

Big Changes with BigY:

Updates on Y-DNA Testing

Baltimore County Genealogical Society

April 28, 2024

Andrew Hochreiter

Objectives



- Use **Y-DNA** results to research the **Patrilineal line**.
 - Identify **father's father's** (etc.) ancestral heritage.
- Y chromosome **basics**, types of **markers**, and how results help find **male relatives**.
- **BigY 700 test** (Rolls Royce of Y-DNA tests).
 - Y-DNA in **genealogically relevant timeframes**.
 - New **“Discover”** tools at FTDNA.
 - Tools for **surname projects/paternal research**.
- Convince **Jim Cross** to take the BigY test.

Y Chromosome

- The Y chromosome is the **sex-determining** chromosome in humans
- Y-chromosome has about **59 million base pairs**
- Y does not have matching chromosome, so it **escapes recombination** every generation
- Y-DNA is passed down through the **male line** with only random mutation



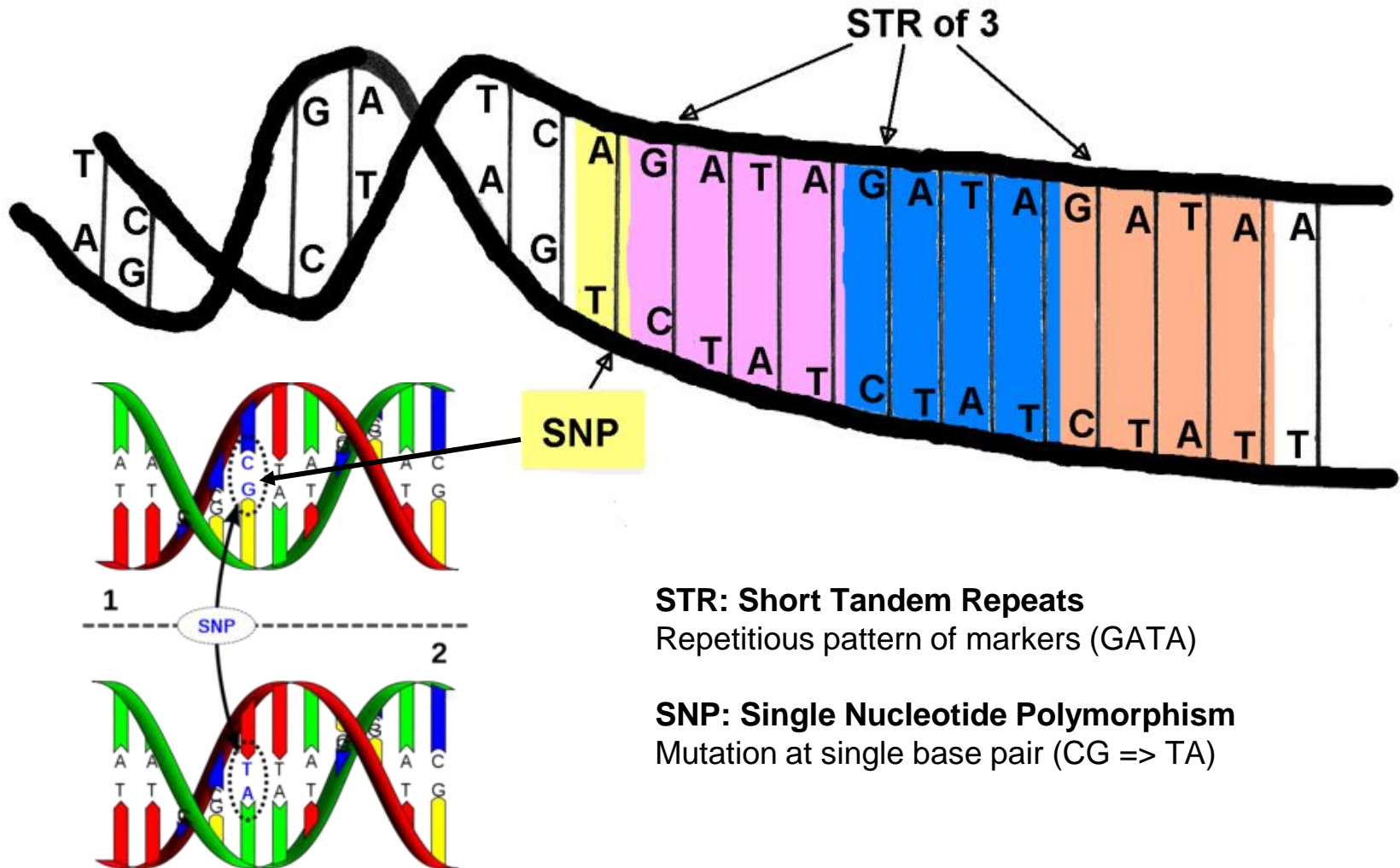
Y-DNA Tests

- Y-DNA Test in use longest, best track record
- Only **males** inherit the Y chromosome, so can **only** be used to trace the **direct paternal line**
- Great genealogical value since Y-DNA has same inheritance pattern as **surnames**
- Uses 2 types of markers: **STRs** and **SNPs**
 - **Short Tandem Repeat**
 - **Single Nucleotide Polymorphism**

