

# DNA for Genealogy Librarians

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Springfield-Greene County Library District

# What does DNA do?

- It replicates itself.
- It codes for the production of tens of thousands of proteins responsible for
  - transport,
  - communication,
  - movement,
  - structure,
  - defense.

# Where is DNA?

Every part of our bodies are made of cells.

We have skin cells.

We have heart cells.

We have muscle cells.

We have liver cells.

Etc!

# Cheek Cells

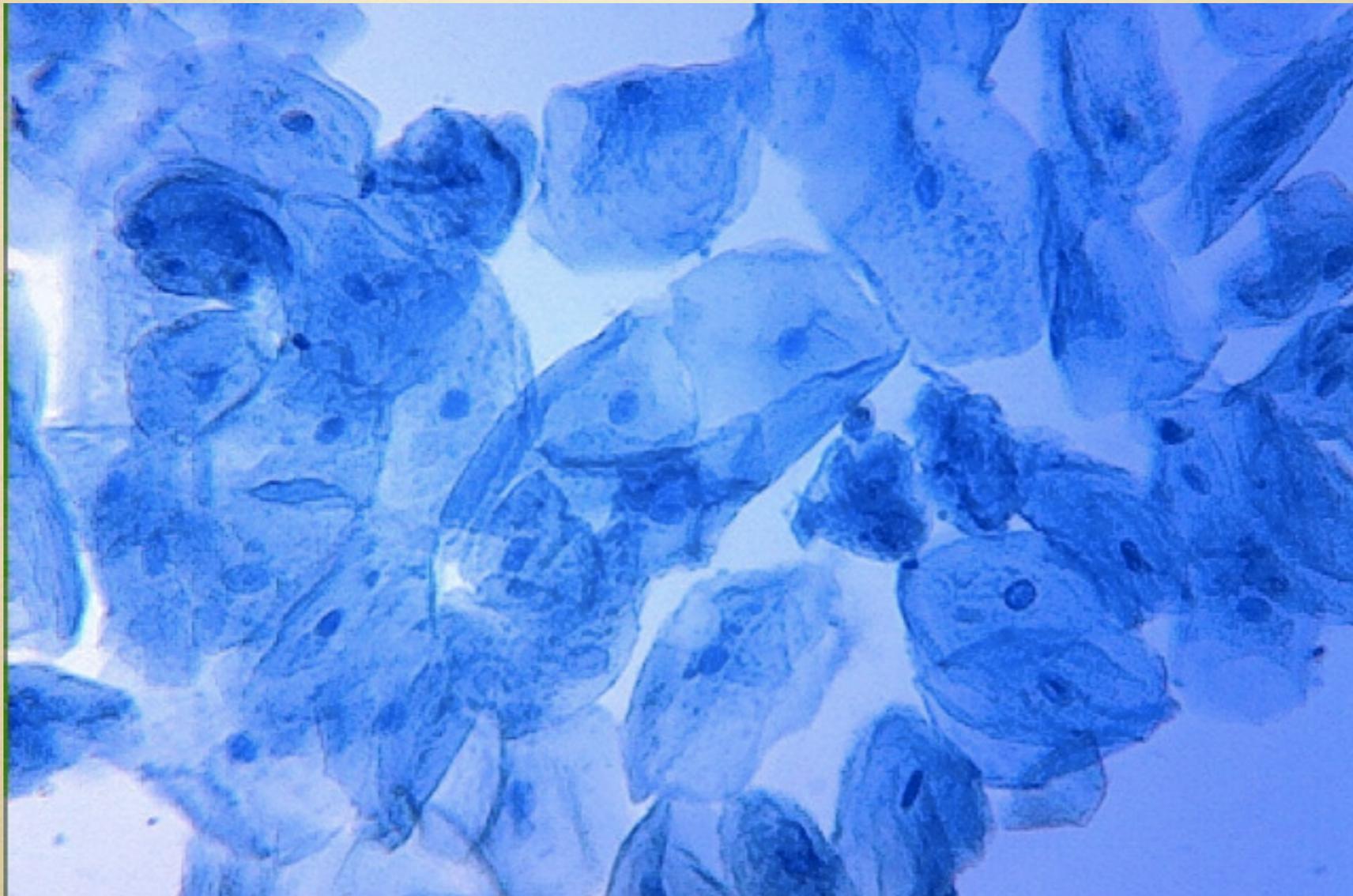
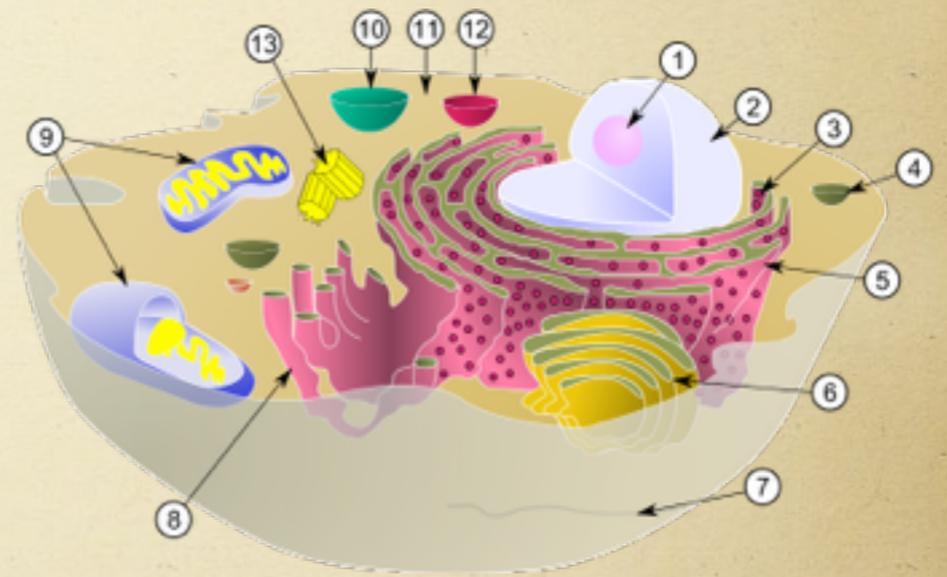
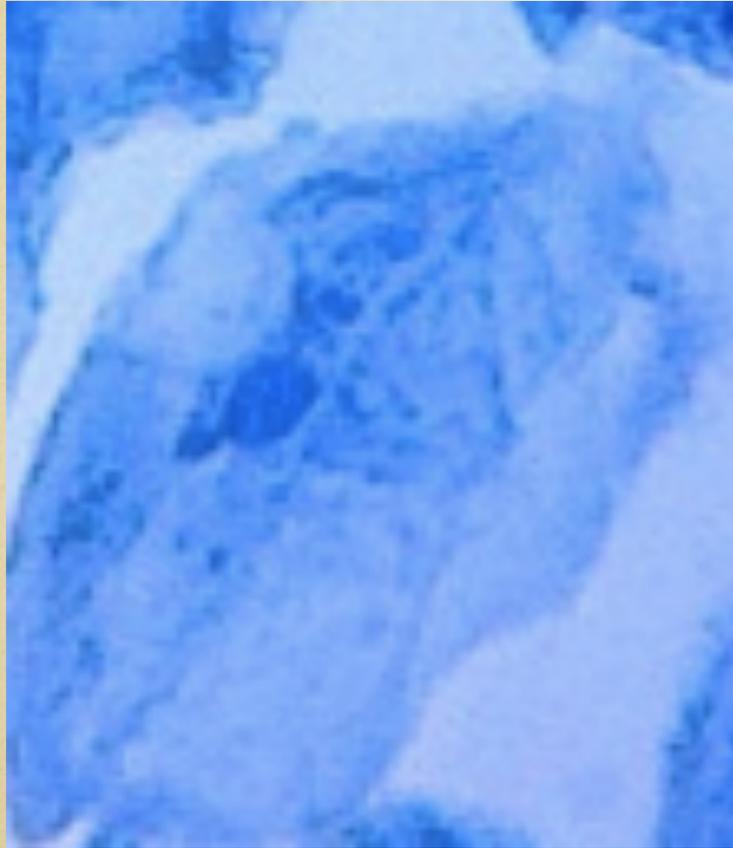


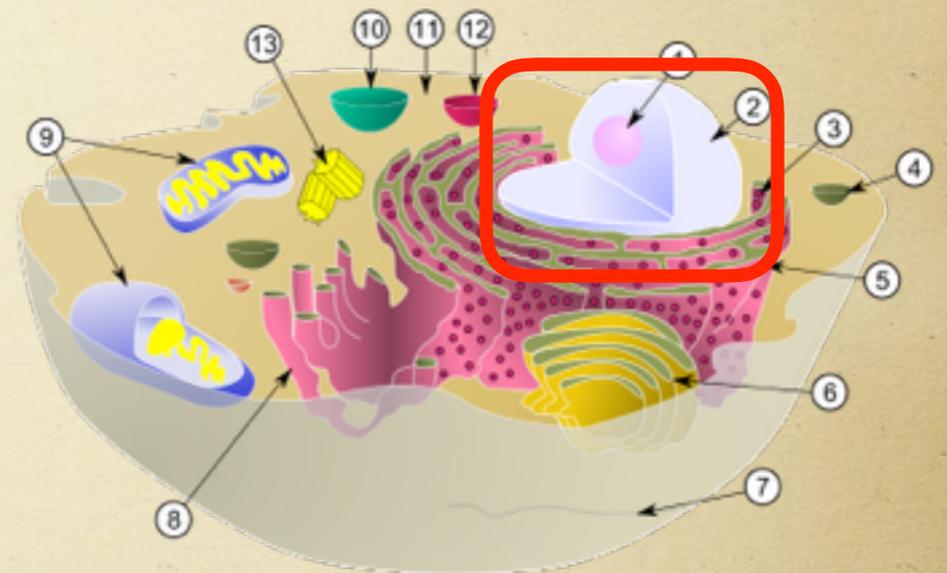
Image courtesy of Wikipedia Creative Commons <https://creativecommons.org/licenses/by-sa/2.0/>

# A Cell

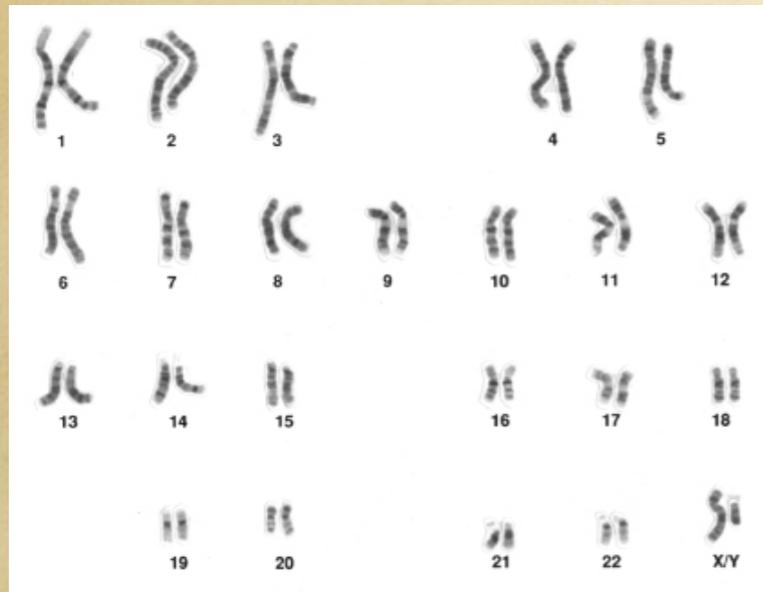


# A Cell

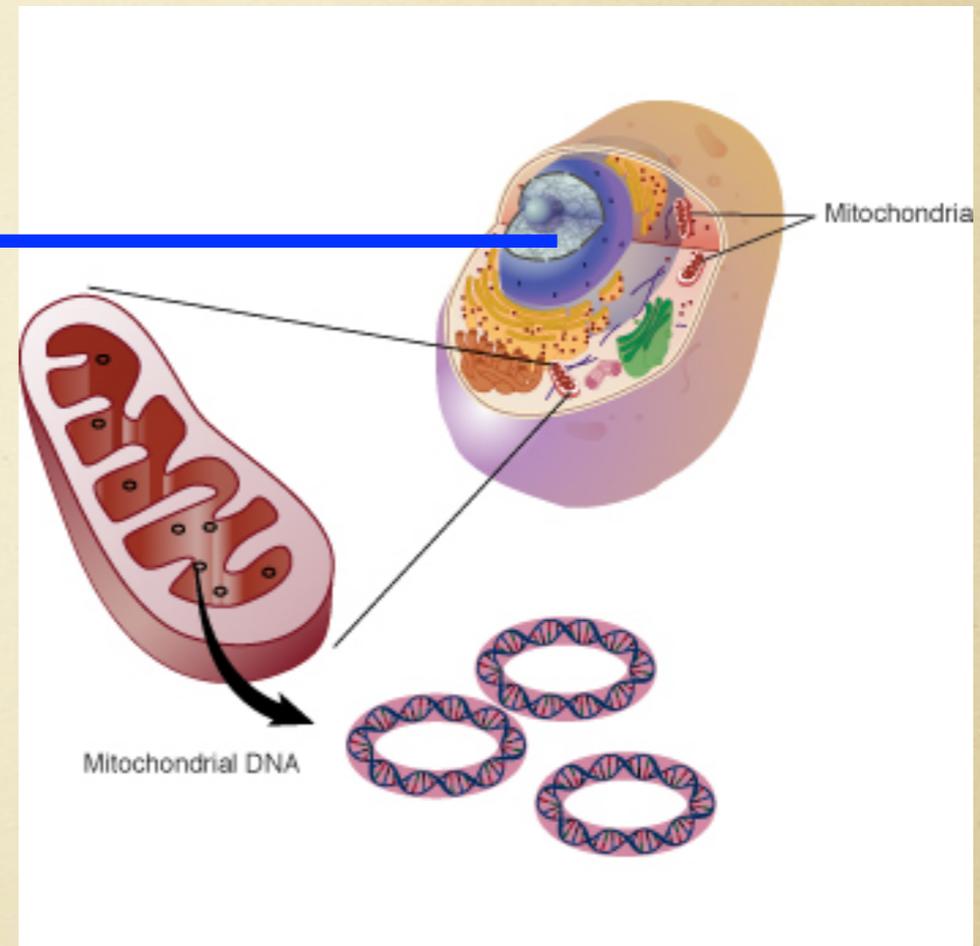
Nucleus



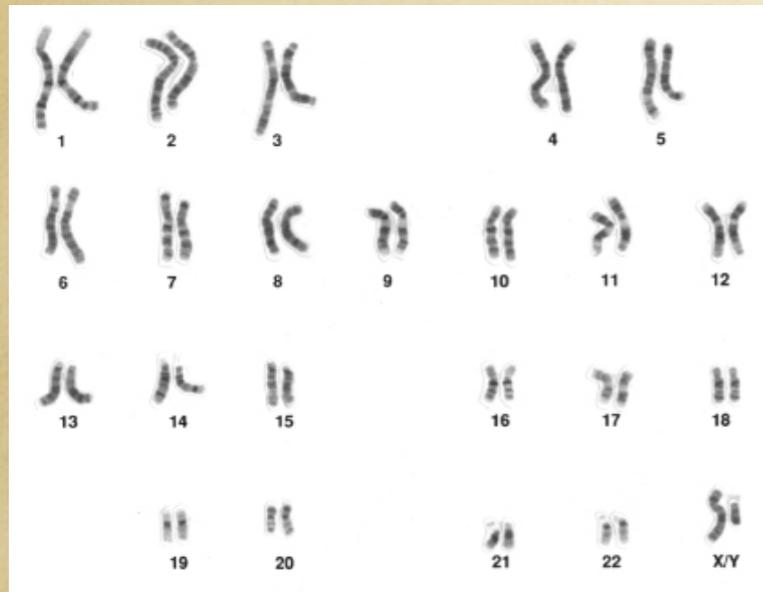
# Where is DNA?



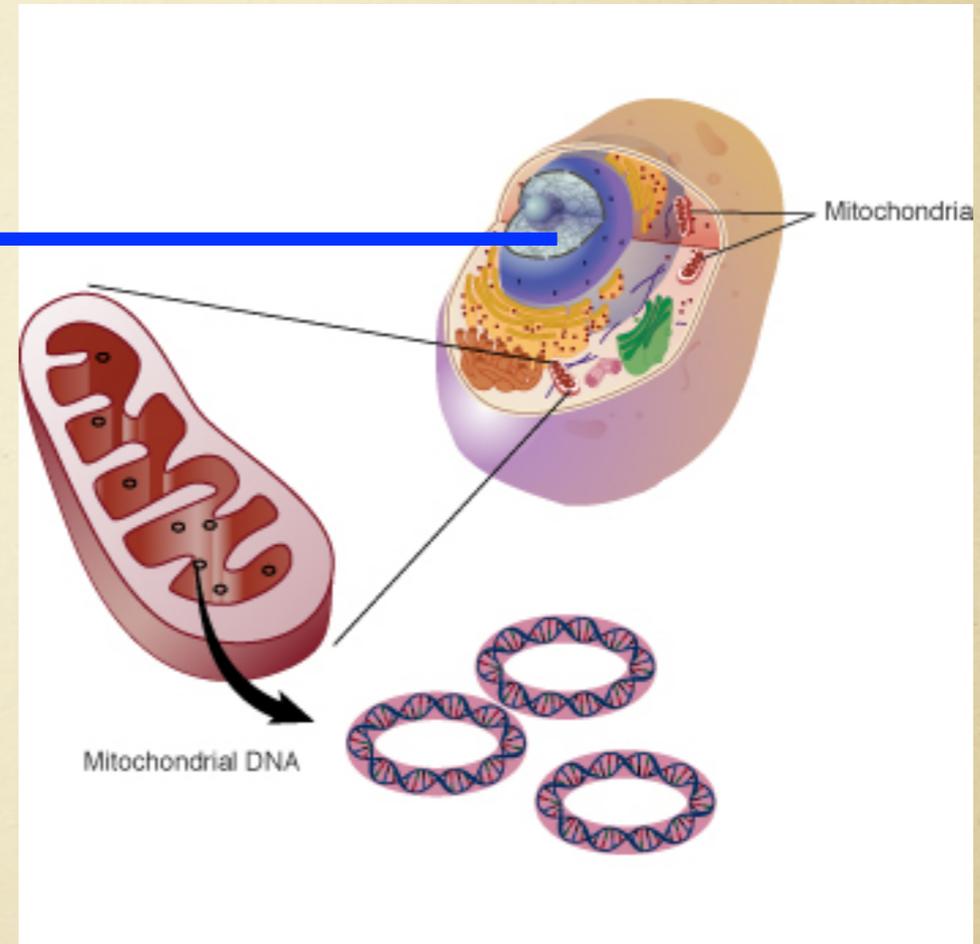
Nuclear DNA



# Where is DNA?

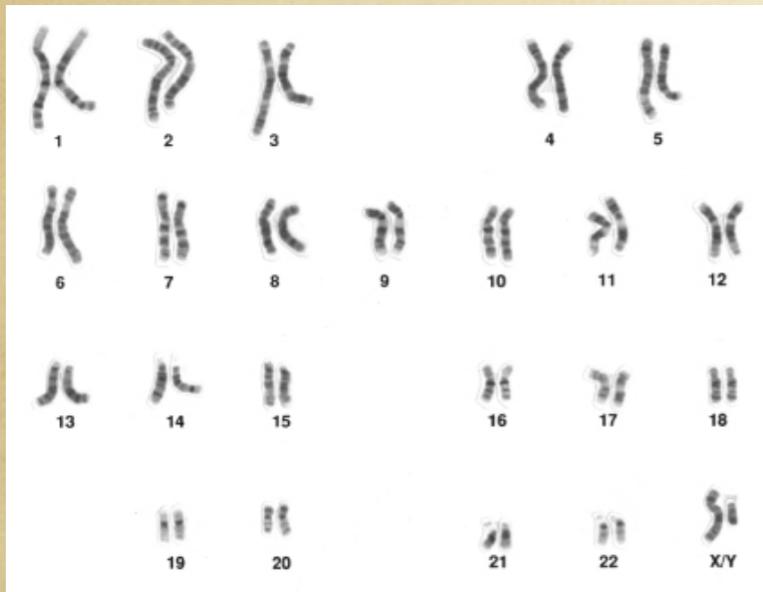


Nuclear DNA

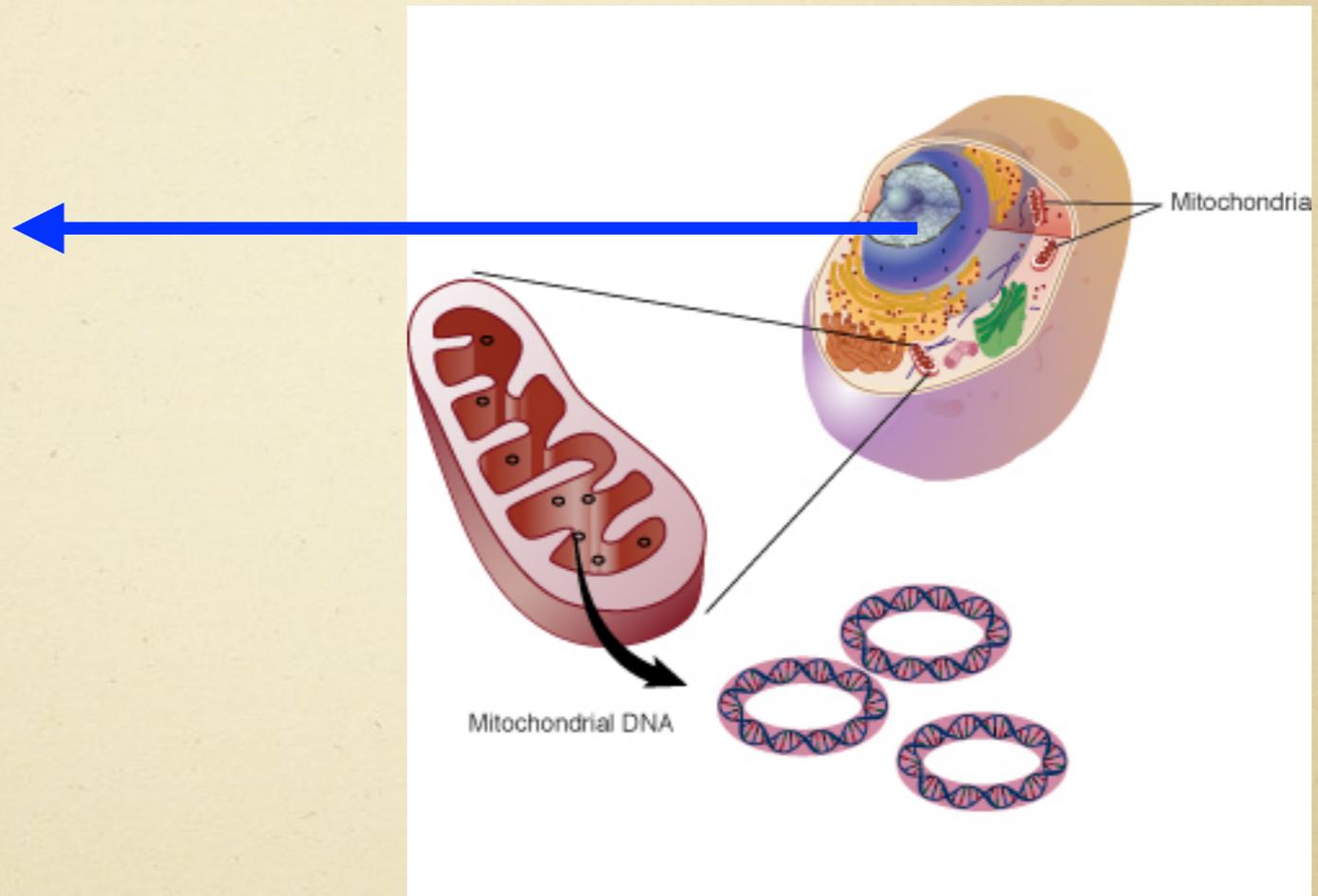


Mitochondria have one job: to provide power to the cell.

# Where is DNA?



Nuclear DNA



Mitochondria have one job: to provide power to the cell.

Cells do everything else powered by the fuel produced by the mitochondria.

