1908 - 28 Aug 2005)

Richard Joseph Waters (22 Dec 1919 - 08 Nov 1979)

Joan Anita Craddock (12 May 1929 - 11 Oct 2015)

Kenneth Richard Waters (-)

HONOR CODE SIGNATORY   VOLUNTEER   DNA TESTED   GEDCOM EQUIPPED

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

[GED match] Tools for DNA and Genealogy Research
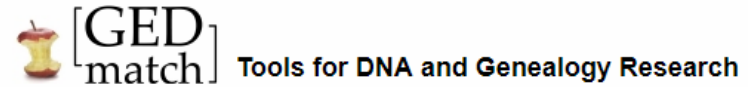
Welcome to GEDmatch. If you are already registered, just enter your login ID and password in the place provided below.

If you are not previously registered, click on the registration link near the bottom of this page. You will be asked to provide a valid email address and a password. After you are registered, you will be required to accept the GEDmatch Terms of Service. You can read the Terms of Service before you register by clicking on the link at the bottom of this page.

GEDmatch provides applications for comparing your DNA test results with other people. There are also applications for estimating your ancestry. Some applications are free. More advanced applications require membership in the GEDmatch Tier1 program at $10 per month.

If you have any questions or comments, you can reach us at GEDmatch@Gmail.com

Log In

Email Address: [_____]@gmail.com
Password: [••••••••]

[Log in]

Not Registered? Click HERE to register at the main site - when registered return to this page to access genesis.gedmatch.com

Forgot your password or wish to change your password? Click HERE to recover your password at the main site - when recovered return to this page to access genesis.gedmatch.com

Site policy: Click HERE

Dnapainter's shared cm project

- Enter cM value
- See all the possibilities

DNA PAINTER « back to tools

The Shared cM Project 3.0 tool v4

August 2017

Blaine T. Bettinger
www.thegeneticgenealogist.com
More about this project
CC 4.0 Attribution License
Interactive version v4 by Jonny Perl at DNA Painter
Click here to contribute data to the shared cM project
Shared cM online tool version 4 with probabilities
Last updated 20th April 2018

This is v4.
Other variants of this tool:

v3 with additional relationships
v2 with editable boxes
v1 original

Filter

Enter the total number of cM for your match here:

[   ]   reset

show %

Then any relationships that fit will stand out below

Click here for a sharable link to the cM amount above

Relationship probabilities (based on stats from The DNA Geek)
Enter a number above to see probabilities

How to read this chart

Relationship
Average
Range
(low to high)
(99th percentile)

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

My top 10 tips

- ▶ #1: Test only with the 5 trusted companies (Ancestry, 23andMe, FTDNA, MyHeritage, Living DNA)

- ▶ #2: Download the DNA data and upload it to as many sites as you can

- ▶ #3: Build a single family tree that is accurate and supportable with good-quality records and keep that family tree PUBLIC (!) and make sure it's attached to your DNA record

- ▶ #4: Build private trees for all your hypothesis tests ("what if") to see what hints can be found to help solve mysteries and build your public tree up

- ▶ #5: Learn to use useful tools such as DNAPainter and its relationship estimator

My top 10 tips

- ▶ #6: Be prepared to deal with unexpected surprises!

- ▶ #7: Use well-crafted, well-thought out messaging to DNA matches to share information and test your hypotheses

- ▶ #8: Regularly check for new matches

- ▶ #9: Sort your matches (starting at the top) into family groups
  - ▶ I like to use Ancestry's Tag feature to sort into my 8 great-grandparent lines

- ▶ #10: Learn more (go to conferences, attend local meetings (e.g., East Valley DNA SIG), watch videos, take classes [like mine!])

BONUS RULE: HAVE FUN, ENJOY, WELCOME YOUR NEW-FOUND FAMILY MEMBERS!

Resources

- GEDMatch.com
- DNAPainter.com
- 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]

Learn more --- upcoming classes

▶ Mesa Red Mountain Library (Power & University/Brown)

▶ Classes are free

Classes typically held monthly; virtual for now but hopefully in person soon!

Questions?

- Contact:
  - Ken Waters
  - E-Mail: ken@familytreeaz.com
  - Blog: familytreeaz.com
  - Twitter: @familytreeaz
  - Presentations: http://familytreeaz.com/Presentations