

Using DNA Testing for Genealogy



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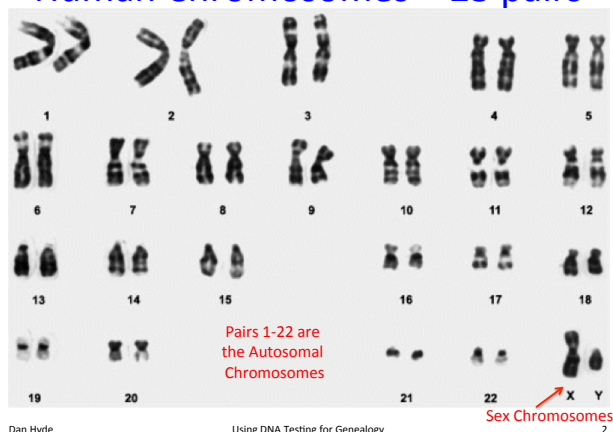
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1

Human Chromosomes – 23 pairs



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2

Facts about Nuclear DNA

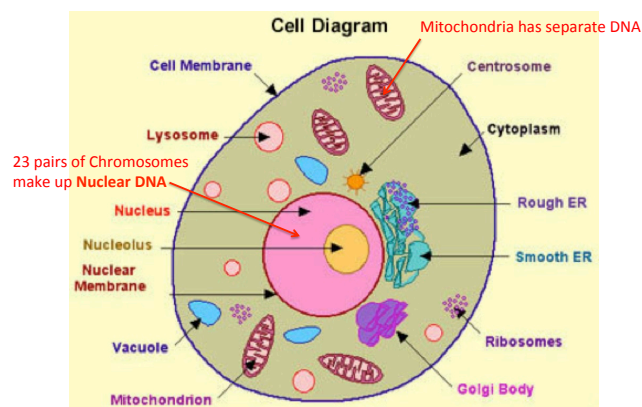
- 23 pairs of Chromosomes make up **Nuclear DNA**
 - Over 3 billion **base pairs** or **nucleotides**.
 - Adenine (A), Cytosine (C), Guanine(G), and Thymine(T)
 - DNA is long sequence of the **nucleotides**.
 - The **A-C-G-T** letters
 - **Single Nucleotide Polymorphism (SNP)** “snip” – a small genetic change that occurs within a DNA sequence, e.g., an **A** to a **G**. Occurs infrequently, e.g., once in several thousand years - used to determine **Haplogroup** (your ancient ancestry).
 - All humans share 99.5% of same DNA.

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3

Cell's Mitochondria has own DNA



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Facts about a Cell's Mitochondria

- In a cell's cytoplasm, they provide energy for the cell. Hundreds in a cell.
- **Mitochondrial DNA (mtDNA)** – genetic material passed from mothers to their children, but only daughters pass it on.
- About 16,000 base pairs and **SNPs** occur.
- Useful for tracing **direct maternal** line.
- Valuable for identification of **degraded remains**, e.g., thousands of years old teeth.

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5

DNA Tests useful for Genealogy

Called “Genetic Genealogy”

- #1. **Y-DNA test** – looks at markers on Y chromosome
- #2. **mtDNA test** – looks at markers in Mitochondrial DNA
- #3. **Autosomal DNA test (atDNA)**– looks at markers on chromosomes 1-22 (non sex ones).

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6

#1. Y-DNA test

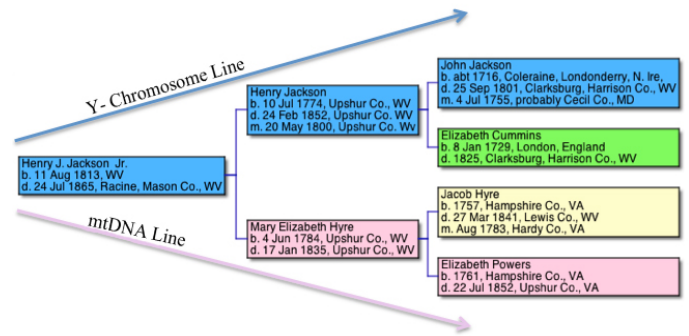
- Men pass their Y-chromosome onto sons.
- Looks at markers on man's Y-chromosome.
- Can test 12, 25, 37, 67, 111 markers.
- Markers are **Short Tandem Repeats (STR)**
 - In a non-coding region, a pattern such as "AGAT" is repeated. E.g., AGATAGATAGAT has 3 repeats.
 - STRs mutate relatively fast, say, once in 150 years.
 - Ex: marker **DYS 393** is known to repeat "AGAT" from 9 to 17 times. John and Lee Jackson both have 13.
- Only males can take test. DNA Y-chromosome Sequence
- Y-DNA 67 test costs about \$265.

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Pedigree Chart



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More on Y-DNA Test

Advantage: Y-DNA follows surname path in most cultures.

Limitation: Only supplies information about a few ancestors!