# DNA in the Cell

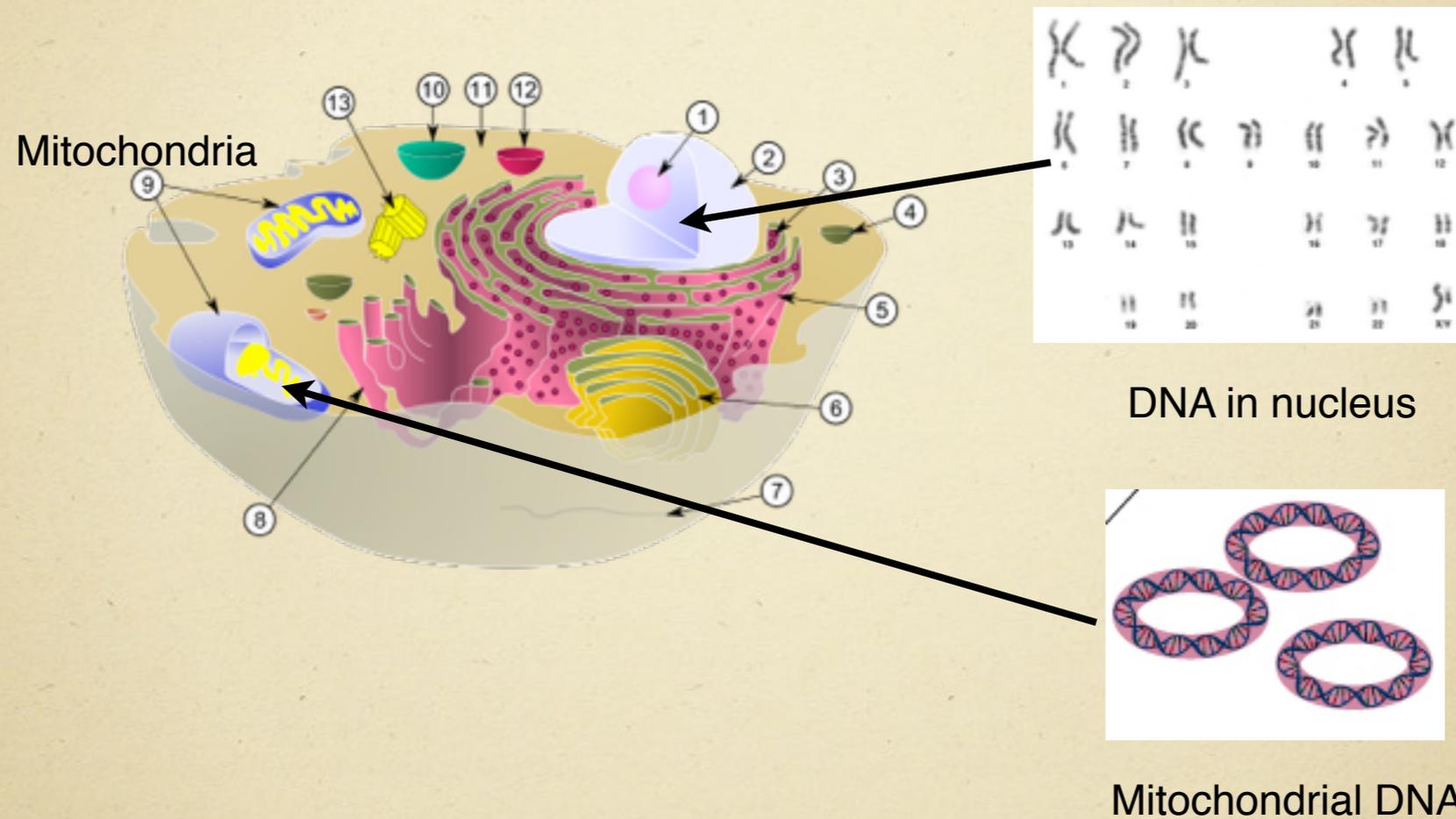
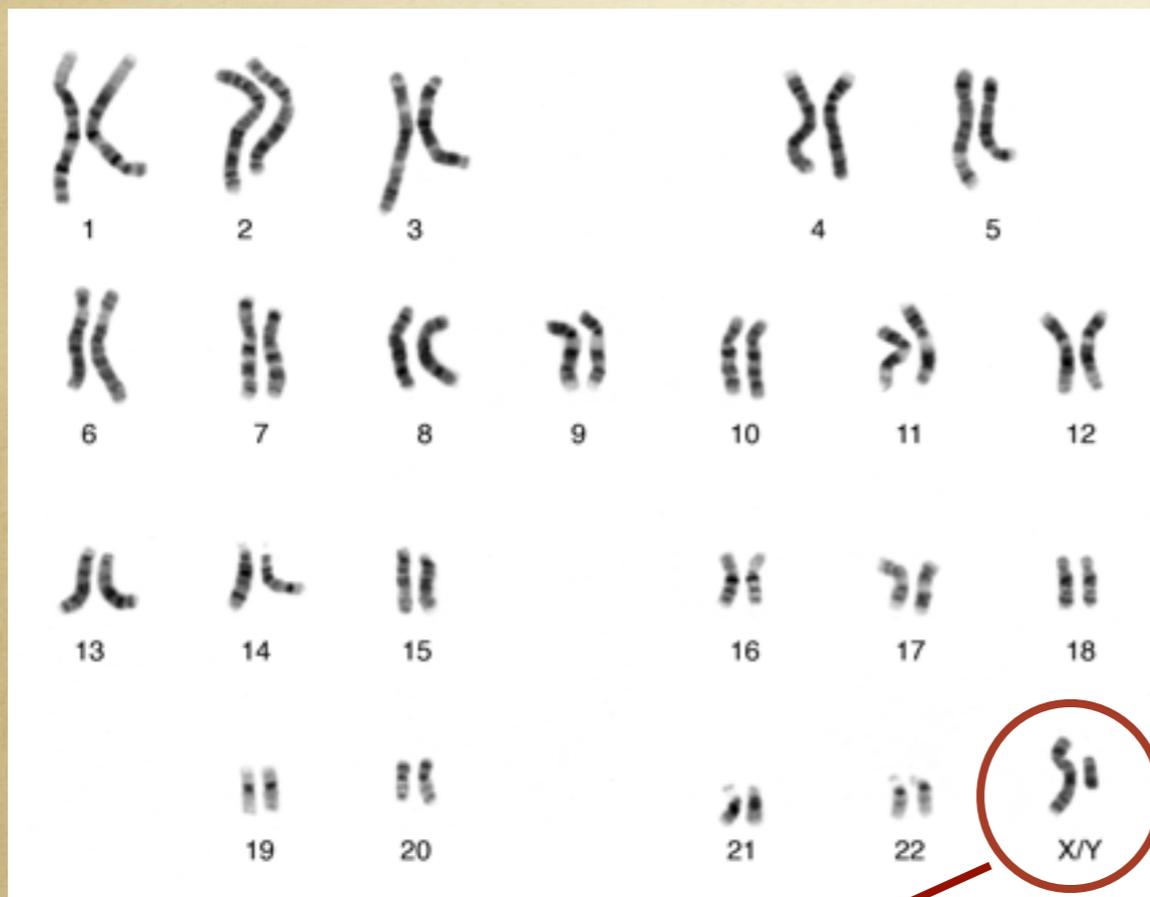


Image of cell used under GNU Free Documentation License.

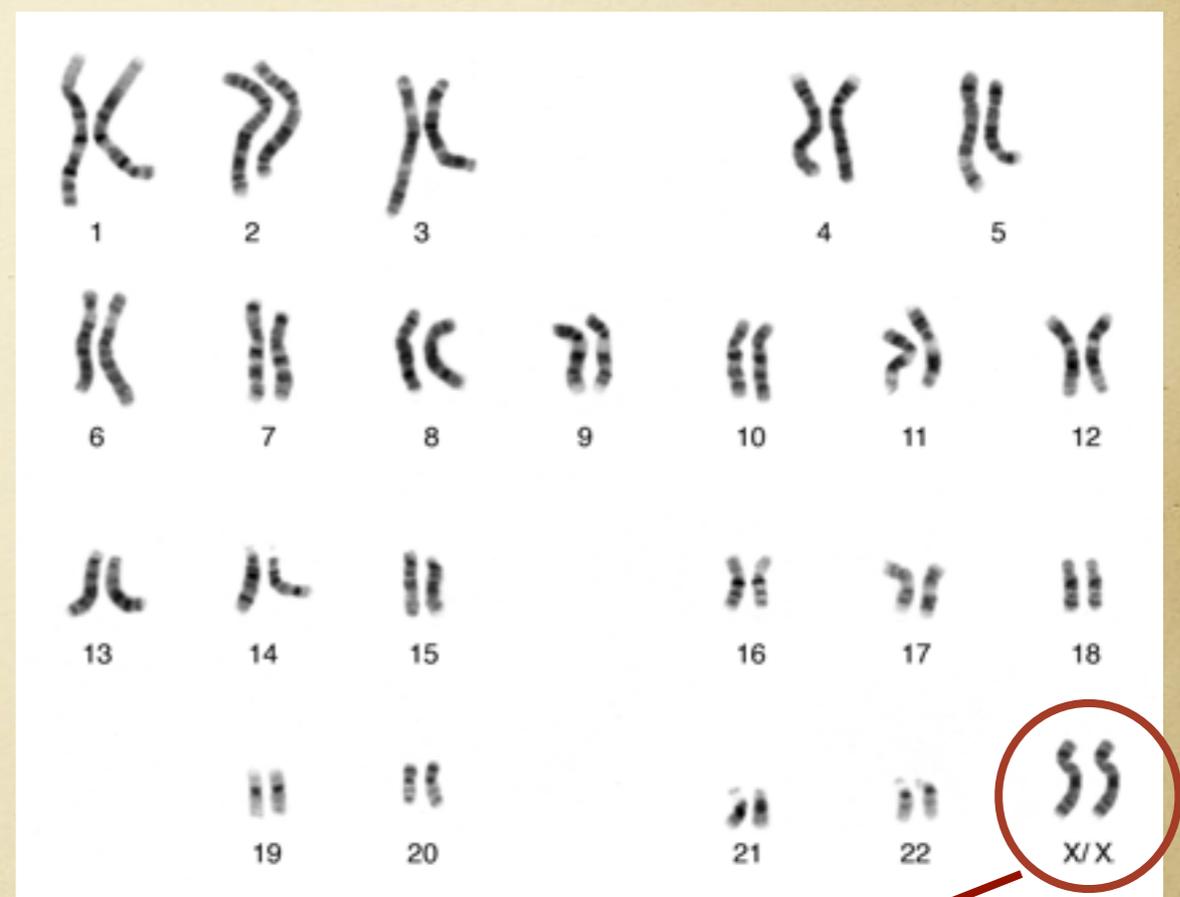
Image of chromosomes courtesy of National Human Genome Research Institute, <http://www.genome.gov>

# Nuclear DNA

22 pairs of autosomes + 1 pair of sex chromosomes =  
23 pairs of chromosomes

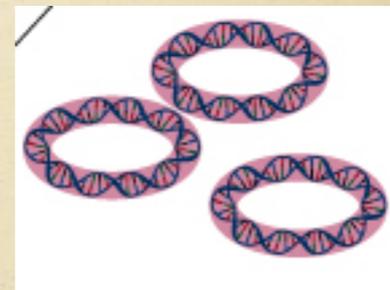
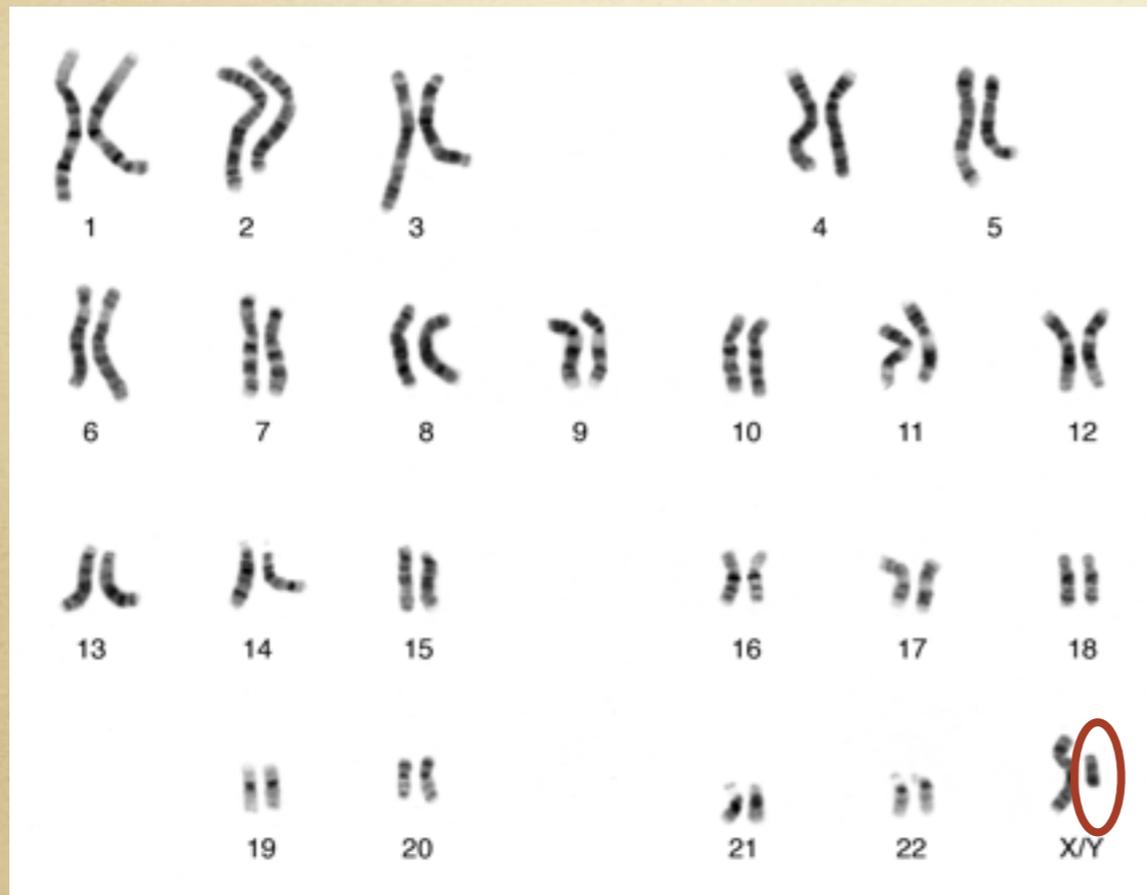


XY=male



XX=female

# All DNA Tested

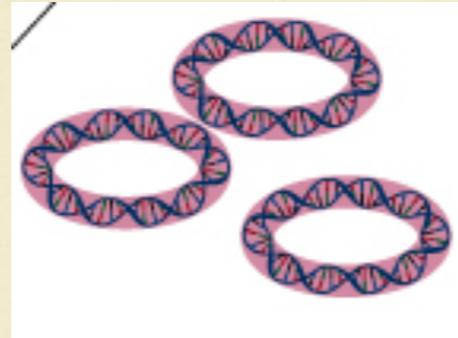
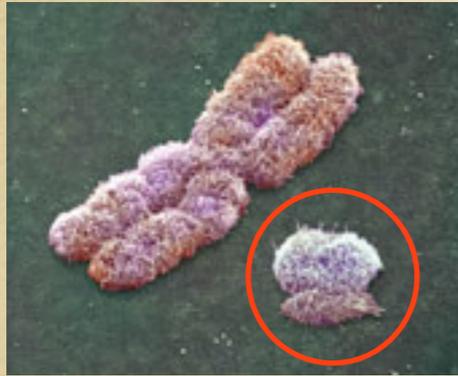


Mitochondrial DNA

Y-DNA

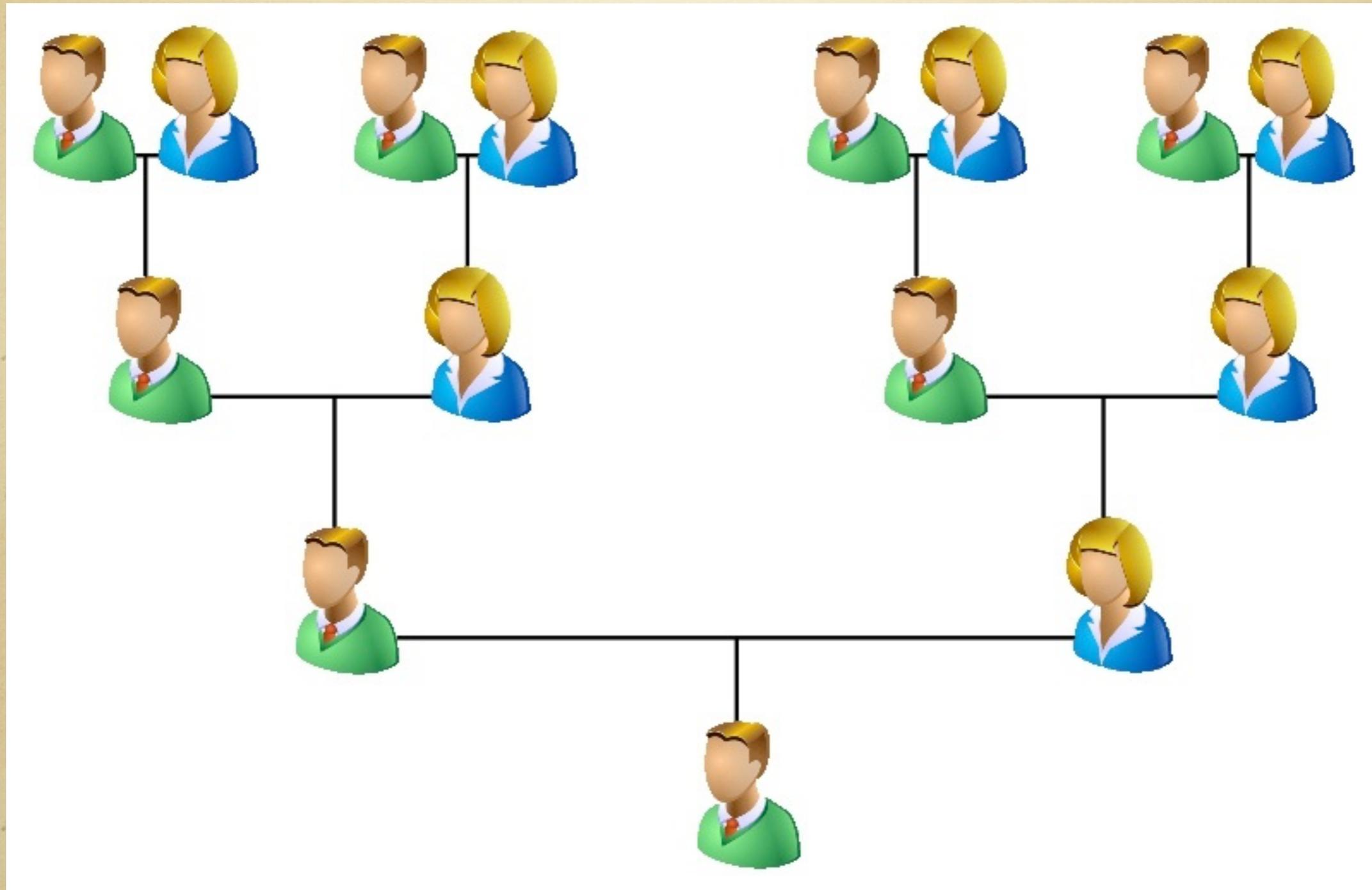
Autosomes including X chromosome

# DNA Tests

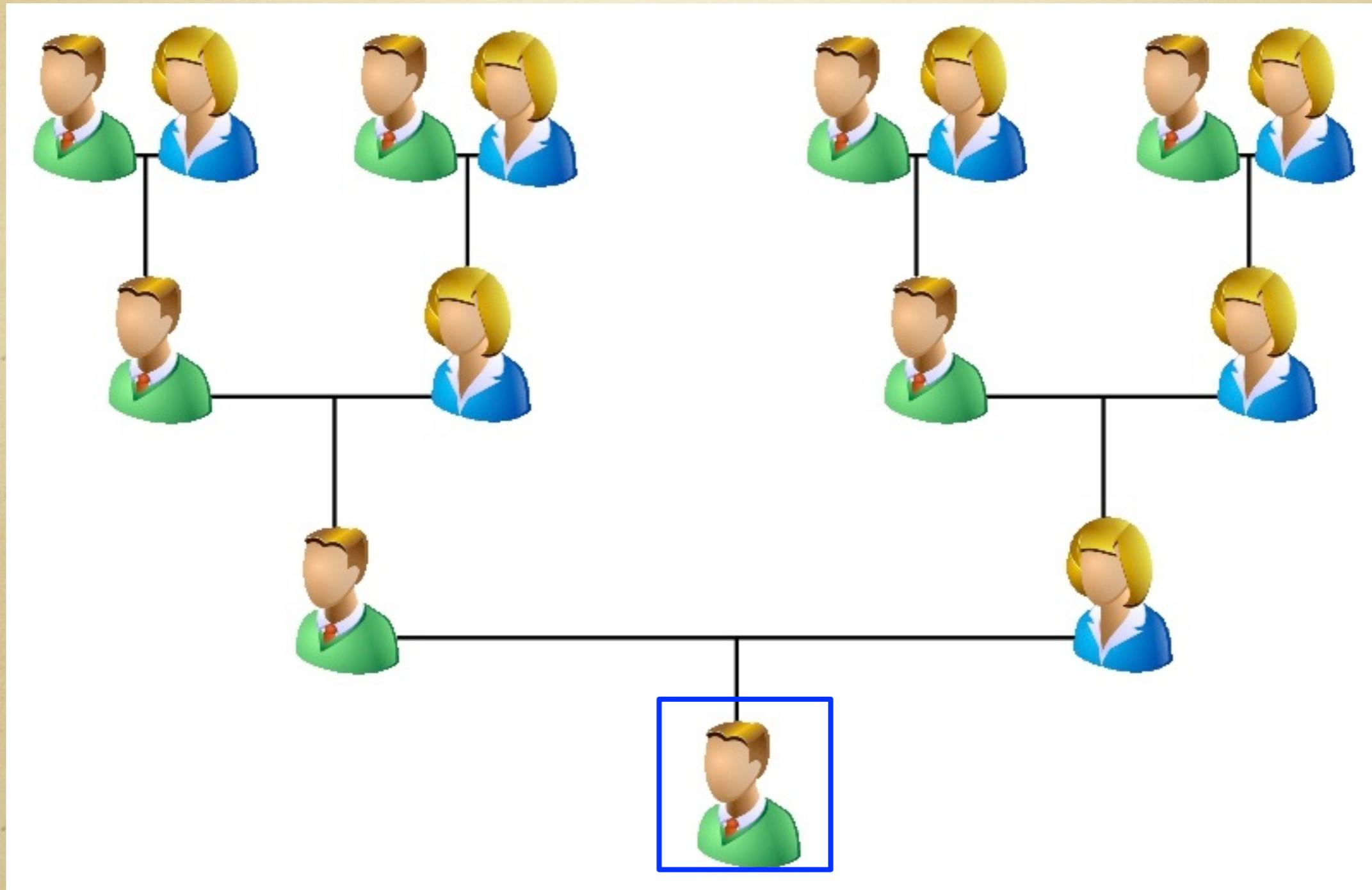


	yDNA	mtDNA	atDNA
Who tests?	Only males	Everyone	Everyone

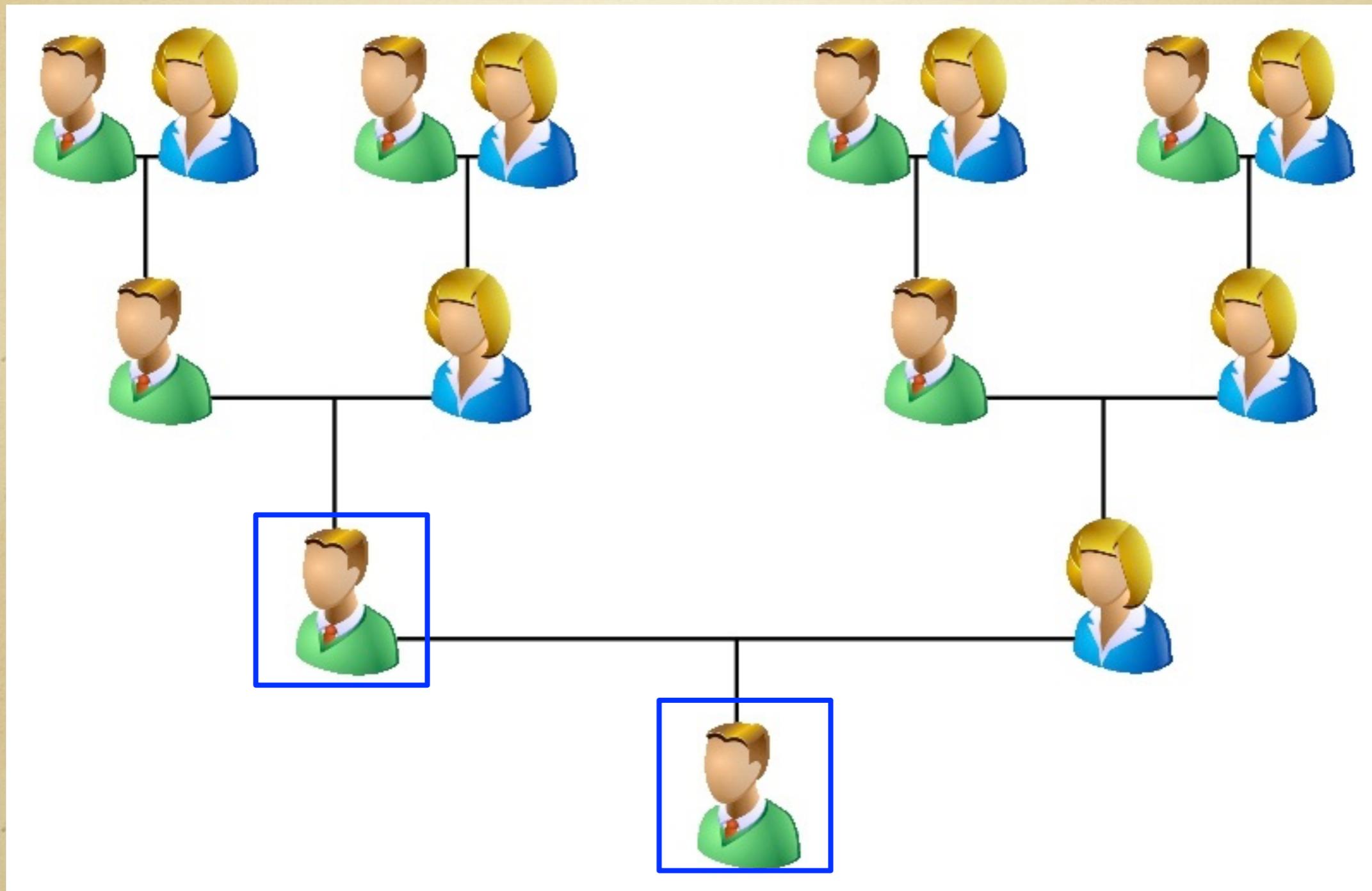
# Y-DNA Inheritance



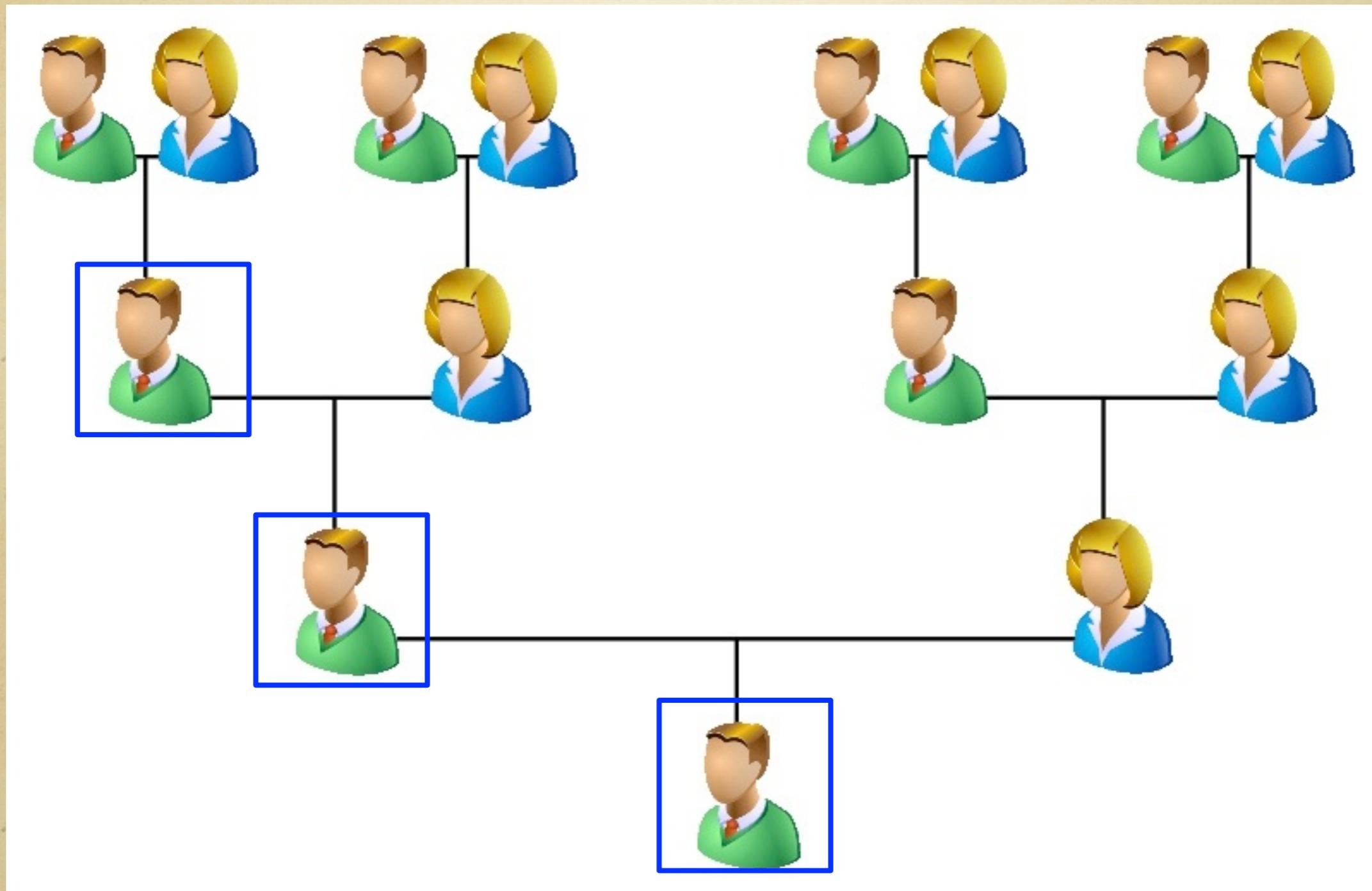
# Y-DNA Inheritance



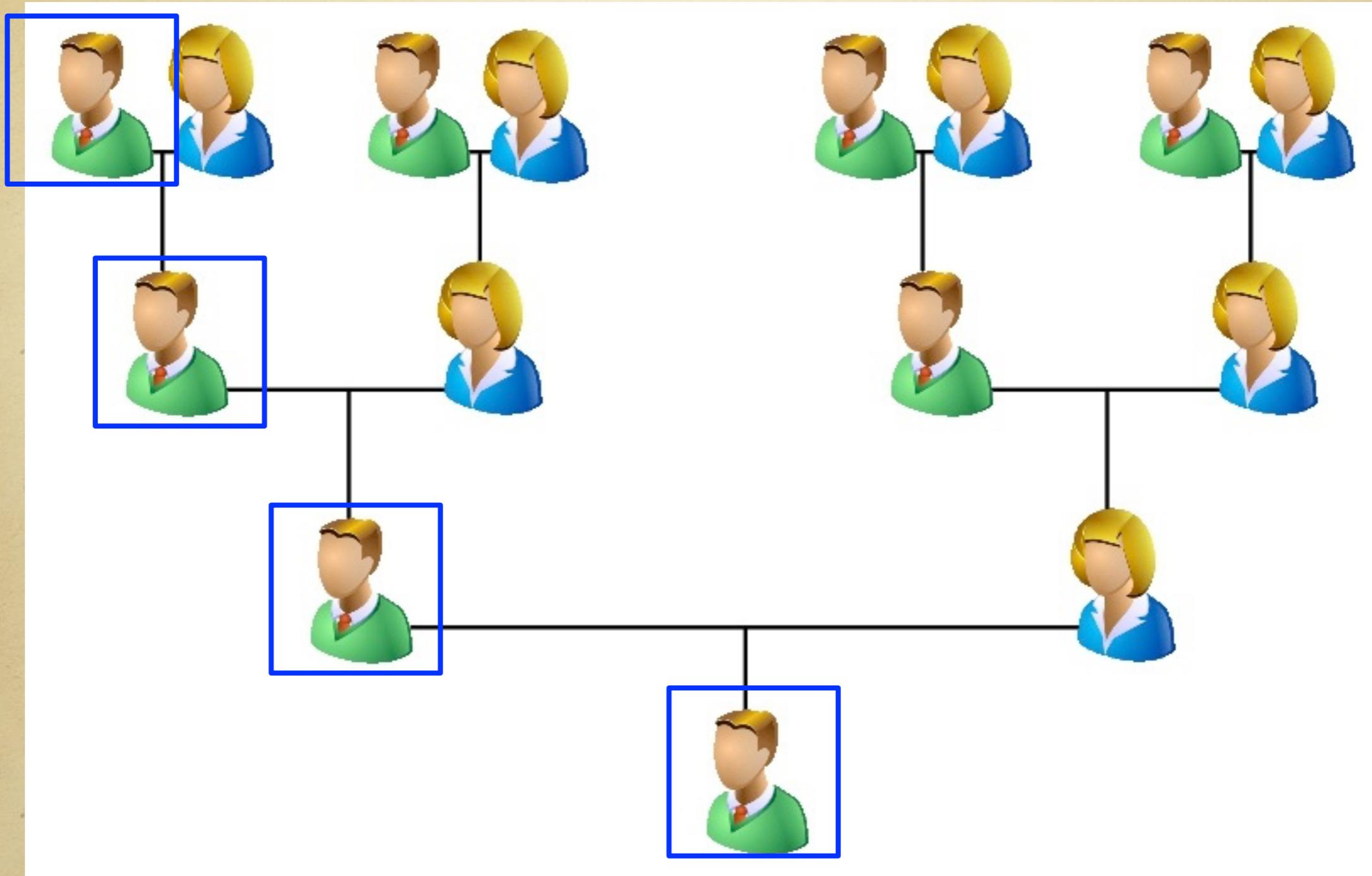
# Y-DNA Inheritance



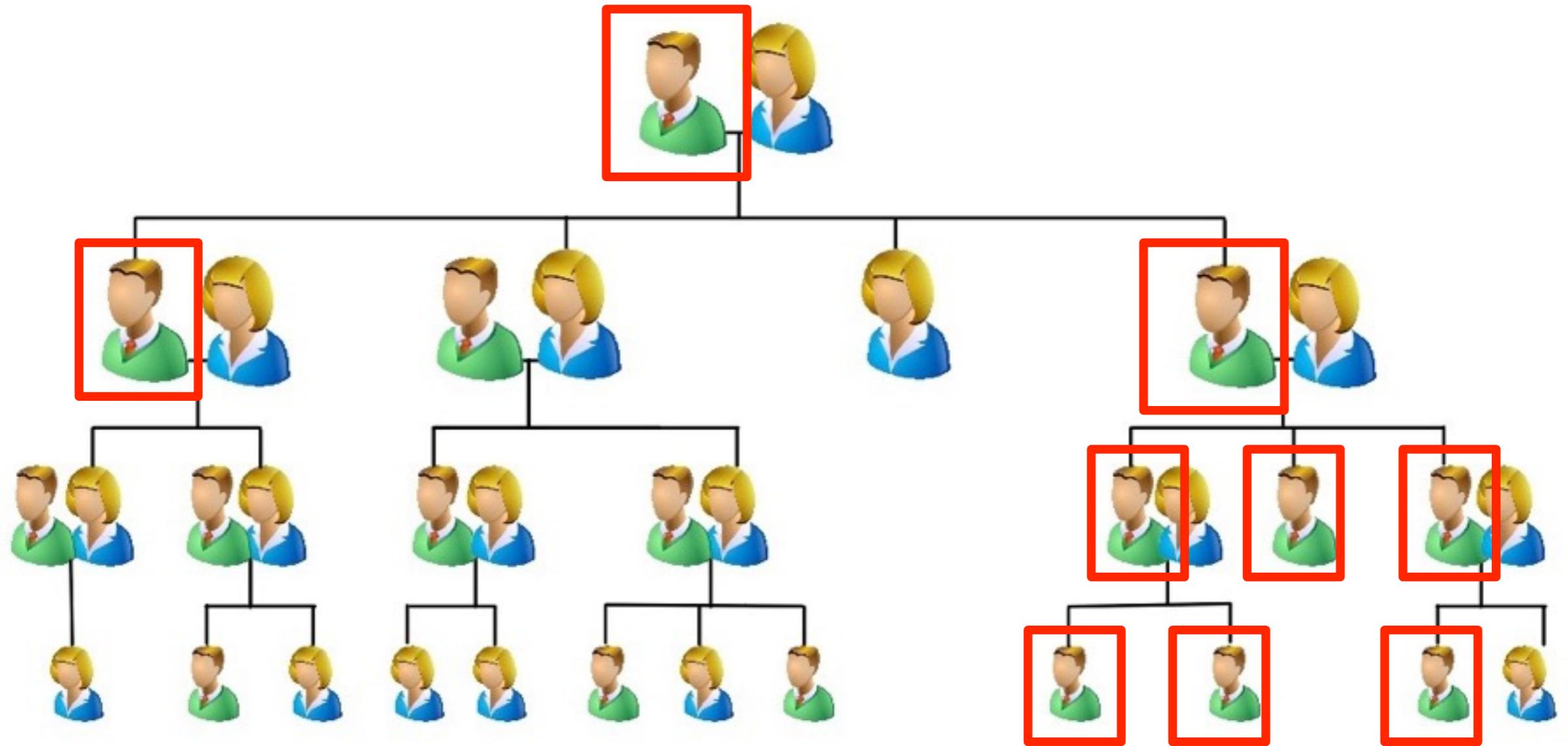
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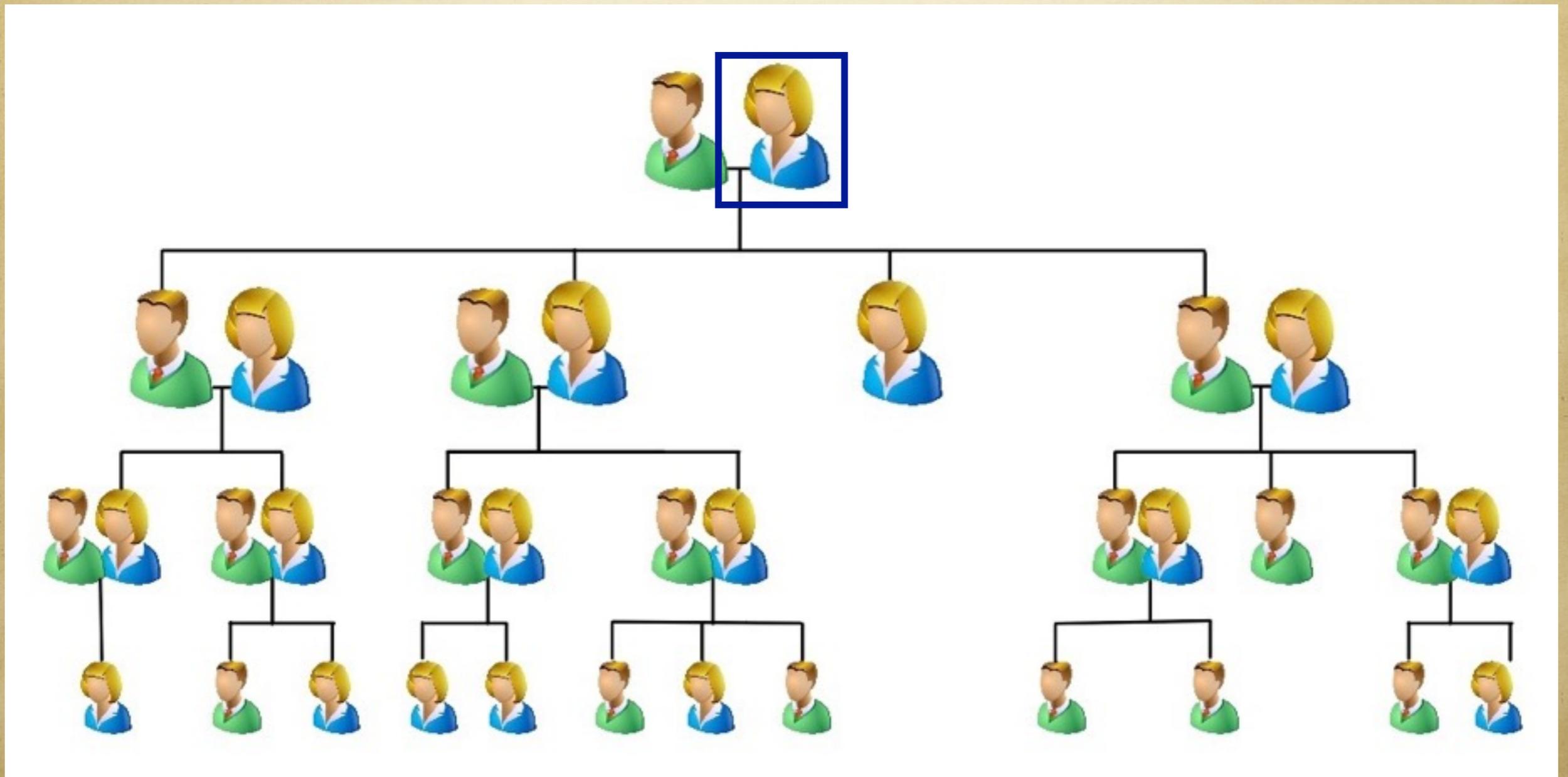


# Y-DNA Descent



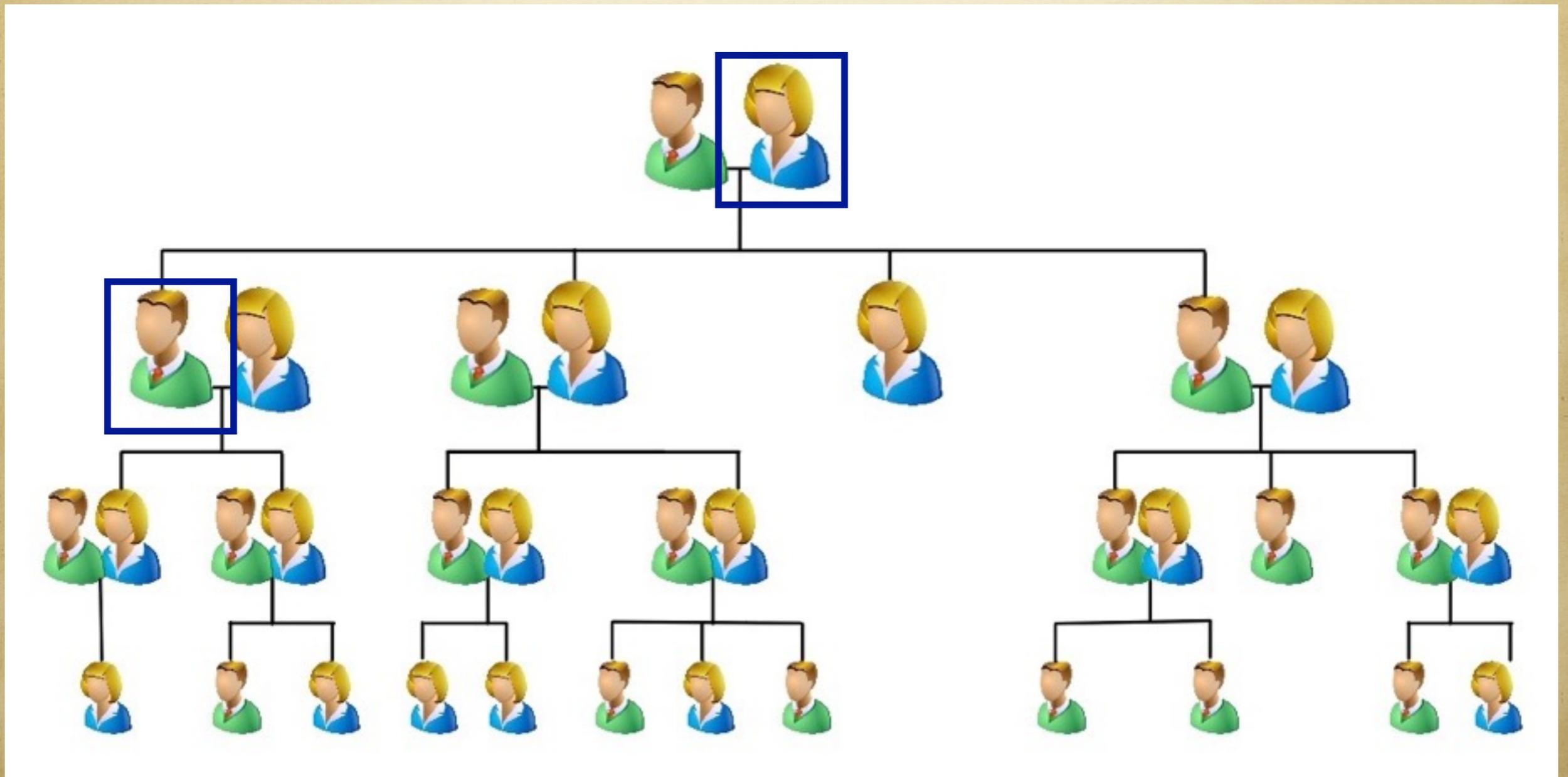
# Mitochondrial DNA Inheritance

The mitochondria in the egg is passed to the child.