Ex: 5 generations back, a male has 62 ancestors (parents, grandparents, etc.). Y-DNA test is only useful for the **six direct males** (man, his Dad, his Dad, his Dad, etc.).

Y-DNA testing provides **no** information on the other **56 ancestors**!

Result on its own reveals little. Matches with others are key!

Y-DNA test is still very useful!

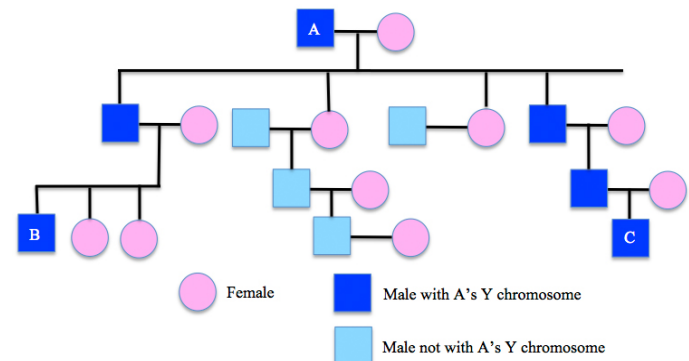
- Can verify paper trail along surname path.
- Can show two surname lines are closely related.
- Can help determine father in an adoption or illegitimacy case.
- Can help identify the **Most Recent Common Ancestor (MRCA)**.

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Most Recent Common Ancestor



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Y-DNA Results of John M. and Lee

First 25 markers of 67 for Lee Jackson (first line) and John M. Jackson (second line):

	Haplogroup																	
	DYS393	DYS390	DYS391	DYS385	DYS426	DYS388	DYS439	DYS392	DYS391I	DYS458	DYS459	DYS455	DYS454	DYS447	DYS448	DYS449	DYS464	
R-M269	13	23	14	11	11-14	12	12	13	13	29	19	9-10	11	24	15	19	29	15-15-17-18
R-M269	13	23	14	11	11-14	12	12	13	13	29	19	9-10	11	24	15	19	29	15-15-17-18

66 of 67 markers are the same. Marker DYS534 differs: Lee: 14 John: 15

66/67 means with 95% probability **MRCA** in last 8 generations.

From **paper trail**:

Lee is descendant from John Jackson, Jr. and 6 generations from John Jackson.

John M. is descendant from Henry Jackson and 8 generations from John Jackson.

Confirms paper trail – no "hidden" adoptions, hanky-panky, surname changes, or major research errors. **Confirms Y-DNA for John Jackson** and all his **direct male descendants** including Stonewall Jackson.

See the full 67 marker Y-DNA results at FTDNA's Jackson DNA Group's website:

<http://www.familytreedna.com/public/Jackson/default.aspx?section=yresults>

Look for label near bottom: **R1b1a2_John_Jackson-Elizabeth Cummins_Lineage**

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11

Samuel Lewis Hays Case

- Family tradition - Samuel Lewis Hays (1794-1871) was **illegitimate** son of George Jackson, son of John Jackson.
- Dan contacted by Jason Hickman, descendant of Samuel Lewis Hays. Excitement about resolving Samuel Lewis Hays' case.
- Jason's paternal grandmother was Hannah Mace. Her grandfather was the **illegitimate** son of Peregrine Hays, son of Samuel Lewis Hays.
- Jason's cousin Don Mace took DNA test and to everyone's surprise he exactly matches several **Sharpes**!

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12

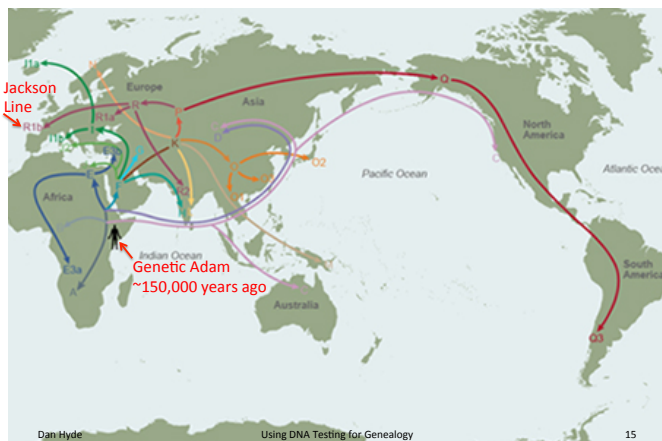
Samuel Lewis Hays Case (cont.)

- Gilmer Co., WV divorce proceedings **dissolved** Jason's 3rd Great Grandmother, Anne Helmick's **marriage** to Timothy McCune. In it, Anne's husband Timothy McCune and several witnesses testifying on his behalf reveal that she was **living with Peregrine Hays** and had been for several years. From this affair several children were born. Jason's 2nd Great Grandfather Peregrine Mace's **birth entry** lists Perry Hays as his father.
- The recent DNA match with the **Sharpes** proves this false and makes Jason believe that Anne was familiar with her final husband Daniel **Sharpe** long before they were married in the 1860s.