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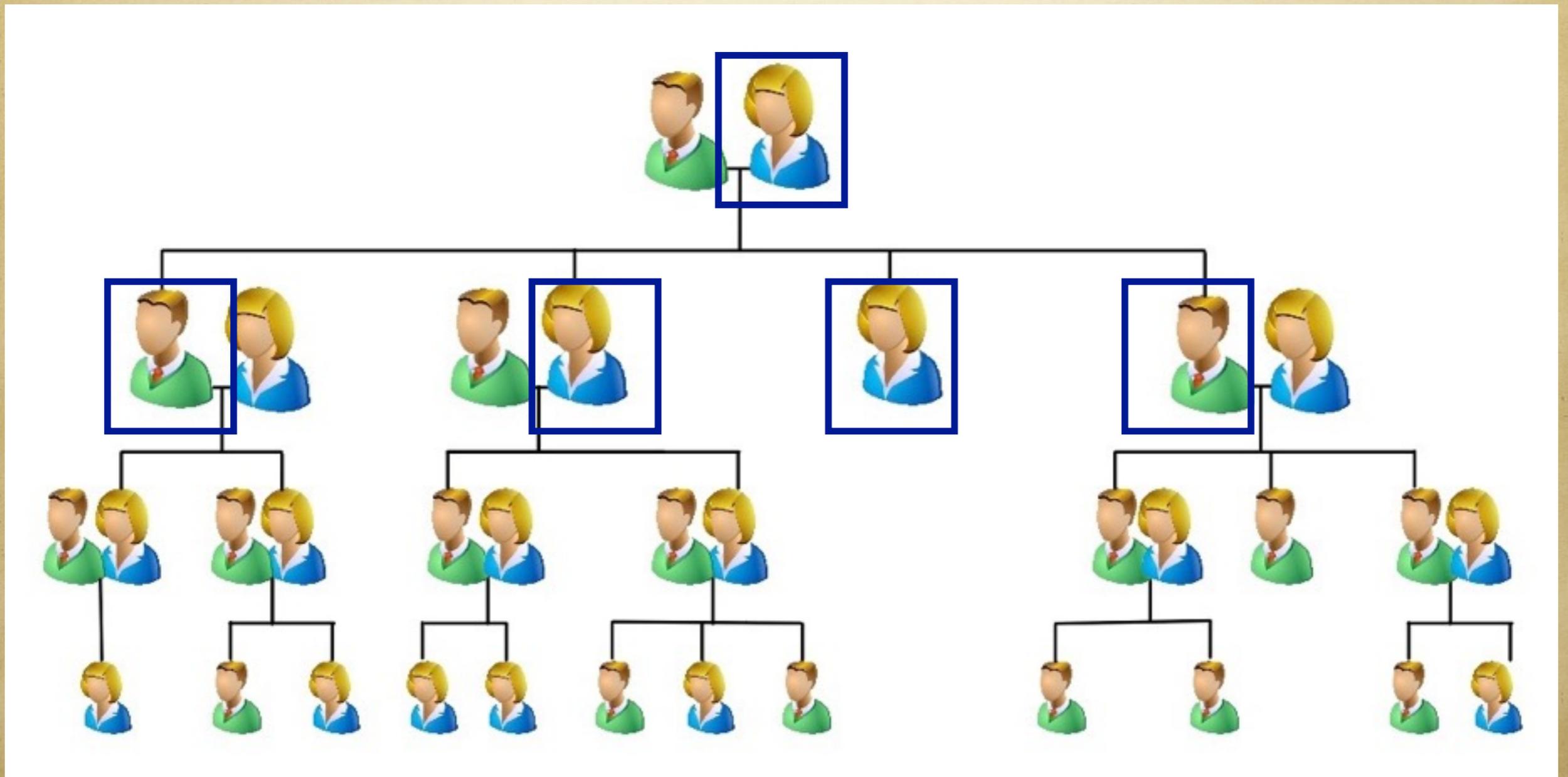






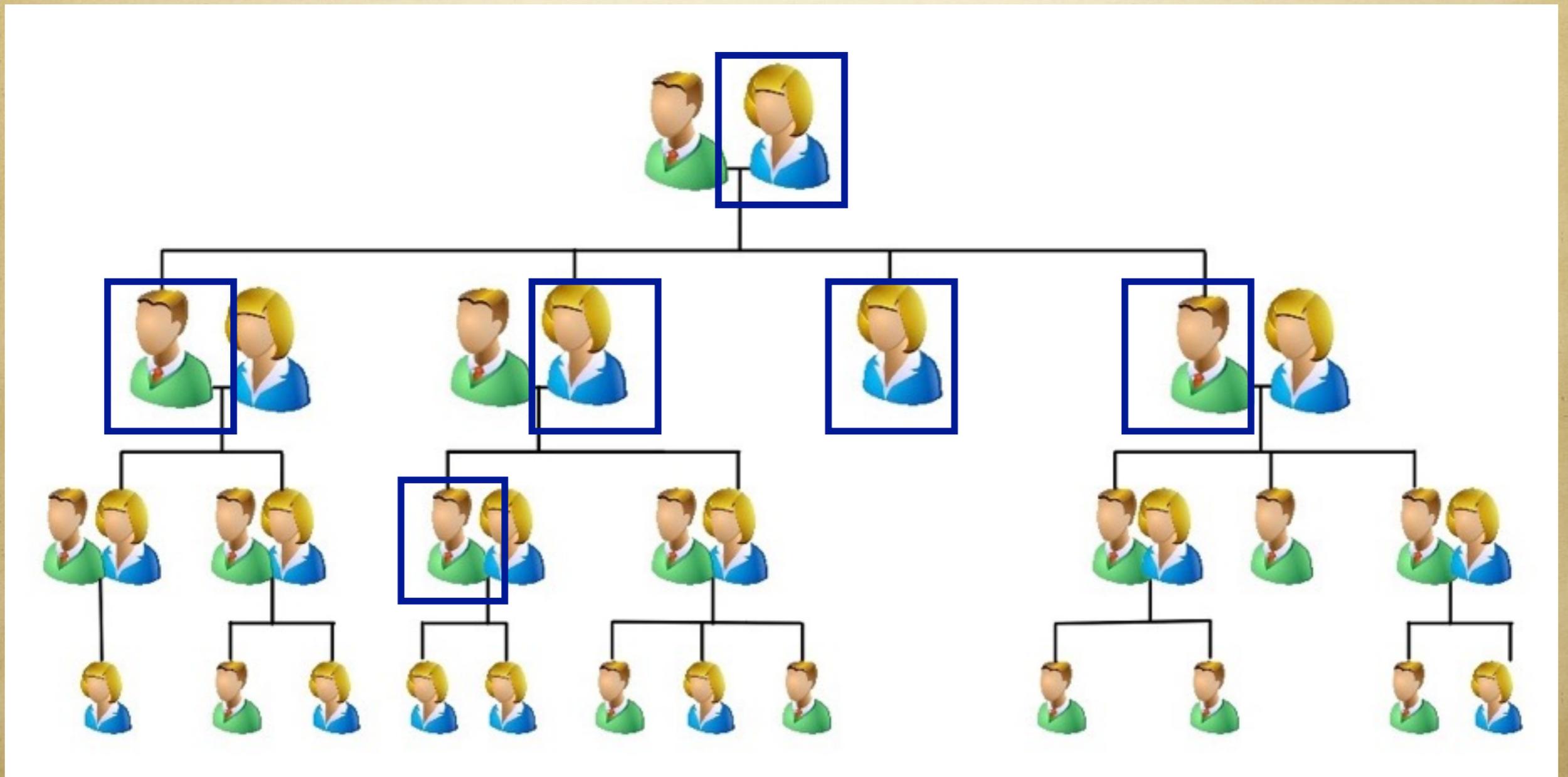
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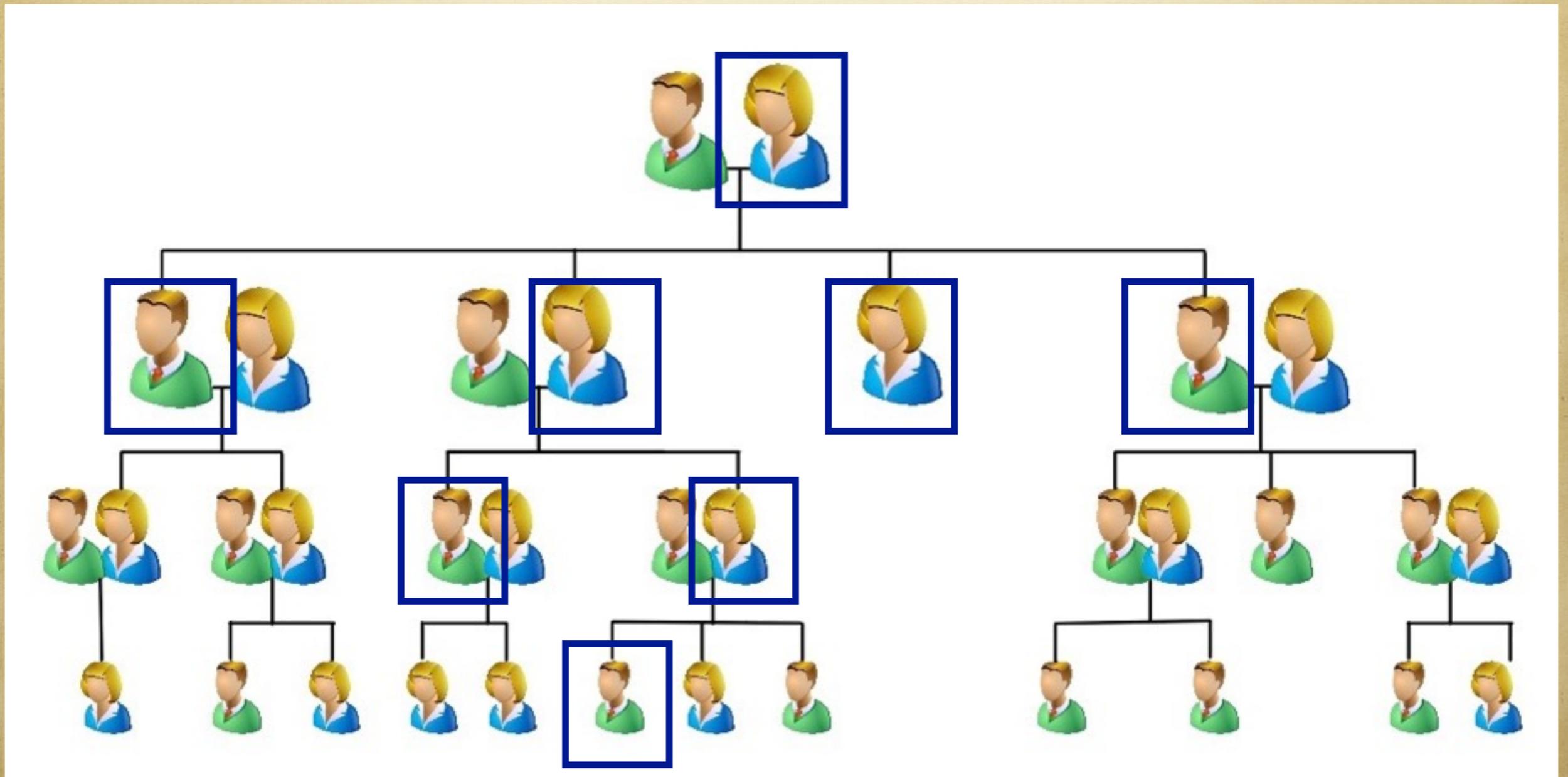
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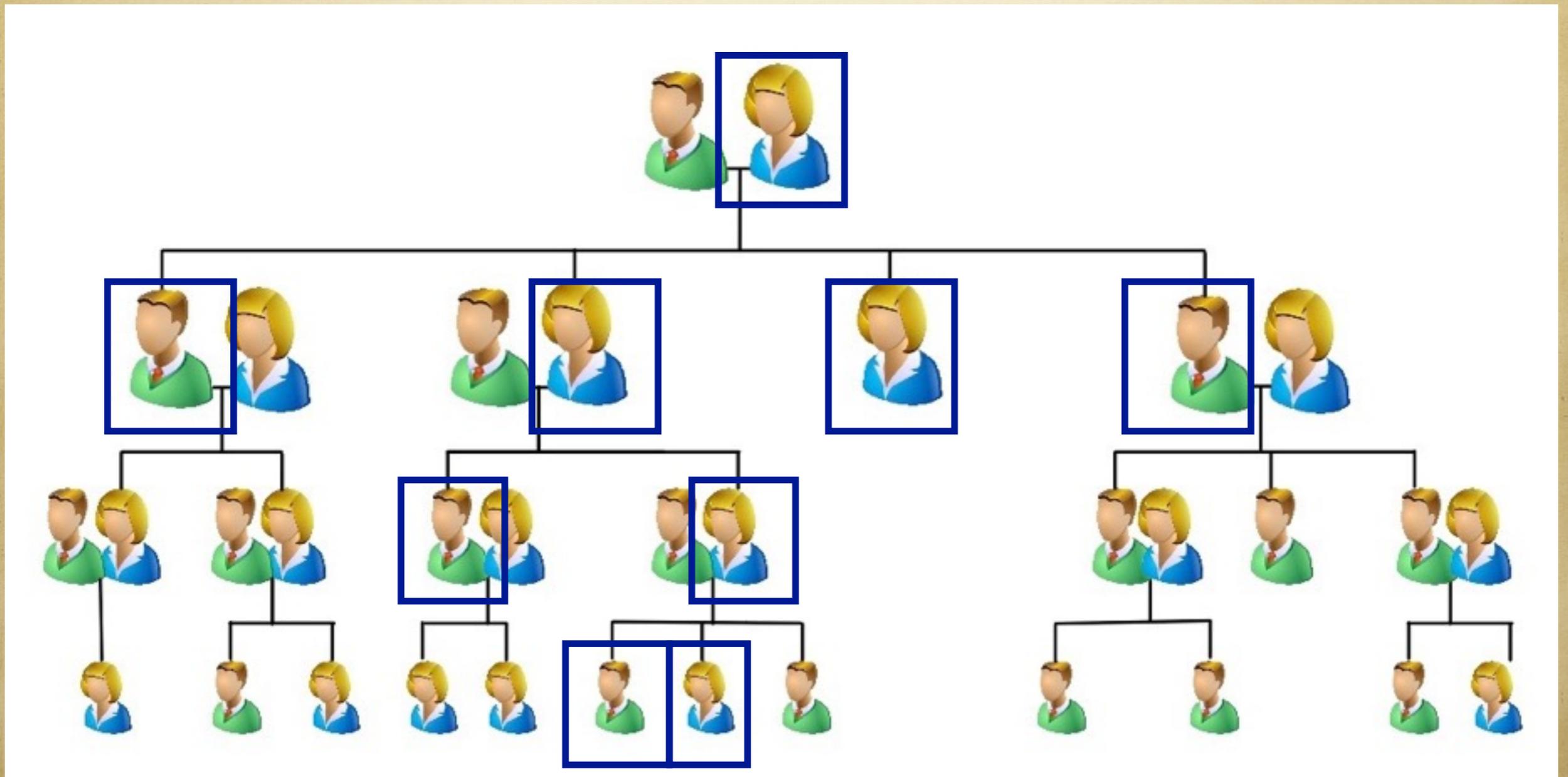
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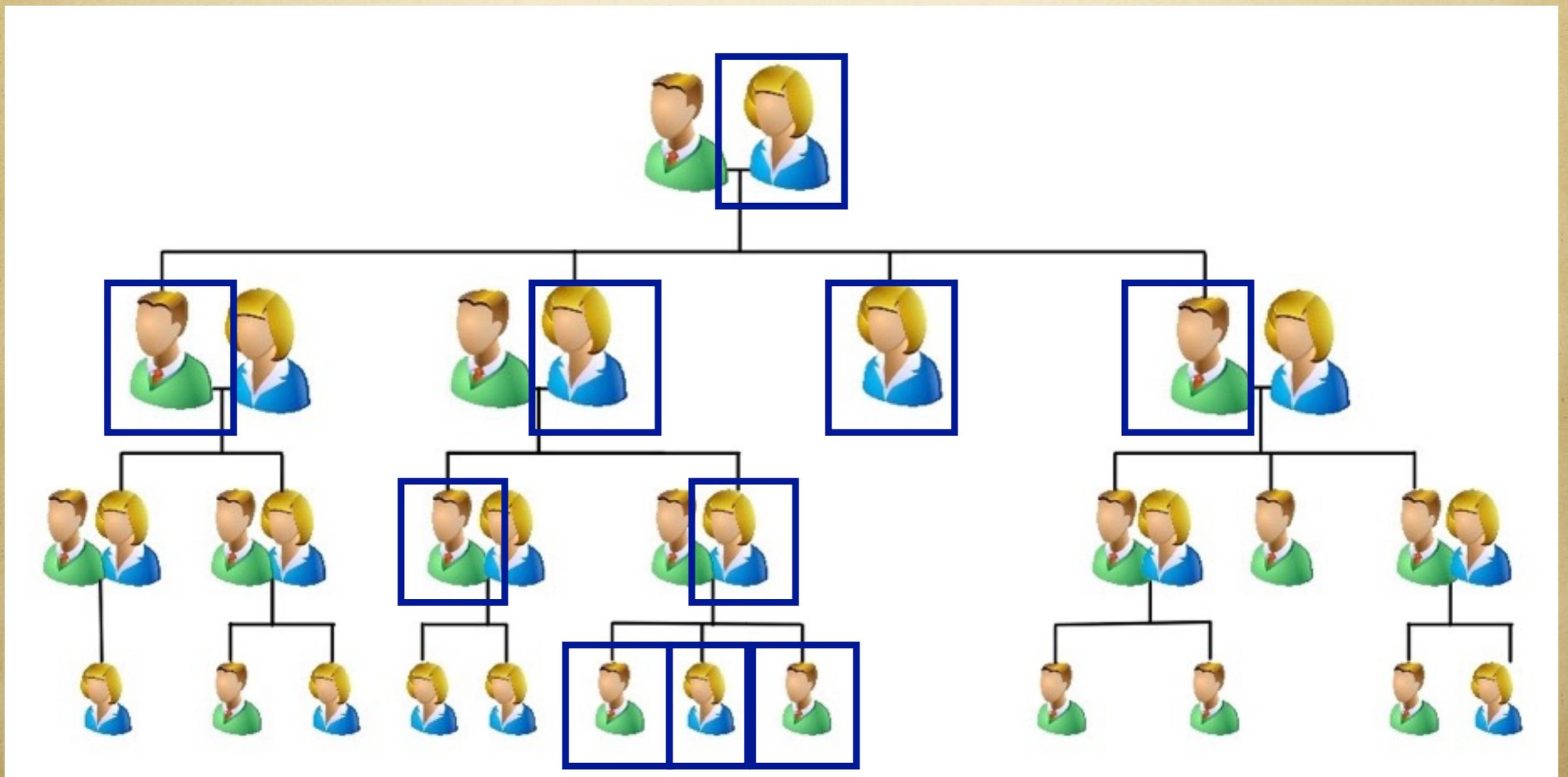
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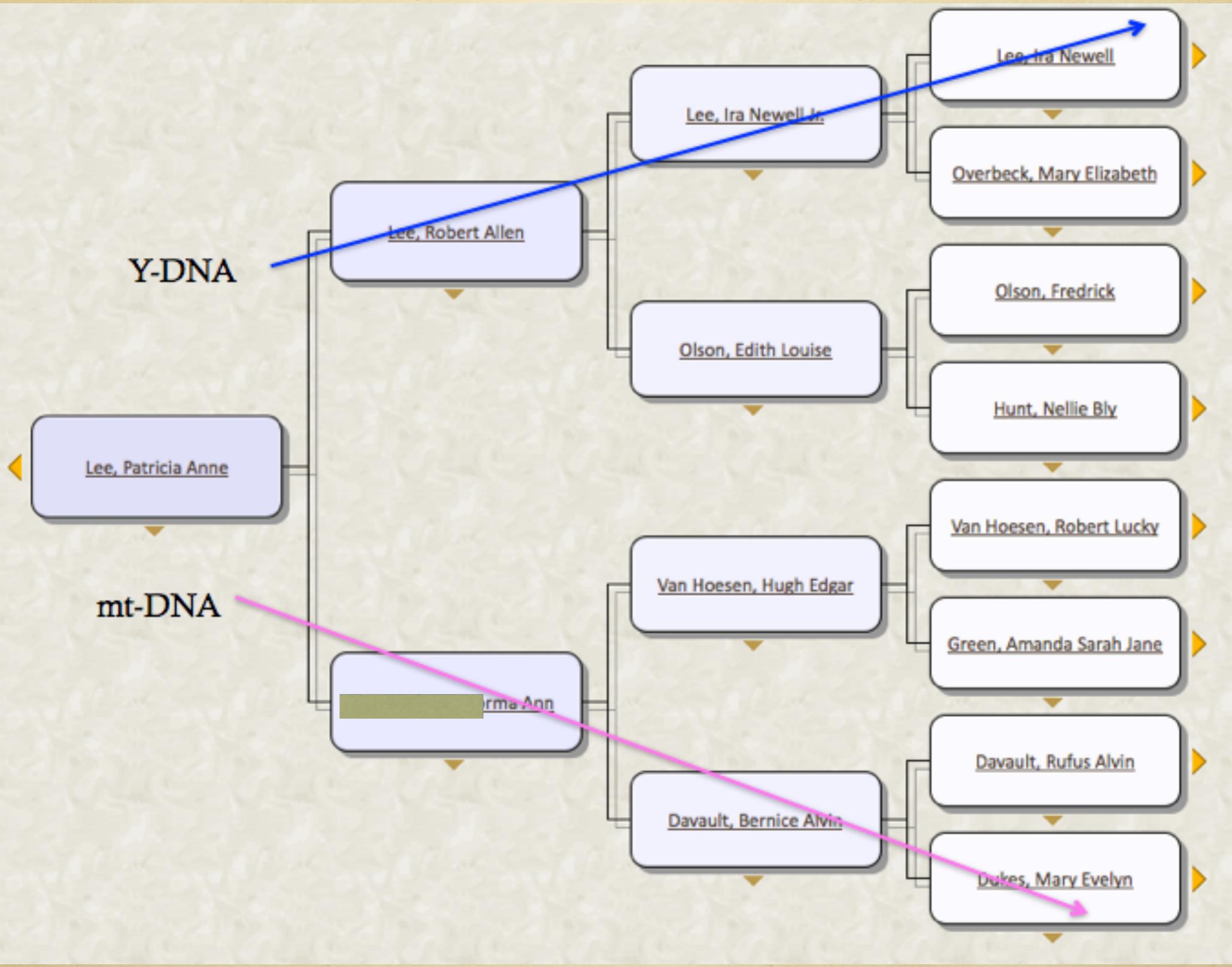
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# Mitochondrial DNA Inheritance

The mitochondria in the egg is passed to the child.





# Y-DNA & mt-DNA

## Similarities

- Y-DNA and mt-DNA are passed without change, intact, to the next generation.
- Mutations occasionally occur.
- Mutations occur more often in Y-DNA than in mt-DNA.
- The stability in mutation rate gives these two types of DNA testing the ability to match people as much as hundreds of years in the past.
- The difference between testers is expressed as “genetic distance.” A smaller genetic distance implies a closer relationship.

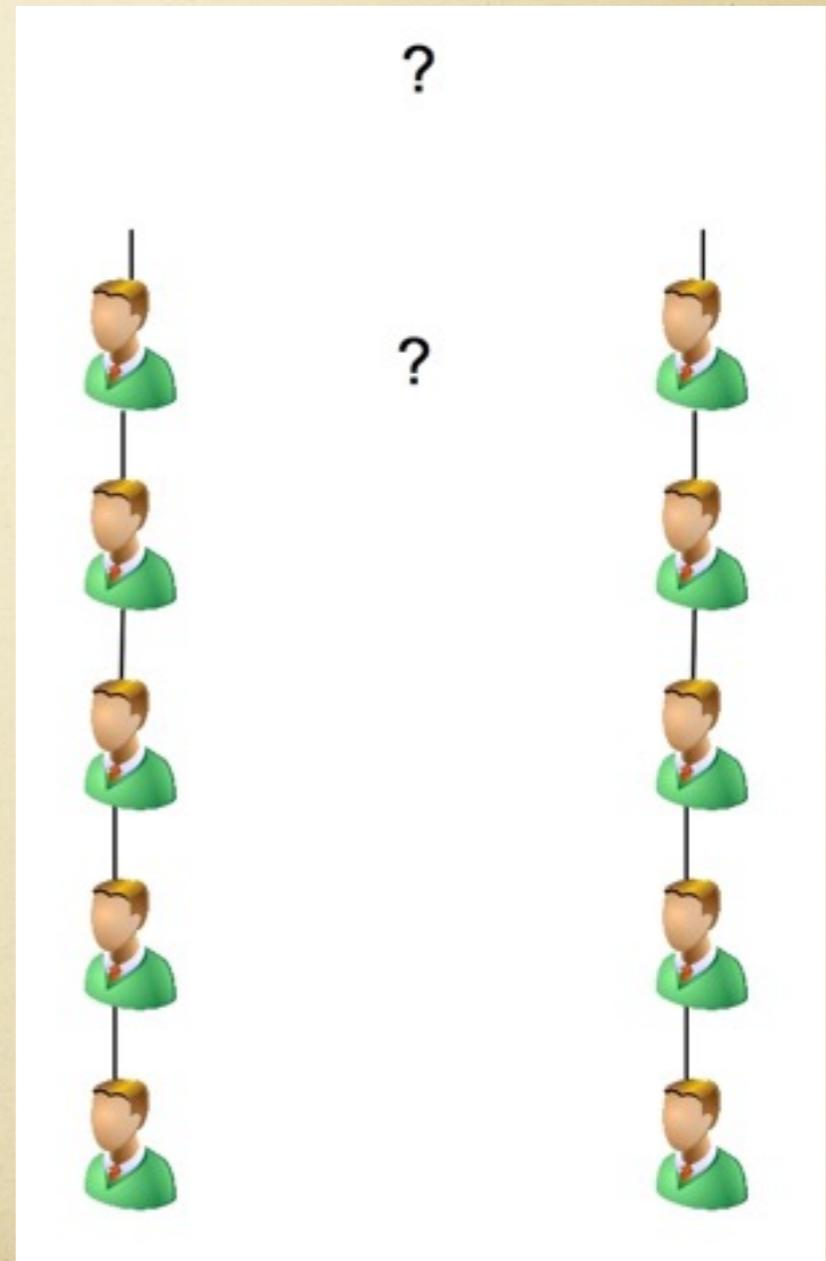
# Y-DNA & Mt-DNA

## Differences

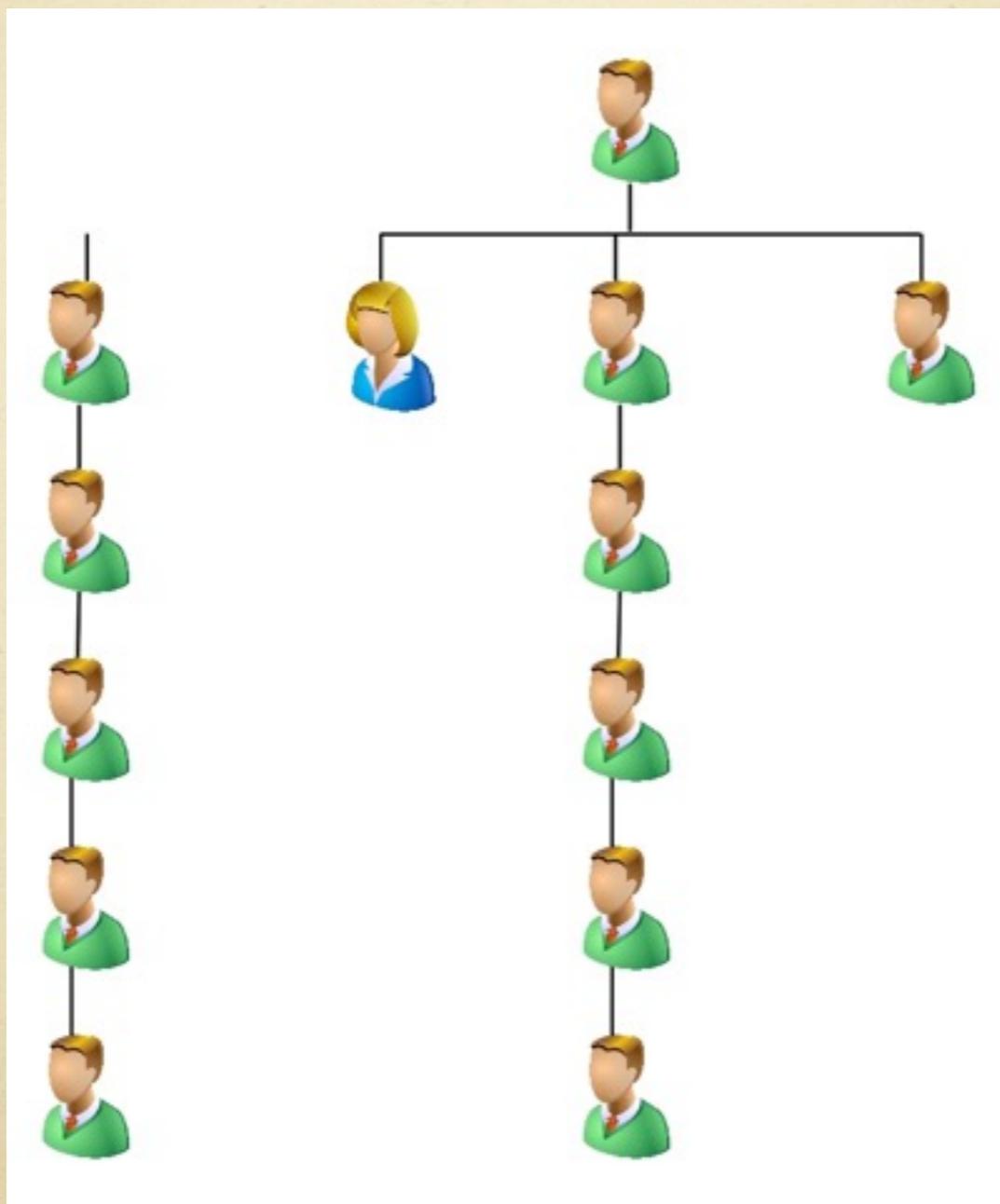
- Y-DNA follows the surname. Mt-DNA does not.
- Therefore it is more challenging to find the common ancestor using mitochondrial DNA.
- Because mt-DNA is much more stable than Y-DNA, the common ancestor can be much more distant than a common Y-DNA matching ancestor.
- Generally, mt-DNA is most useful in solving particular genealogical problems.

# Hypothetical Examples

- Two men named Edwards lived in the same area of Tennessee in the early 1800s. They are too close in age to be father and son.
- Their male descendants do Y-DNA testing.
- They match on 35 out of 37 markers.
- Are they related?  
Are they brothers?



# Connecting to a Documented Family

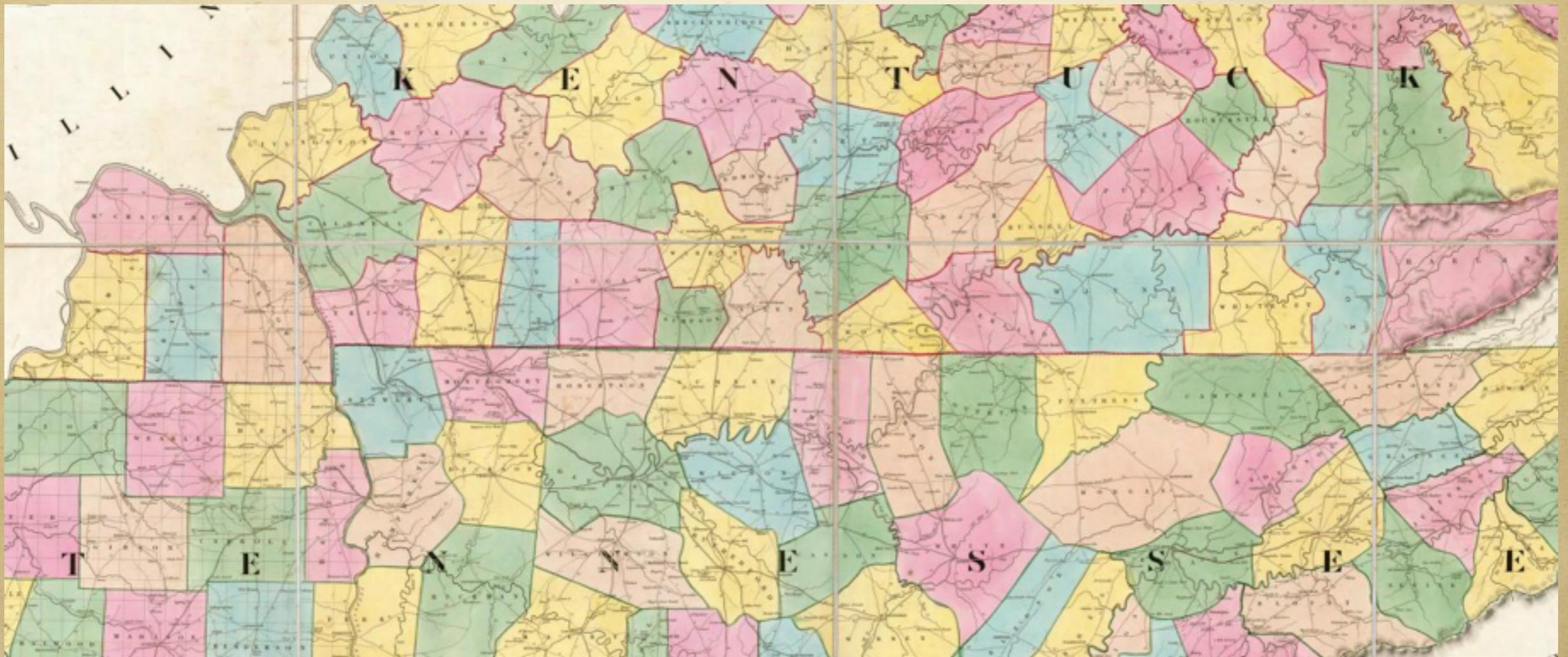


Sibby Dukes, died 1944

# Sibby Duke, died 1944

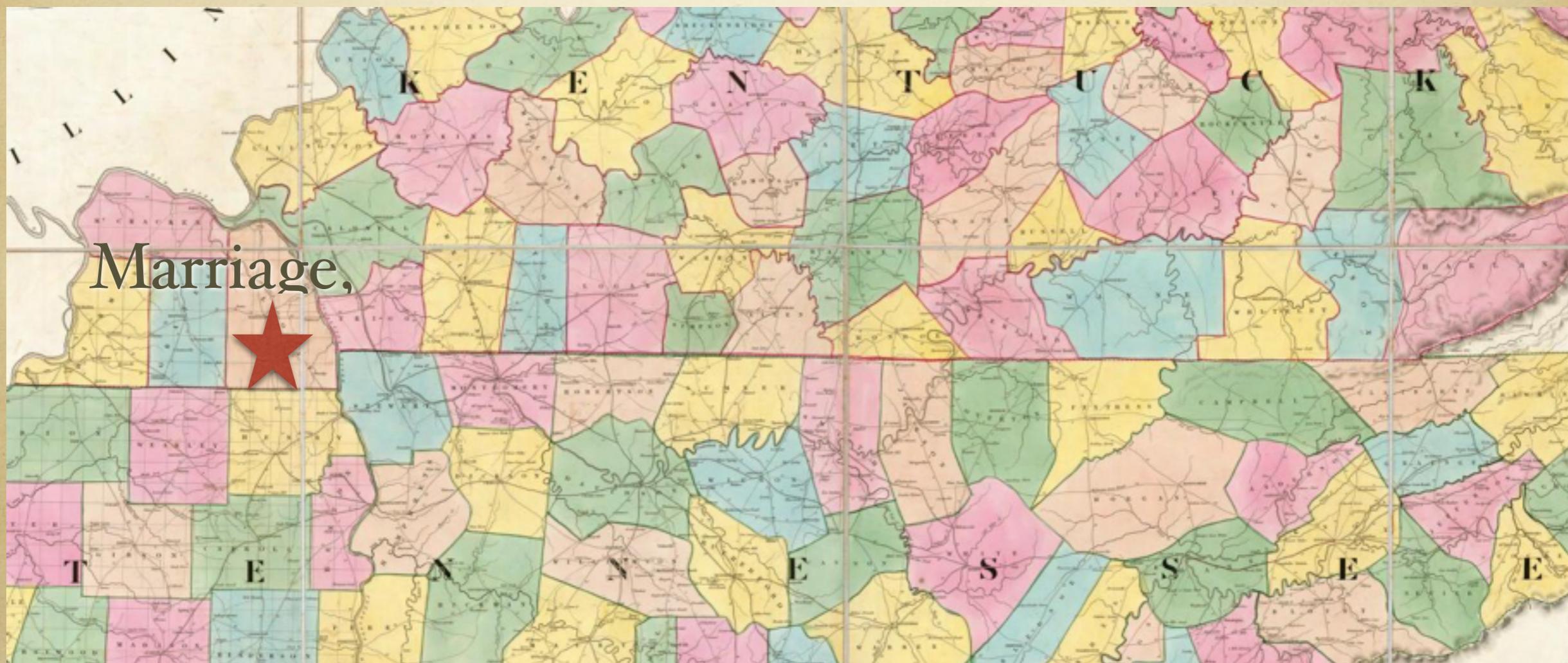
6(b) Name of husband or wife <u>Aaron Dodds</u>					
6(c) Age of husband or wife if alive _____ Years					
7. Birth date of deceased <u>Feb 29th 1859</u> (Month) (Day) (Year)					
8. AGE:		Years <u>85</u>	Months <u>1</u>	Days <u>26</u>	If less than one day hr. _____ min. _____
9. Birthplace <u>San Co Ky.</u>					
10. Usual occupation <u>Housekeeper</u>					
11. Industry or business <u>Home</u>					
FATHER	12. Name	<u>James Allen Duke</u>			
	13. Birthplace	<u>Knoxville Tenn</u>			
MOTHER	14. Maiden name	<u>Mary Elizabeth Stewart</u>			
	15. Birthplace	<u>Callaway</u>			
16(a) Informant's own signature <u>Vergil Heater</u>					

# Geography



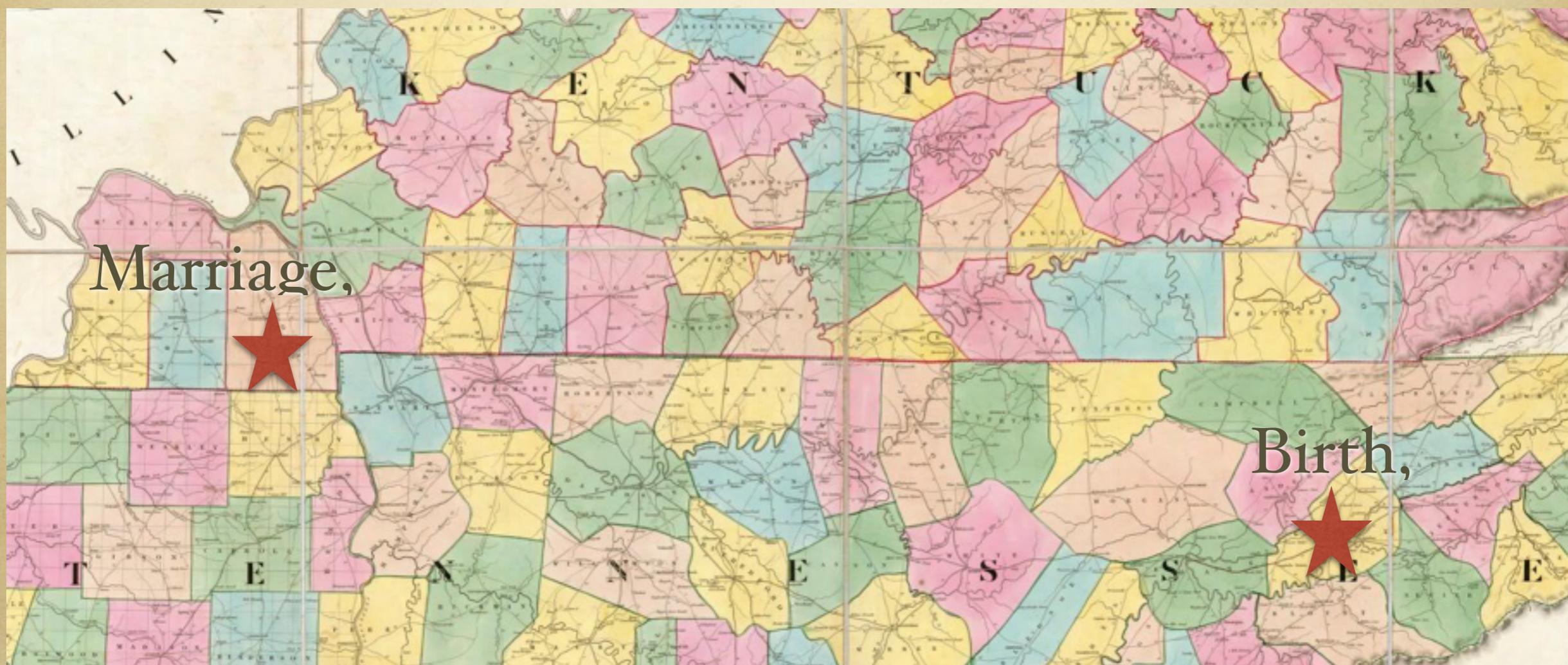
David H. Burr, *Map of Kentucky & Tennessee Exhibiting the Post Office, Post Roads, Canals, Rail Roads, &c.* (London : John Arrowsmith, 1839); digital image, *David Rumsey Map Collection* (<http://davidrumsey.com> : accessed 2 September 2015).

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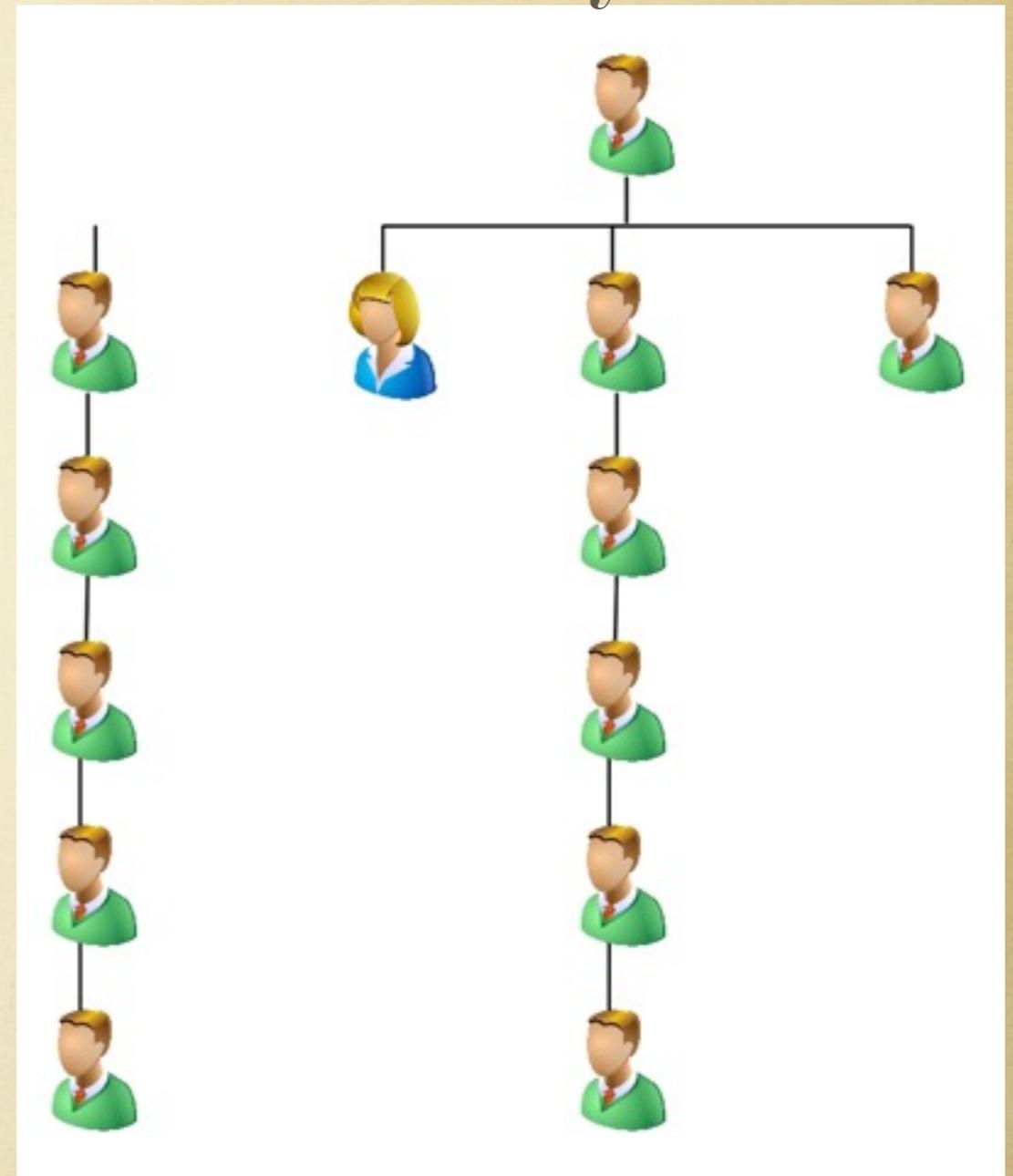
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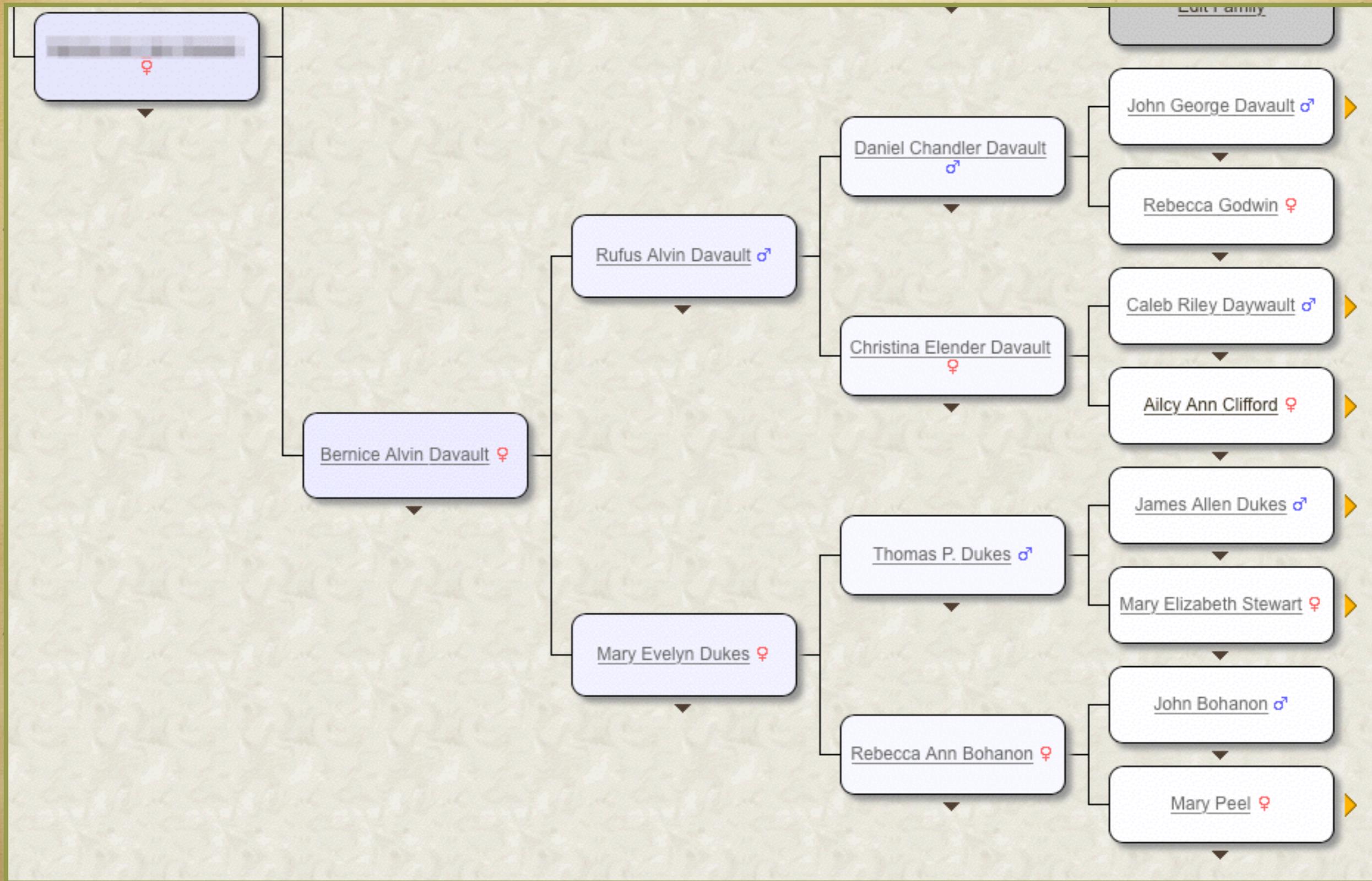
- The death certificate of a child places the birthplace of her father in Knoxville, Tennessee, around 1810.
- Her father was in western Kentucky by the 1830s.
- No men of the surname appear in Knox County records.
- Y-DNA testing shows that the descendant is a 36 out of 37 marker match to a son of a family with the same surname in bordering Jefferson County, TN.
- Is the western Kentucky man related to the Jefferson County, TN family?
- Is he a son of the Jefferson County family?