#2. mtDNA Test

- Looks at markers in **Mitochondrial DNA**.
- Genetic material passed from mothers to their children, but only daughters pass it on.
- About 16,000 **base pairs** and **SNPs** occur.
- Somewhat useful for tracing **direct maternal line**. BUT mutates too slowly for genealogy.
- Used by **genetic anthropologists** to trace female migration paths.
- More stable. Valuable for identification of degraded remains, e.g., thousands of years old teeth.
- Both males and females can take test. Cost \$200

Human Migration Paths - Males



Ancient Ancestry – Y-DNA Haplogroups



#3. Autosomal DNA Test - Newest

- Looks at markers on **chromosomes 1-22** (non sex ones).
- We inherit a mix of **autosomal DNA** from both parents (**about 50% each**) but it is **shuffled** and **diluted** with each new generation.
- atDNA** is **scrambled** when woman's **egg** and man's **sperm** are made.
- You share about 50% **atDNA** with a sister or brother but a **different** 50% with each sibling!
- Share 25% of a grandparent's; 12.5% g-grandparent's; etc.
- Back more than 5 generations **too diluted** to be useful.
- Share 12.5% with 1st cousin; 3% with 2nd cousin; 0.05% 5th cousin
- Can determine if close relative, e.g., g-aunt, is a full or half relative.
- Can determine if g-grandpa and g-grandma were first cousins.

Autosomal DNA Test (cont.)

- Good for finding **matches** up to 5th cousins.
- Common ancestor with a 5th cousin is a ggg-grandparent.
- Problem:** Need to determine as many descendants from your 32 ggg-grandparents as possible.
 - Say, on average, 5 children from each union live to marry and have children that's 12,480 possible people to research in the resulting four generations! Yipes!
- Both males and females can take test. Cost \$99 at FTDNA.
 - FTDNA calls **Family Finder**
 - 23andMe calls **Relative Finder**
 - Ancestry.com calls **AncestryDNA**

Taking DNA Test is Easy!

- DNA tests used in Genealogy uses special markers that reveal no sensitive medical information or information useful to Police. No fear of Police pounding on your door!
- Scrape inside of cheek and mail the swab in.
 - Some companies use saliva sample.
- Done in comfort of your home.
- Hardest part is not eating or drinking for the hour before! 😊

Taking DNA Test is Easy!



Kit from Family Tree DNA

Taking DNA Test is Easy!



DNA Testing Companies

- **Family Tree DNA** – focuses on DNA for genealogy.
 - Y-DNA; mtDNA; haplogroups; SNPs; atDNA (Family Finder) 700,000 markers; swab test
- **Ancestry.com** – focuses on genealogy.
 - atDNA only, 700,000 markers; saliva sample.
- **23andMe** – focuses on health issues and genealogy.
 - atDNA (Relative Finder), haplogroups - tens of thousands of markers; saliva sample.
- **Gen 2.0** – focuses on human migration patterns.
 - National Geographic Project
 - SNP tests to determine Haplogroups (ancient ancestry)
 - swab test

Resources

Websites

Jackson Brigade's DNA Project - <http://www.jacksonbrigade.com/dna-project/>
International Society of Genetic Genealogy (ISOGG) - <http://www.isogg.org>
Family Tree DNA - <https://www.familytreedna.com>
Ancestry DNA - <http://dna.ancestry.com>
23andMe - <https://www.23andme.com>
Geno 2.0 - <https://genographic.nationalgeographic.com>

Books on Genetic Genealogy

1. **Trace Your Roots with DNA: Using Genetic Tests to Explore your Family Tree** by Megan Smolenyak and Ann Turner, Rodale, 2004. Best single book on subject.
2. **Hey, America, Your Roots are Showing** by Megan Smolenyak, Citadel Press, 2012. Very good follow up of Megan's first book.
3. **DNA and Social Networking: A Guide to Genealogy in the Twenty-First Century** by Debbie Kennett, The History Press, 2011. Very good book.
4. **Genetic Genealogy: The Basics and Beyond** by Emily D. Alicino, AuthorHouse, 2014. Not as good as Megan and Ann's book but discusses recent developments.

Resources

Books on Ancient Ancestry

- **The Seven Daughters of Eve** by Bryan Sykes, Norton Press, 2001. National Bestseller, very readable book on the science that reveals our genetic ancestry.
- **Saxons, Vikings, and Celts** by Bryan Sykes, Norton Press, 2006. The genetic roots of Britain and Ireland. Very readable.
- **Journey of Man: A Genetic Odyssey** by Spencer Wells, Random House, 2002. Story of human origins in Africa and dispersals across the world.
- **Deep Ancestry: Inside the Genographic Project** by Spencer Wells, National Geographic, 2007. Describes the National Geographic's Genographic Project.