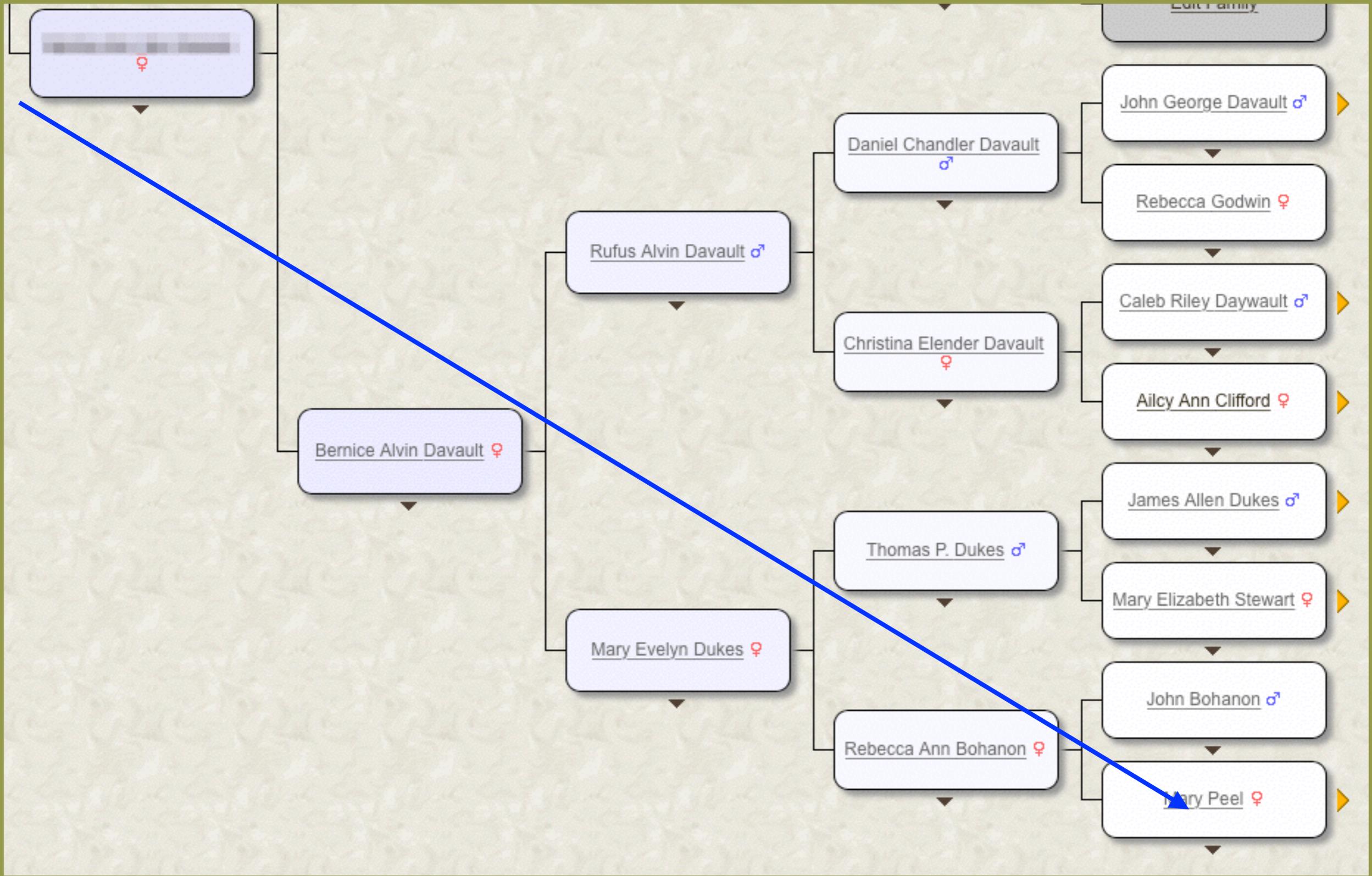


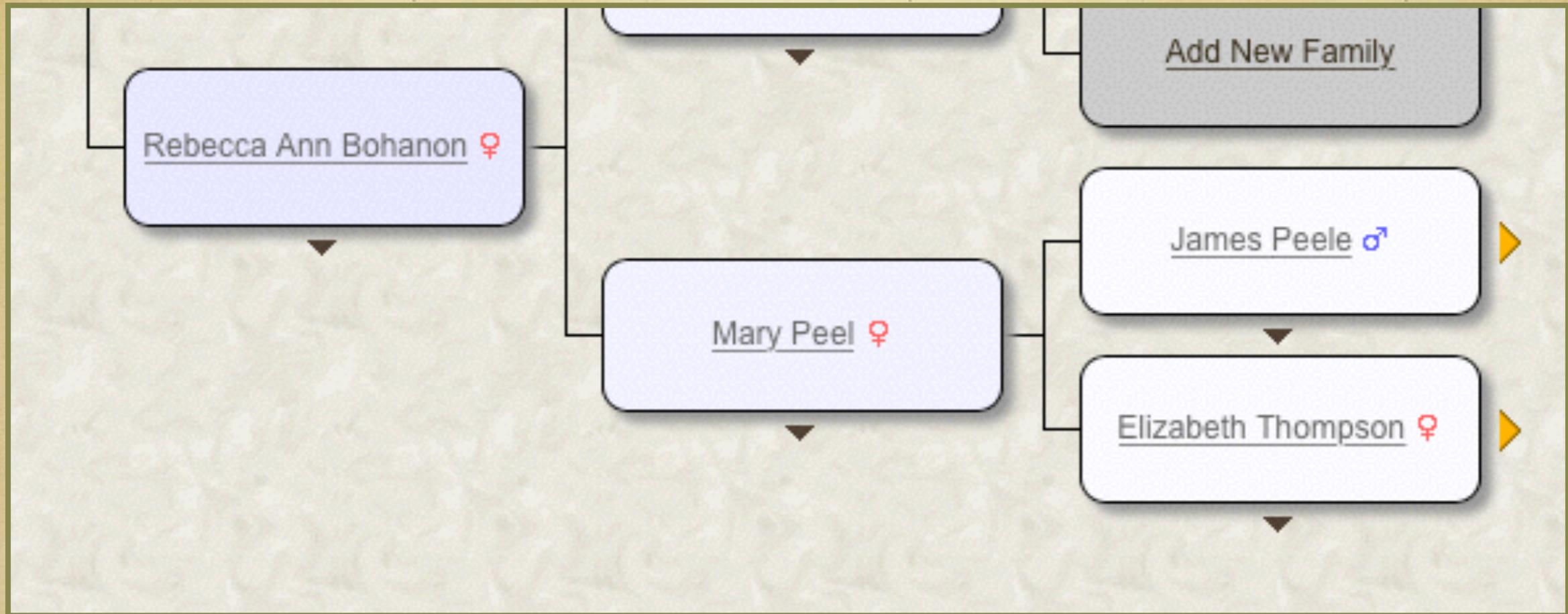
# Documentary Evidence

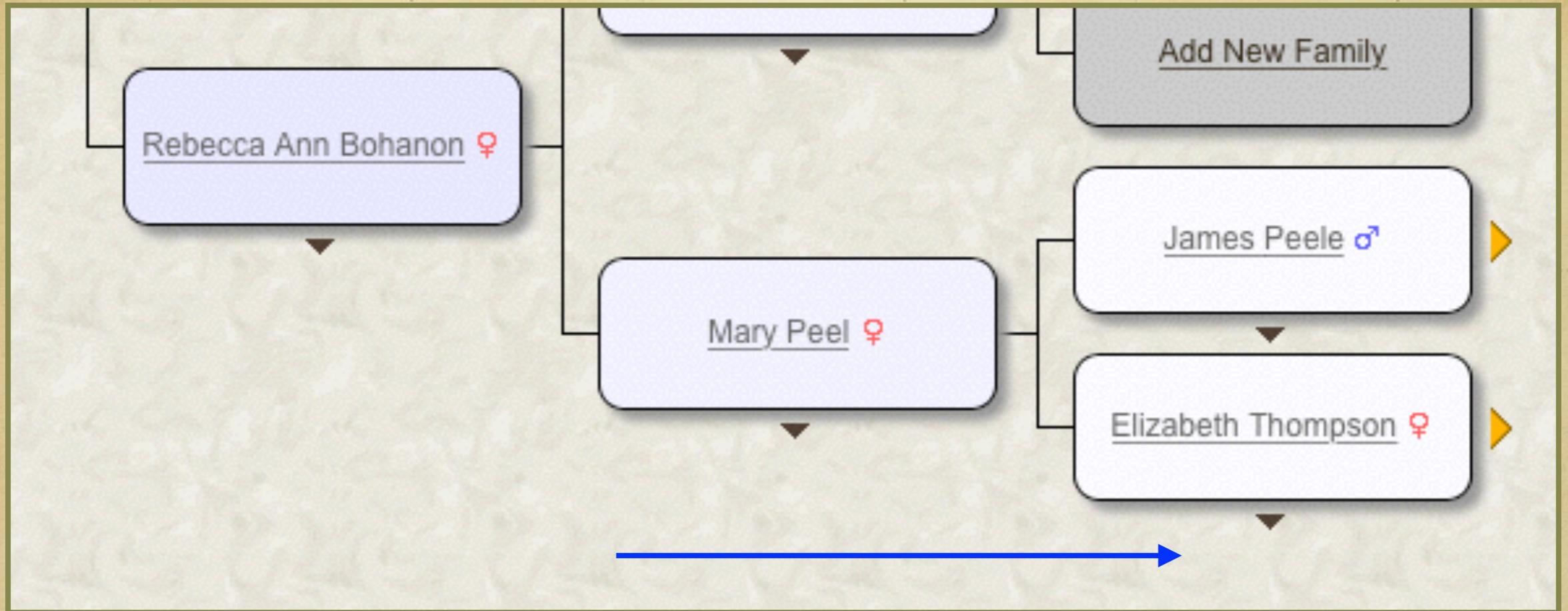
- A man with the name of the western Kentucky man appears in the tax records in the early 1830s for a couple of years in Jefferson County, Tennessee, and then disappears.
- After the man of the same name disappears from the Jefferson County, Tennessee, tax records; the man of the same name appears on the western Kentucky tax records.
- The man who has the same unusual name of the ancestor of the matching tester also appears in the western Kentucky tax rolls.

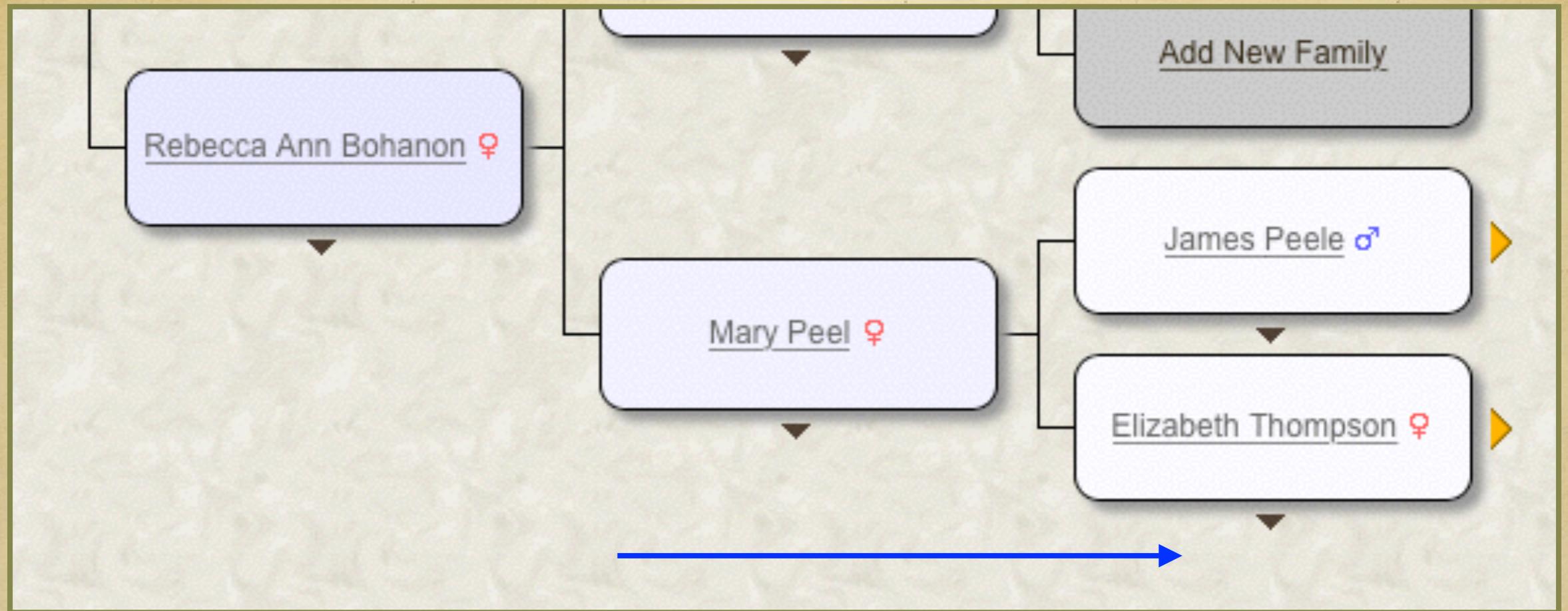
Mitochondrial DNA testing is most useful  
in solving very particular genealogical  
questions.



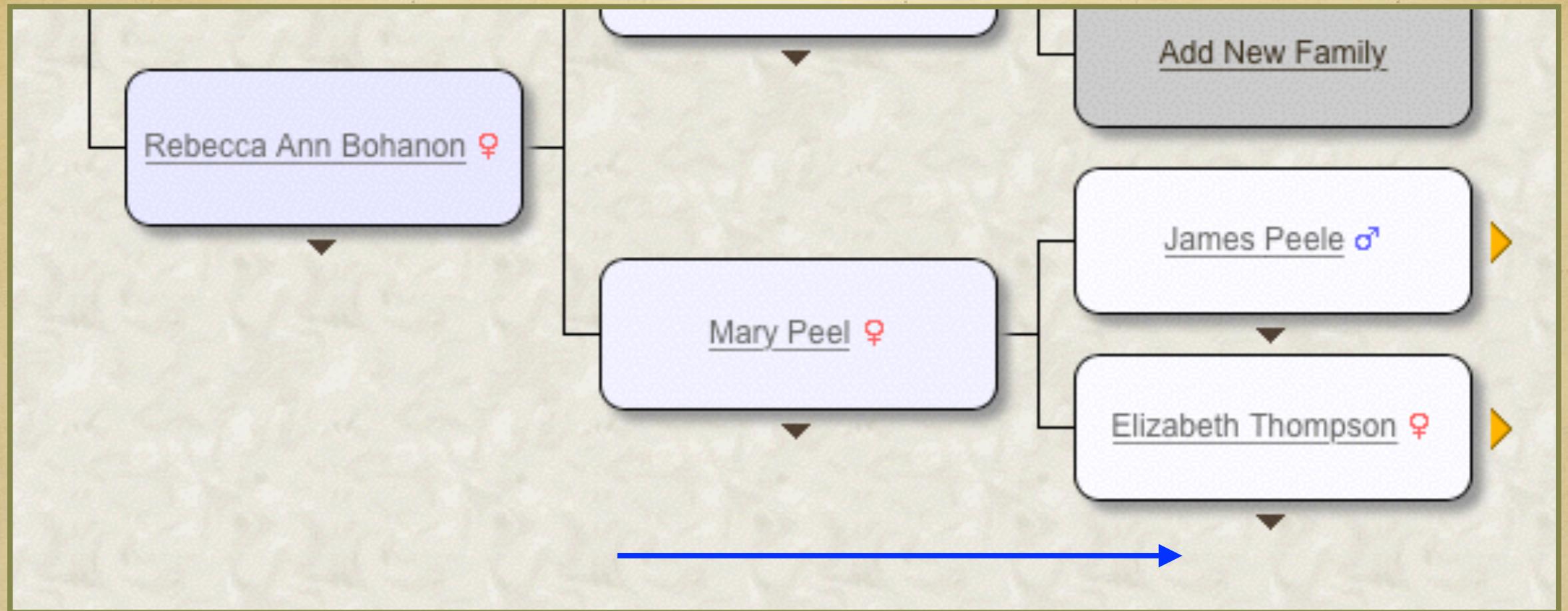








No “paper trail” for Mary Peel’s relationship to James Peele and Elizabeth Thompson.



No “paper trail” for Mary Peel’s relationship to James Peele and Elizabeth Thompson.

However, if the connection is right, I have Elizabeth Thompson’s mtDNA.

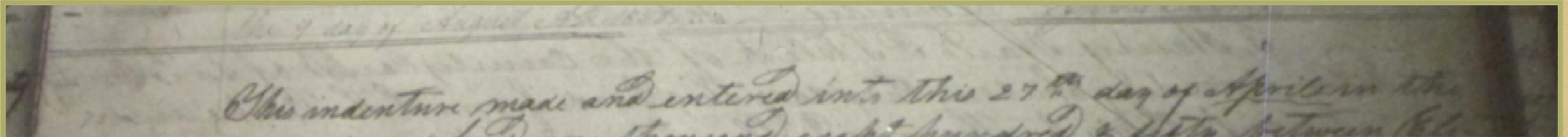
# Marshall County, Kentucky, 1850

The 27 day of April 1850

This indenture made and entered into this 27<sup>th</sup> day of April in the year of our Lord one thousand eight hundred & fifty, between Elizabeth Peel of the county of Marshall and state of Kentucky of the first part and David Peel, Henry Peel, and W. W. Gilbert and Nancy, H. Gilbert his wife, late Nancy, H. Peel of the county and state aforesaid of the second part, Witnesseth. That in consideration of the love and natural affection I have for and bear to my sons David Peel & Henry Peel and my daughter Nancy, H. Gilbert late Nancy, H. Peel, and also for and in consideration of the sum of one dollar to me in hand paid by each of the parties of the second, the receipt whereof is hereby acknowledged have bargained granted and sold and by these presents doth sell and convey unto the said David Peel, Henry Peel, and W. W. Gilbert and Nancy, H. Gilbert his wife the following tract or parcel of land

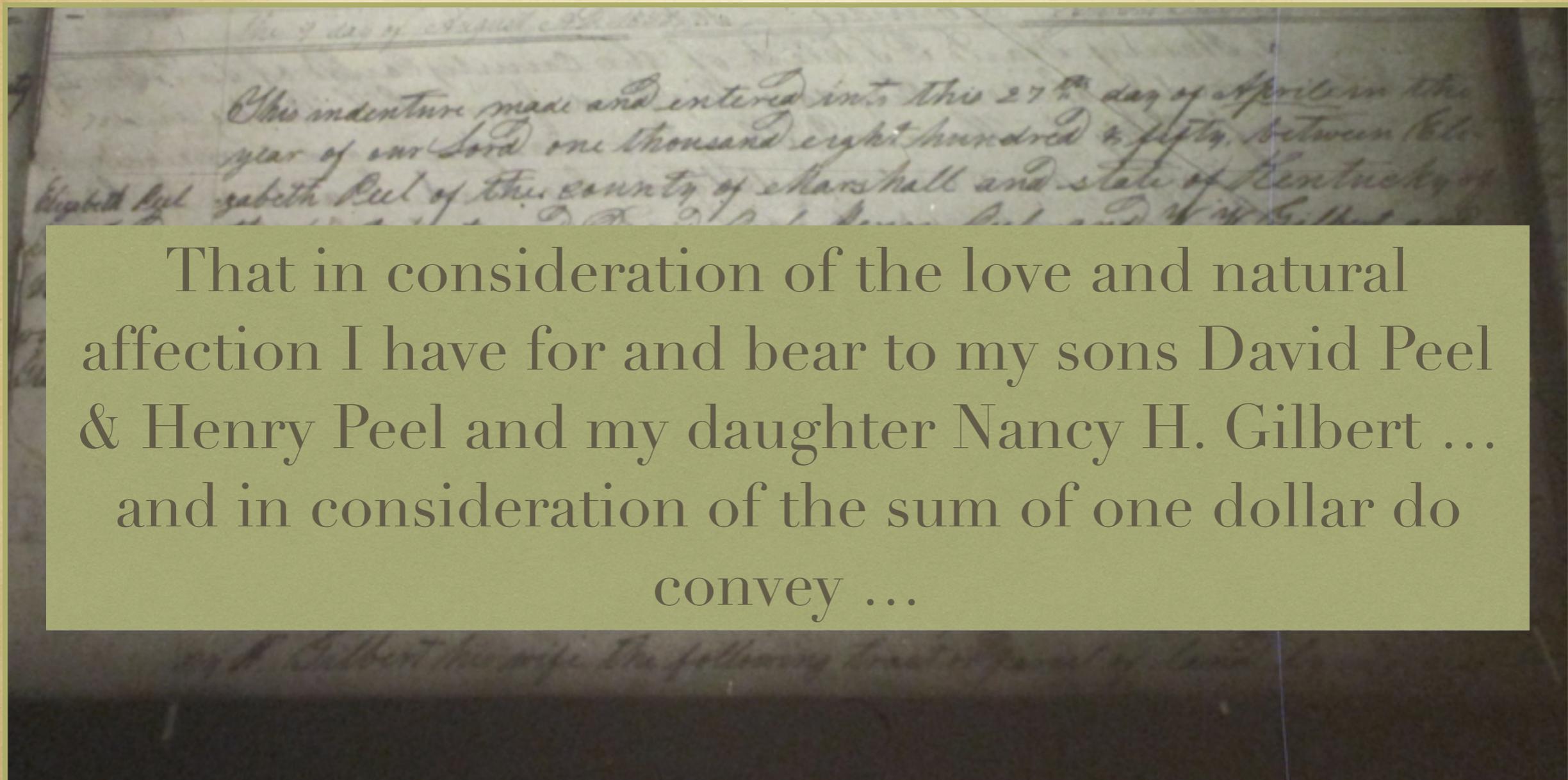
Marshall County, Kentucky, Deeds No. 3:360-362, Elizabeth Peel to David & Henry Peel and W.W. and Nancy Gilbert, 27 April 1850.

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This indenture made and entered into this 27th day of April in the year of our Lord one thousand eight hundred & fifty, between Elizabeth Peel of the county of Marshall and state of Kentucky of the first part and David Peel, Henry Peel, and W.W. Gilbert and Nancy H. Gilbert his wife, late Nancy H. Peel of this county .. of the second part ...

Marshall County, Kentucky, Deeds No. 3:360-362, Elizabeth Peel to David & Henry Peel and W.W. and Nancy Gilbert, 27 April 1850.



That in consideration of the love and natural affection I have for and bear to my sons David Peel & Henry Peel and my daughter Nancy H. Gilbert ... and in consideration of the sum of one dollar do convey ...

Mary Bohanon not mentioned!

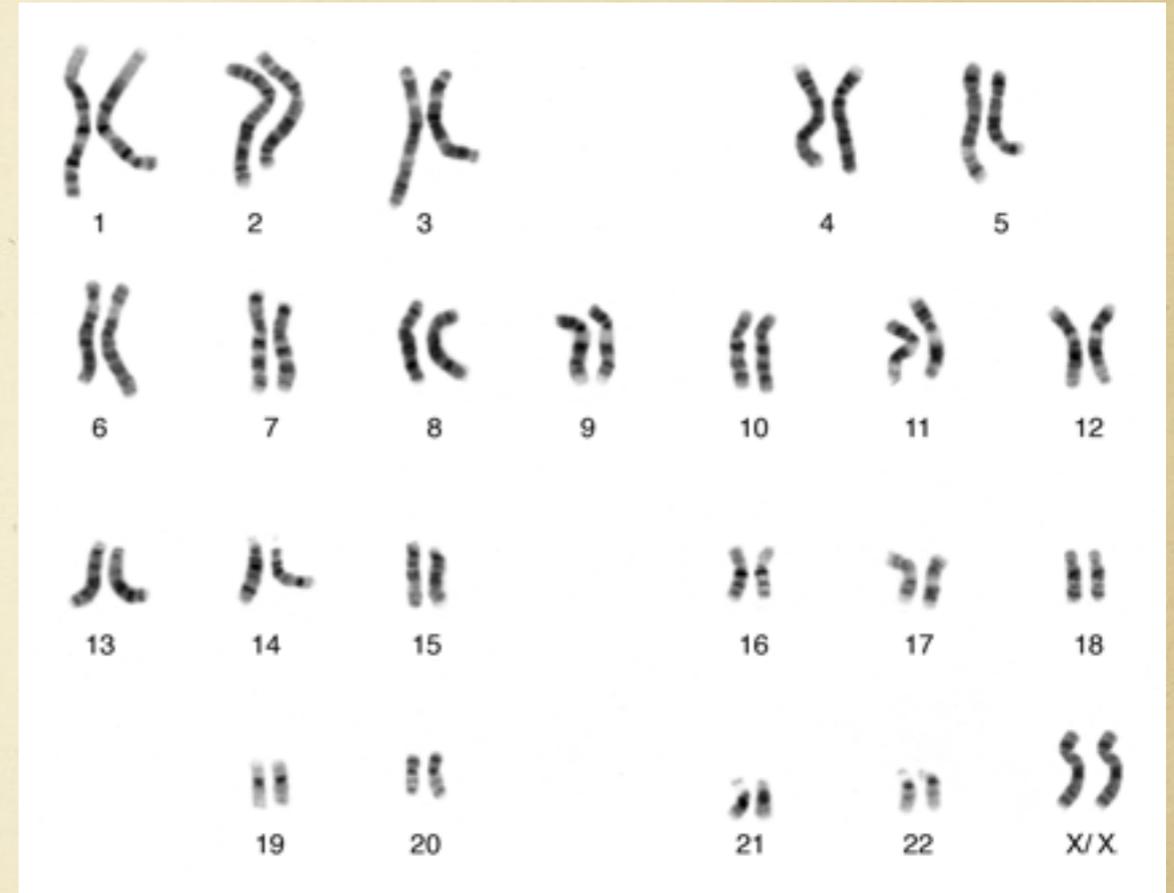
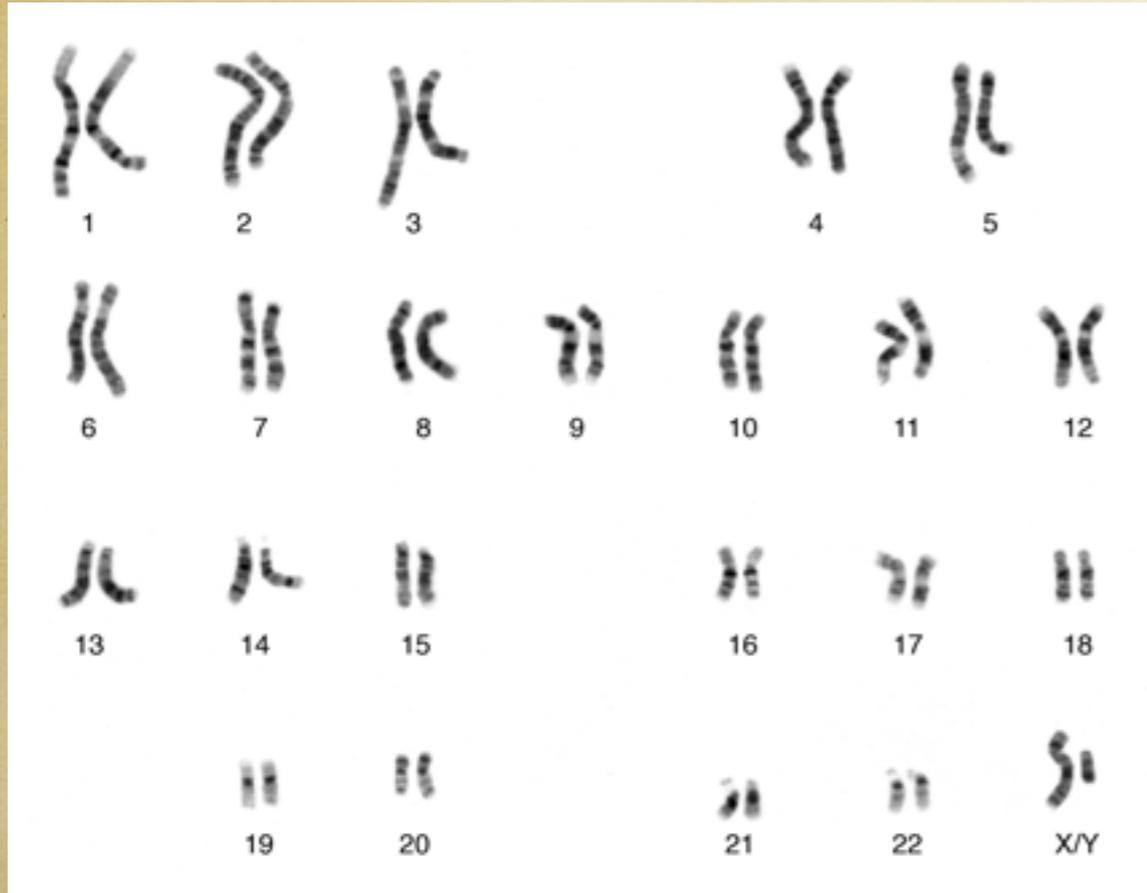
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# 3 Kinds of DNA Testing

- Y DNA
- Mitochondrial DNA
- Autosomal DNA

# Father

# Mother



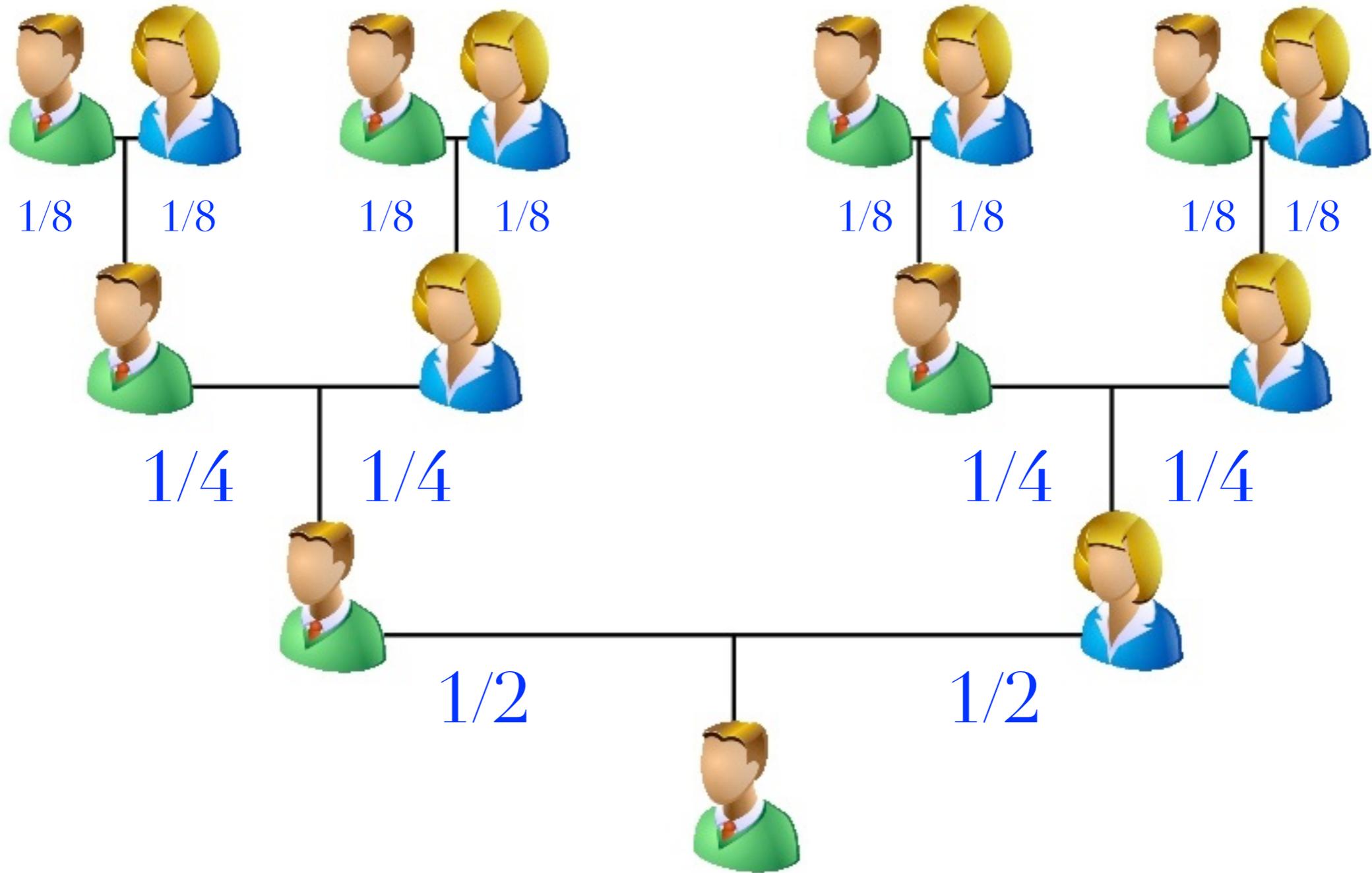
1/2 DNA passed to children  
through sperm

1/2 DNA passed to children  
through egg

The chromosomes are not just divided in half.

They recombine (exchange parts).

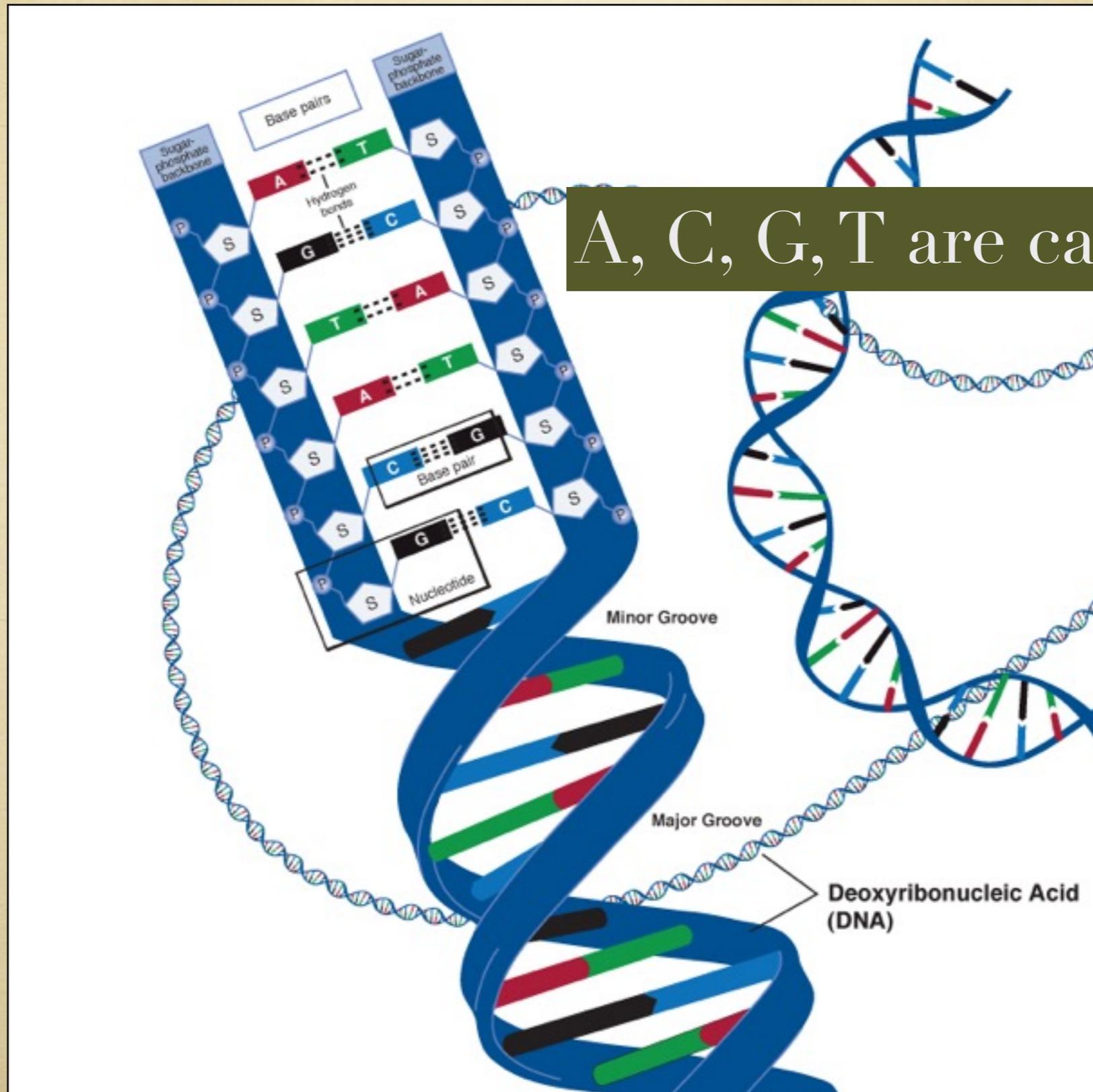
The 1 chromosome passed to the child from each parent is a combination of the child's grandparents' DNA.



# Recruiting

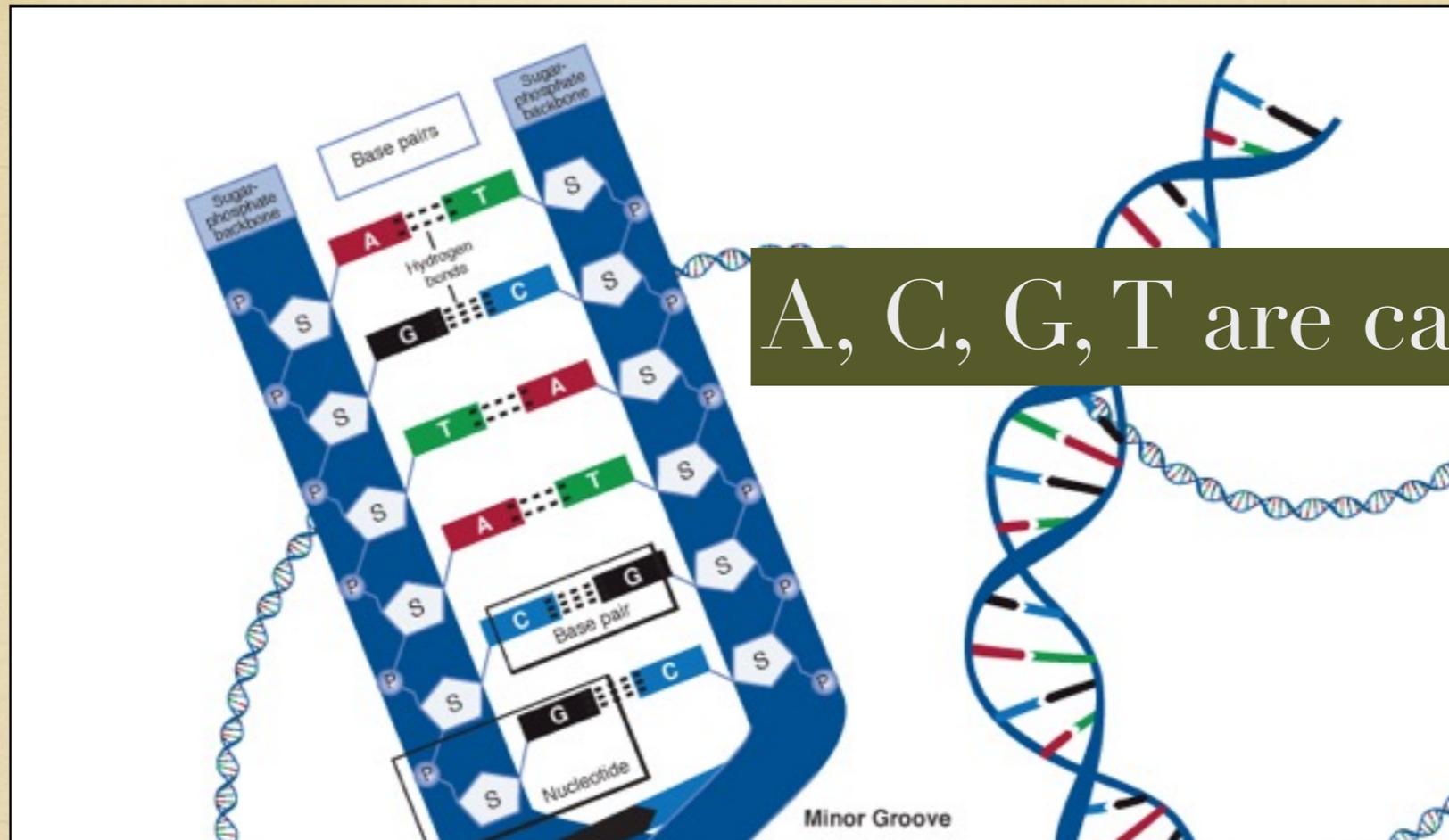
- Although you can just test yourself and wait for matches, you will be more successful if you are proactive and have people with known relationships tested.
- Testing siblings will accumulate most of the DNA of their parents (remember each child only gets half.) This applies to the siblings of your parents, too (aunts, uncles).
- Testing cousins will help narrow matches of unknown relationships to particular branches.
- Get the oldest relatives first.

# DNA Unwound and Up Close



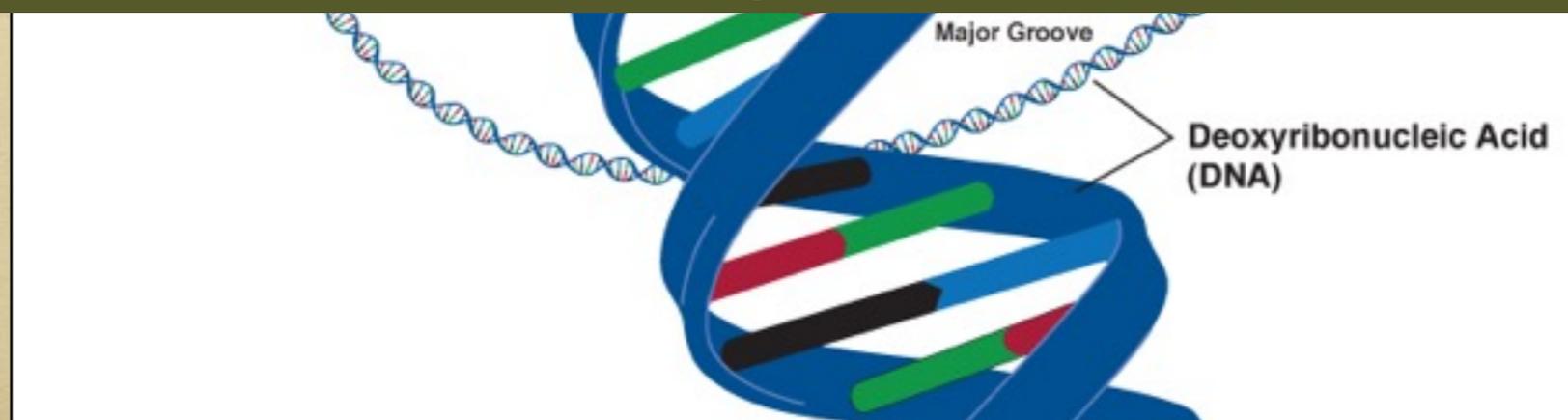
A, C, G, T are called “bases.”

# DNA Unwound and Up Close

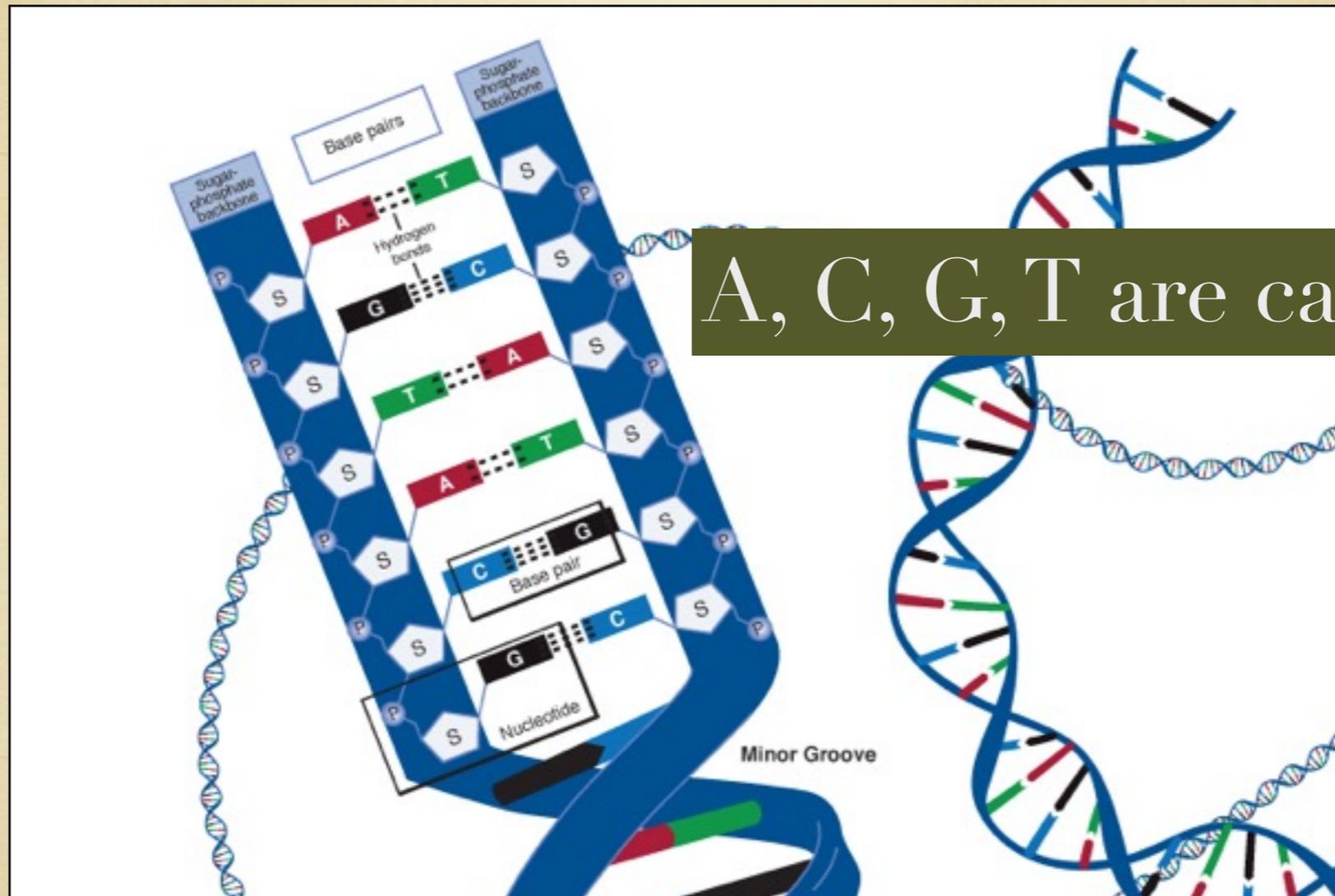


A, C, G, T are called “bases.”

DNA testing looks at the sequence of bases and compares among testers.



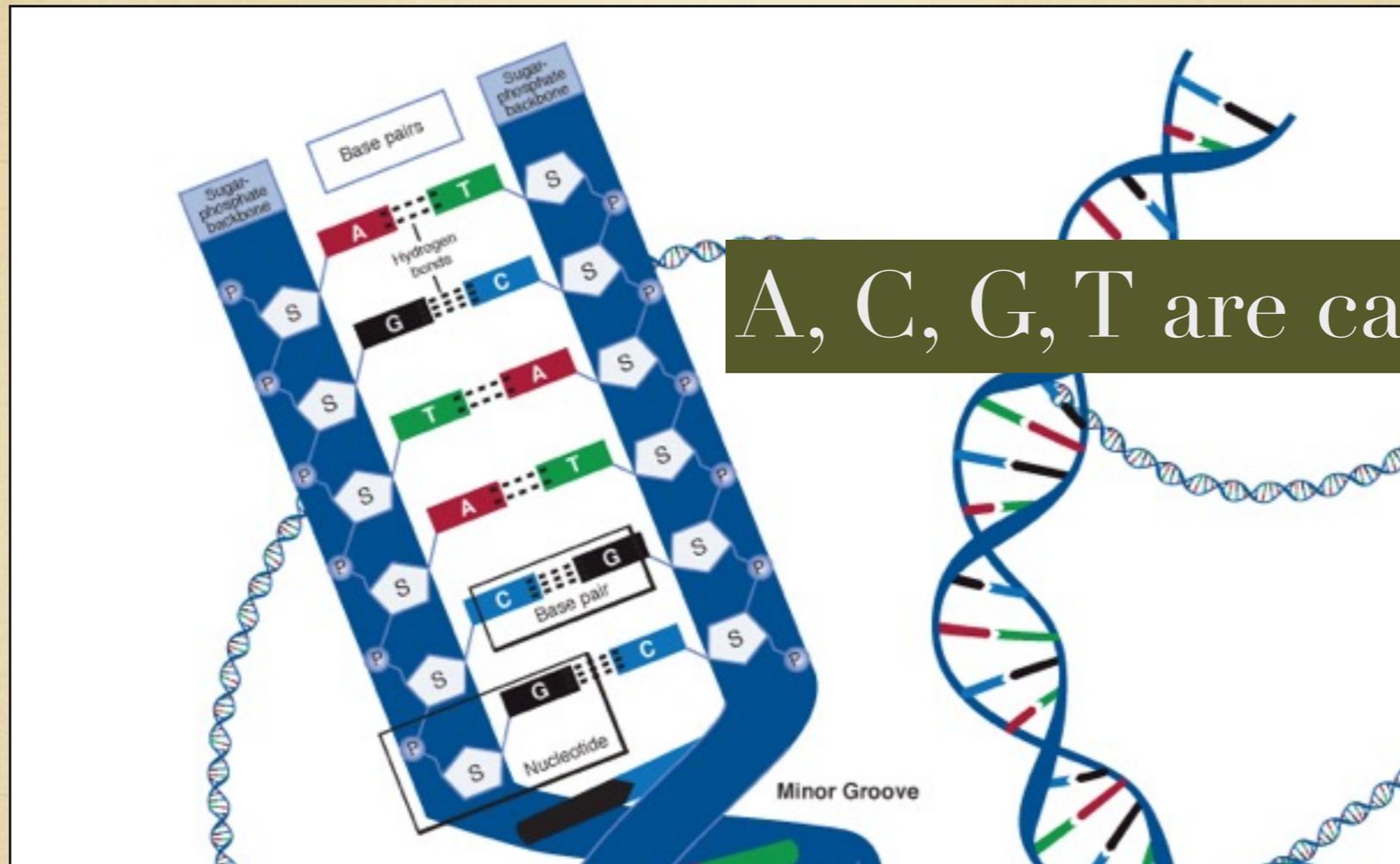
# DNA Unwound and Up Close



A, C, G, T are called “bases.”

DNA testing on the y-chromosome and mitochondria looks for differences and reports them as genetic distance.

# DNA Unwound and Up Close

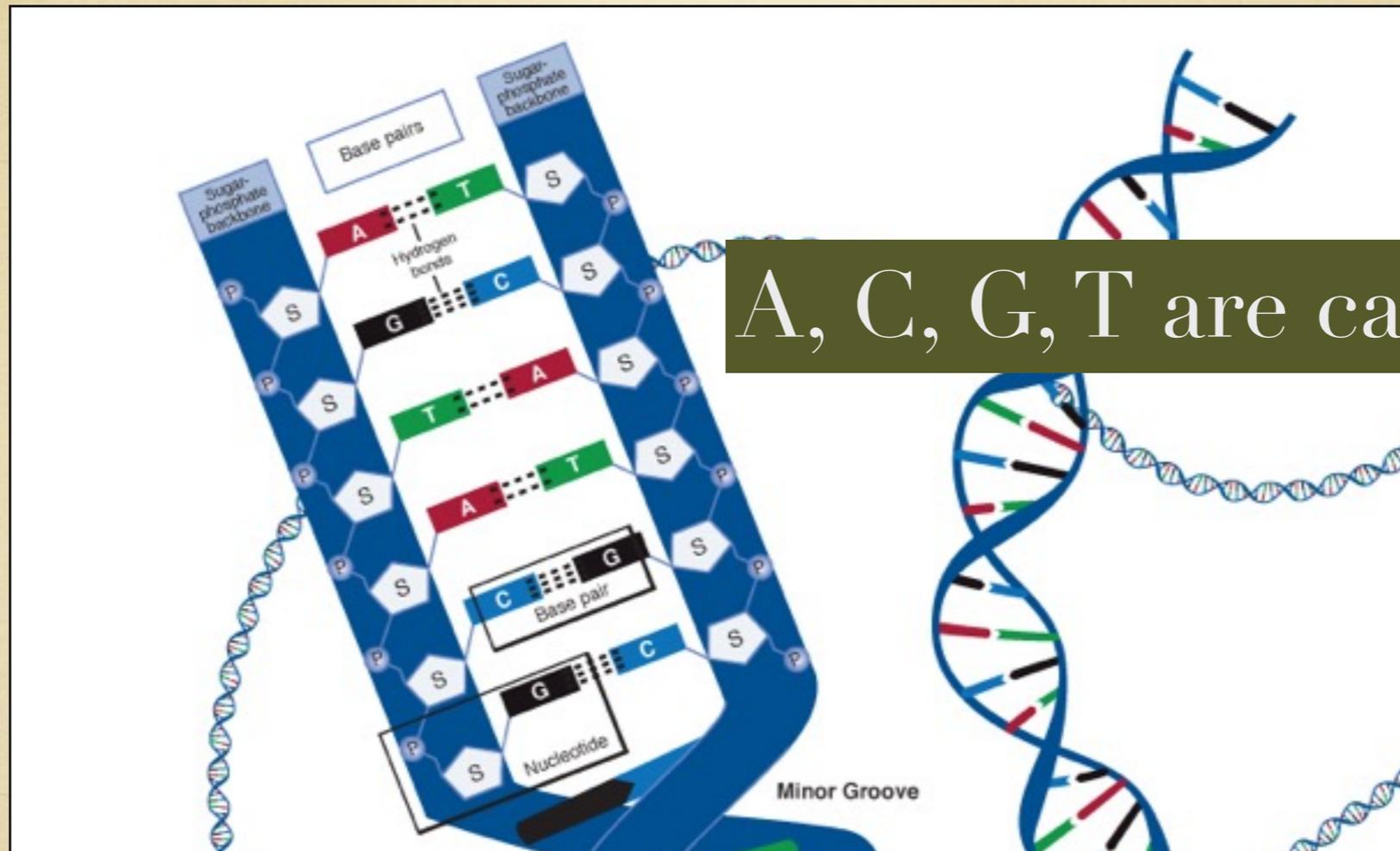


A, C, G, T are called “bases.”

Autosomal DNA testing looks for long sections that are the SAME.



# DNA Unwound and Up Close



A, C, G, T are called “bases.”

For two people to be considered a match, at least 500 of these bases must be the same in the same location and on the same chromosome.



# Autosomal DNA Results

- **Raw data:** sequence of bases (A, C, G, T)
- **Matching chromosome segment data:** identified by a segment identified by its location on a particular chromosome in which one person's DNA sequence is the same as another's. The length of the matching segment is designated by the unit of measure "centiMorgan."
- **Match List**

# Matches

- Matches greater than 15 cM are IBD.
- Majority of matches between 10 and 15 cM are IBD.
- Matches between 7 and 10 cM are more likely to be IBD than not.
- The goal is to find a common ancestor for people matching on the same segment.
- The common ancestor can be positively identified by using triangulation groups.

Matches that are not IBD, are either IBS (Identical by State) or pseudo-segments.

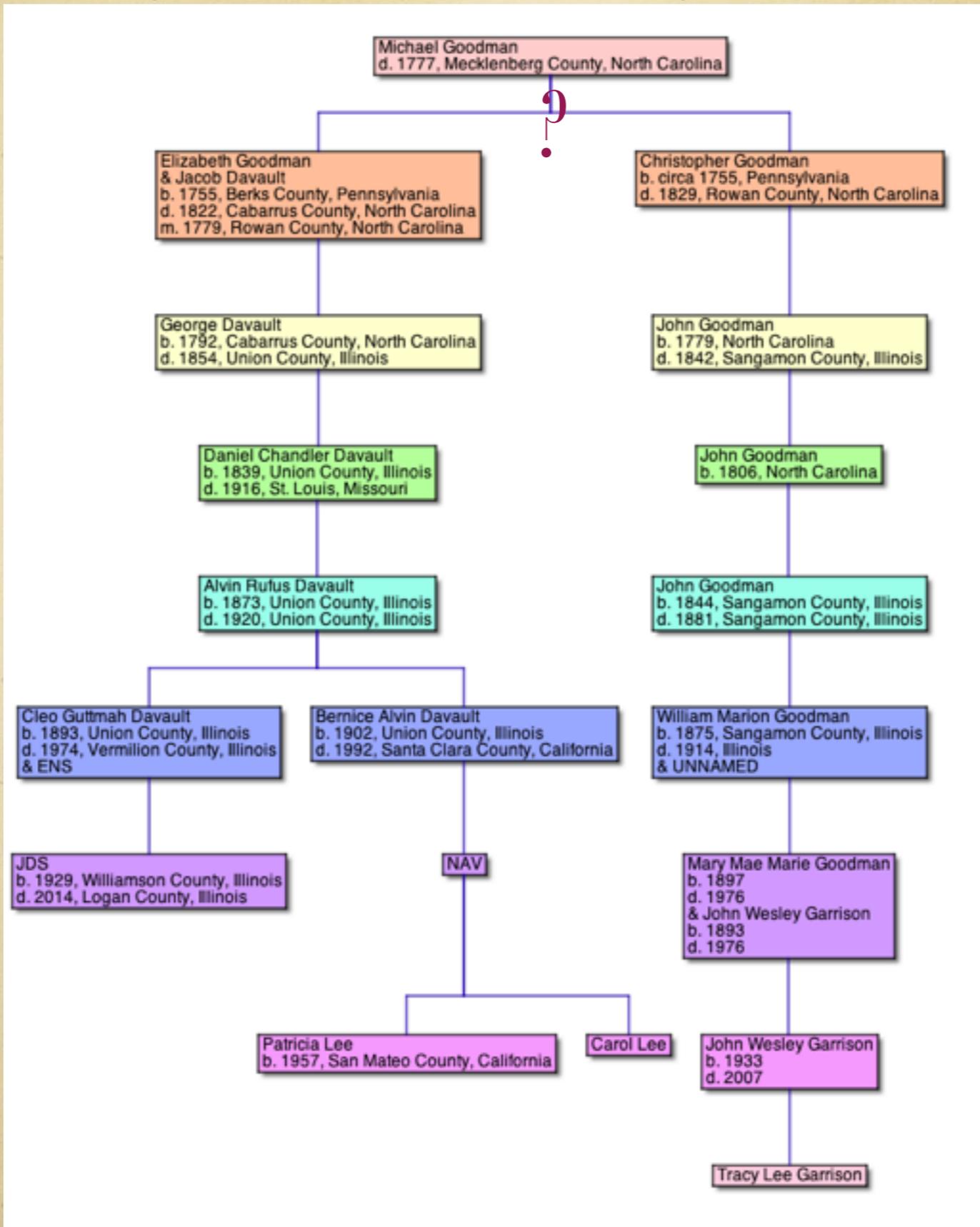
# Testing Companies

- Ancestry **Does not provide matching segment data.**
- FamilyTree DNA
- 23andMe

# Matches

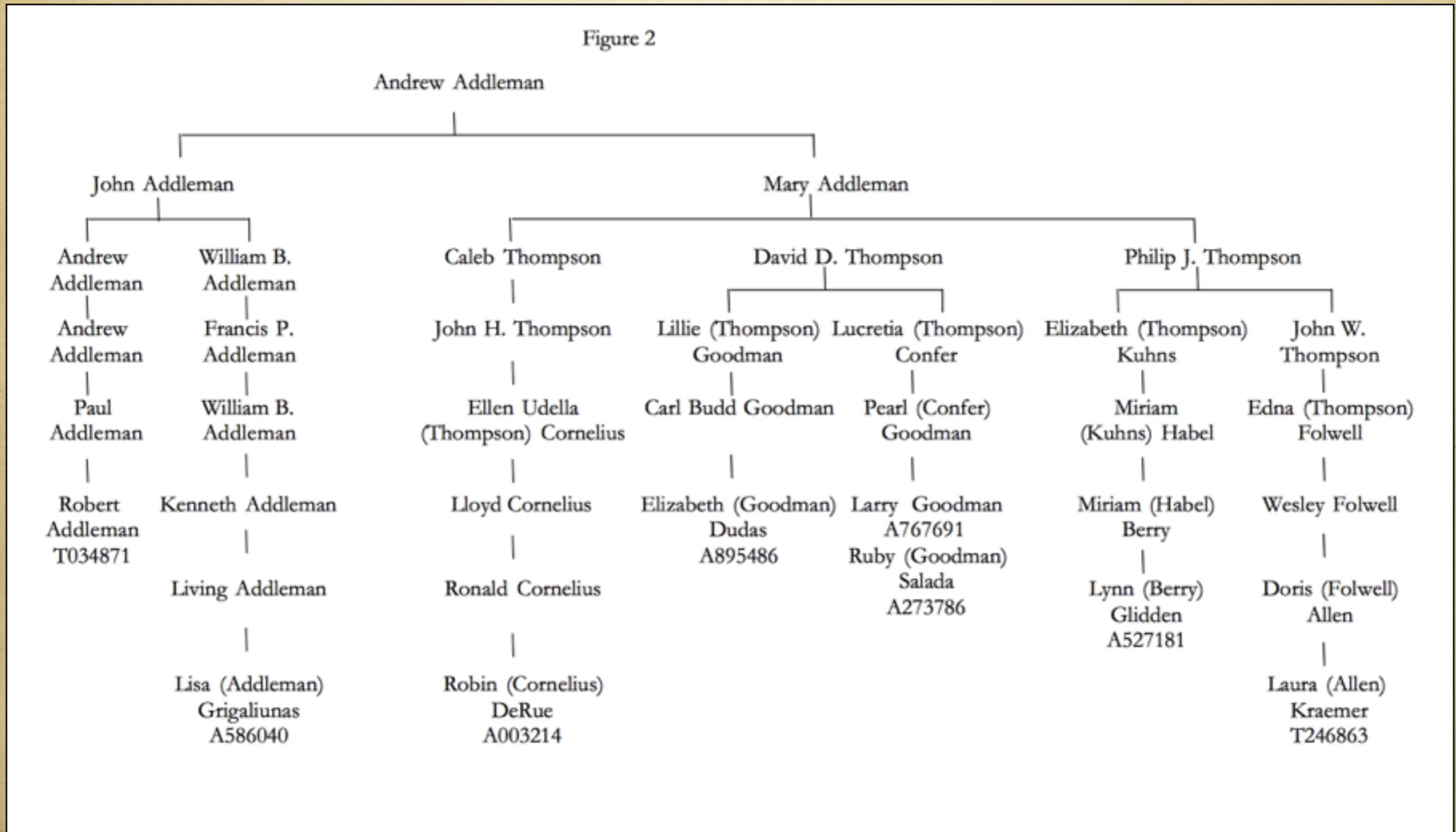
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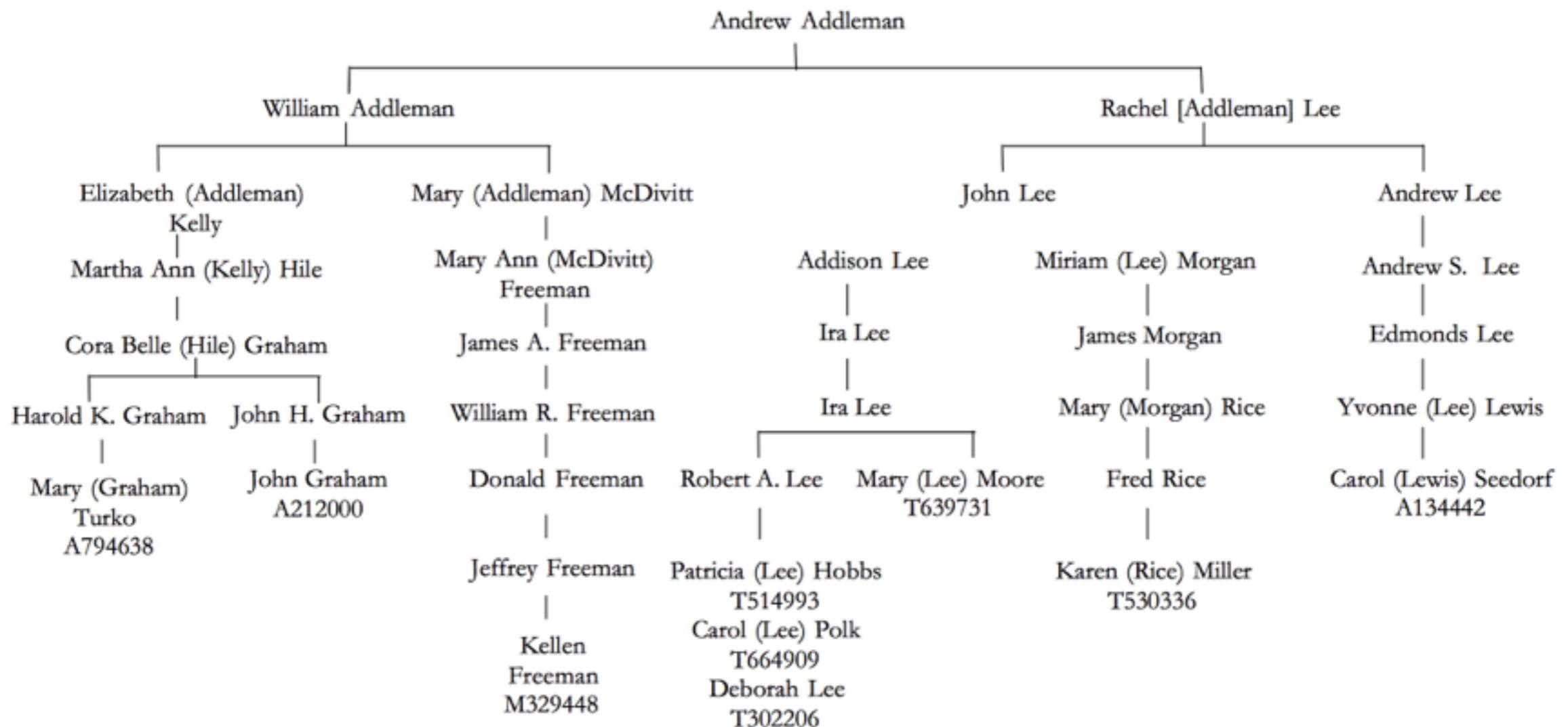
# Andrew Addleman Descendants through 4 children.

Figure 2



# Andrew Addleman Descendants through 4 children.

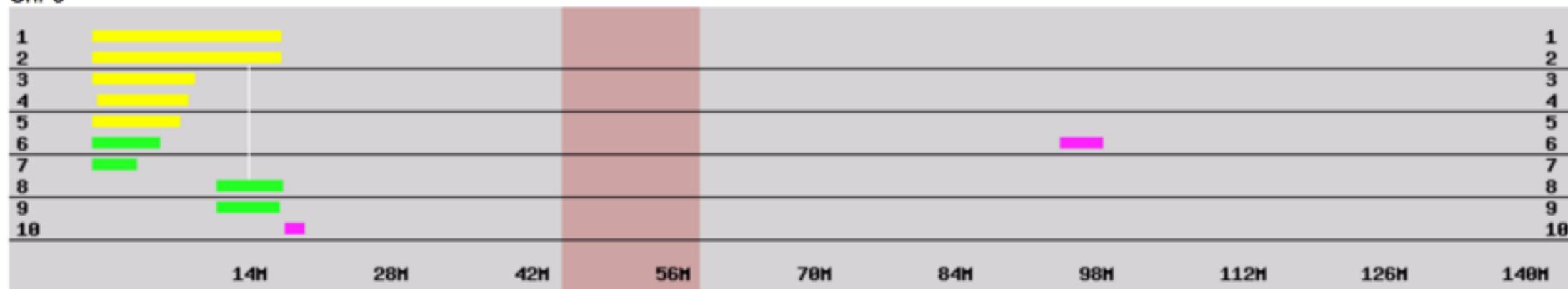
Figure 3



Chr 9

Match ID	Type	Name	Matching segments on Chromosome 9	Overlap with previous match
1	F2	*tew ( <a href="#">A585788</a> )	36587 - 18718689 (40.2931 cM)	New Root
2	V4	Andrew Pera ( <a href="#">M695307</a> )	36587 - 18641444 (40.1792 cM)	36587 - 18641444
3	V4	Amy Stuetzer - Daleo ( <a href="#">M757733</a> )	36587 - 10187122 (25.2704 cM)	36587 - 10187122
4	F2	Michael Cross ( <a href="#">T370080</a> )	603908 - 9459877 (23.1623 cM)	603908 - 9459877
5	V4	Eric Ayers ( <a href="#">M362238</a> )	36587 - 8710393 (21.5078 cM)	603908 - 8710393
6	V3	*Paul R. Smith ( <a href="#">M123154</a> )	36587 - 6625045 (16.2683 cM), 96293399 - 100374766 (3.438 cM)	36587 - 6625045
7	F2	Ashley Anderson ( <a href="#">A610480</a> )	36587 - 4394373 (12.2943 cM)	36587 - 4394373
8	F2	D B ( <a href="#">A548967</a> )	12504323 - 18918039 (12.3115 cM)	Old Branch (2) , 12504323 - 18641444
9	F2	*davestus44 ( <a href="#">A177921</a> )	12504323 - 18630364 (11.8854 cM)	12504323 - 18630364
10	F2	Robert Milton Burns ( <a href="#">T944611</a> )	19209638 - 21046085 (3.117 cM)	New Root

Chr 9



GEDmatch

James McManigle & Susan Baecker

Solomon McManigle Mary Jane Mason

Robert McManigle & Margaret Steele

John McManigle & Sarah Cobaugh

Susanna McManigle & Harvey Bruner

James McManigle & Susan Baecker

Solomon McManigle Mary Jane Mason

Robert McManigle & Margaret Steele

John McManigle & Sarah Cobaugh

Susanna McManigle & Harvey Bruner

Nancy Ellen Mason who married William Joiner

James McManigle & Susan Baecker

Solomon McManigle Mary Jane Mason

Robert McManigle & Margaret Steele

John McManigle & Sarah Cobaugh

Susanna McManigle & Harvey Bruner

Nancy Ellen Mason who married William Joiner

Mary Jane Mason and Nancy Ellen Mason were sisters.

# Matching Segment Data

- Ancestry tells people who their common ancestor is based on their DNA match just by finding the same people in both trees.
- Because of errors or gaps in trees, misidentification can occur.
- Misidentification is minimized when the segment data is compared and triangulated among three or more testers.
- GEDmatch is essential for Ancestry testers because they will not be able to use matching segment data unless they transfer their data.

# Testing Companies

- 23andMe offers autosomal DNA testing only.
  - \$199 for ancestry and medical features
  - \$99 for ancestry-only test
- Ancestry offers autosomal DNA testing only.
  - \$99
- Family Tree DNA offers all three (Y-DNA, mt-DNA, and autosomal DNA) tests.
  - \$79 for autosomal DNA test
  - \$169 for 37 marker Y-DNA test
  - \$199 for mitochondrial DNA test

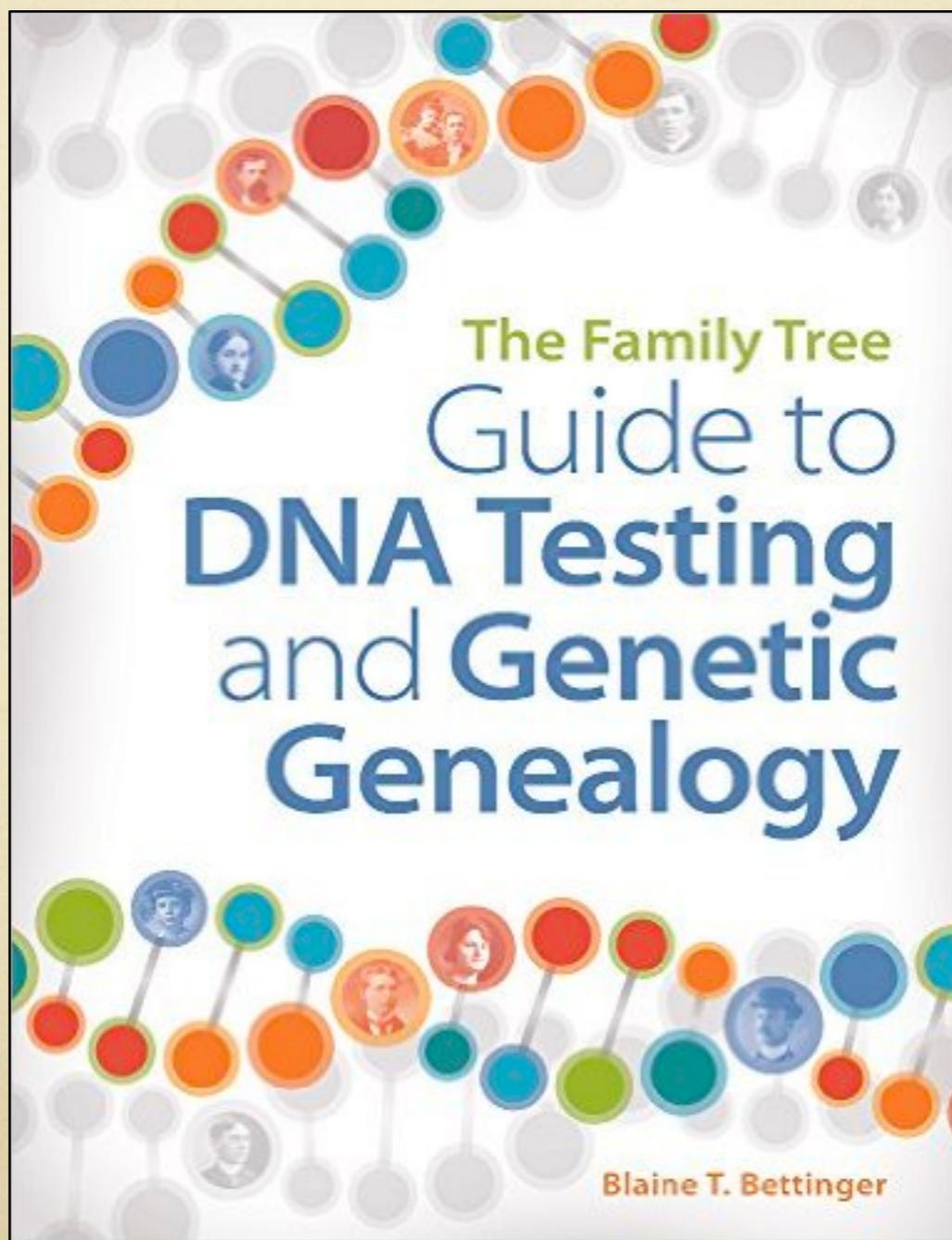
# Testing Companies

- Ancestry and 23andMe require spitting into a vial.
- FamilyTree DNA uses cheek swabs. This may be easier for older people.
- All three companies save some of your sample which theoretically can be used for future tests.
- Only Family Tree DNA offers any other tests to upgrade to. If finances hinder, start with the autosomal DNA test and upgrade to other tests later. No more sample required.
- Ancestry has the largest database of testers and has a large number of testers with family trees. This makes it easier to identify common ancestors.
- Family Tree DNA has the best customer service, and their business is solely dedicated to genetic genealogists.
- 23andMe's main purpose is identifying DNA for the health industry.

# Benefits & Limitations

- DNA testing works only by comparing DNA of one tester to the DNA of others.
- DNA can confirm ancestral lines.
- DNA can give direction to research.
- DNA can help identify previously unknown ancestors.
- DNA can NOT identify a specific ancestor by itself.
- DNA testing is one piece of indirect evidence which, when used with documentary evidence, can support suspected lines or identify unknown lines.

# Books



# Institutes

- Genealogical Research Institute of Pittsburg, July 16-21, 2017
- Institute of Genealogy and Historical Research, July 23-28, 2017 at University of Georgia - Athens.

# ISOGG

International Society of Genetic Genealogists

<http://isogg.org/wiki>