Y-DNA Test Evolution

- **STR testing**
 - Number of markers increased
 - 12 > 25 > 37 > 67 > 111 > 500 > 700
- **SNP testing**
 - Expanding number of SNP discoveries
 - New Terminal Branches on Y Tree
- **Big Y**
 - Walk through the Y
 - Big Y advancement caused SNP “tsunami”

STRs & SNPs

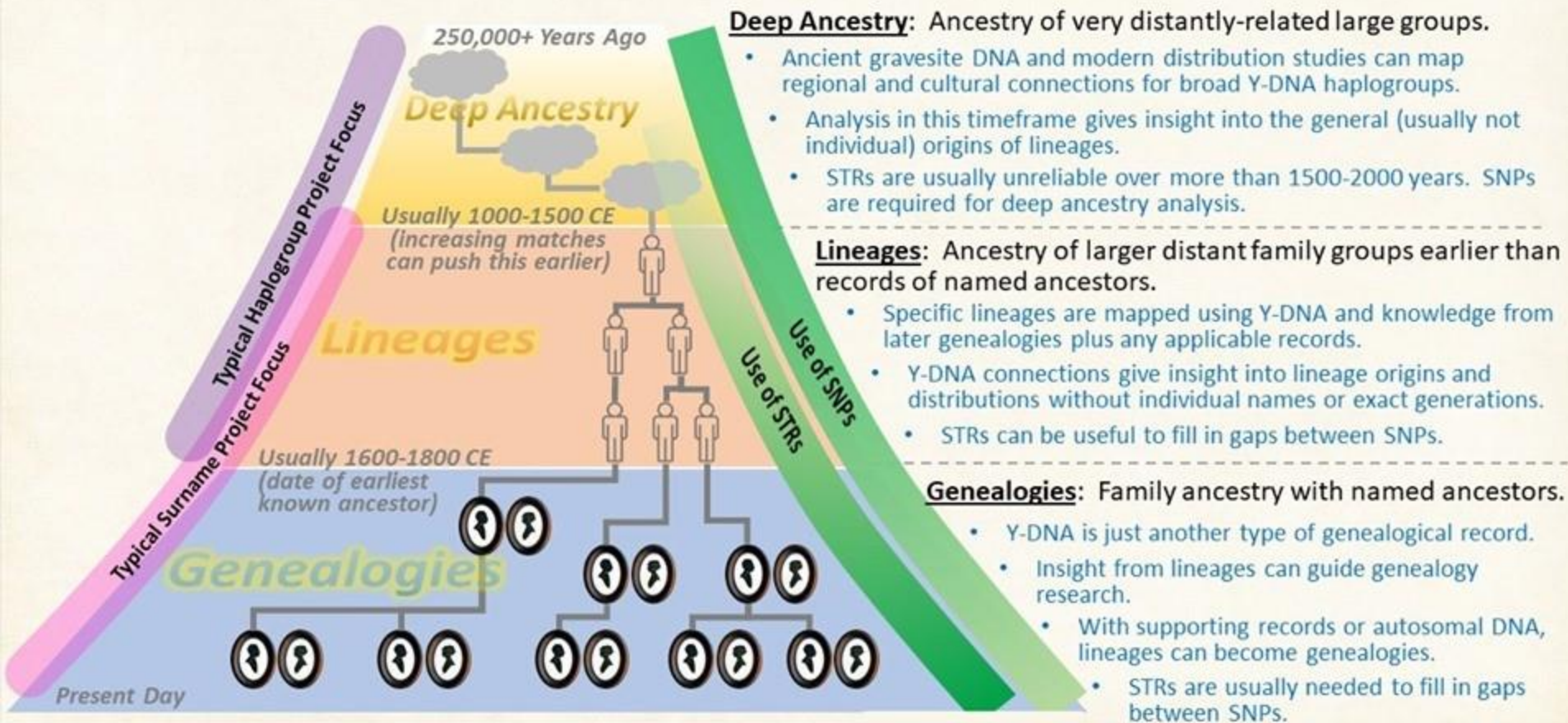


Differences of STRs & SNPs

- **STRs** represent **Haplotypes**
 - Determine **matches in recent times**
 - Past 500 years
 - STR changes happen often
 - Can differ between father and son
- **SNPs** define **Haplogroups**
 - Ancient Origins - thousands of years
 - SNPs happen infrequently
 - SNPs inherited from same ancestor
 - Everyone sharing a particular Y-SNP is related

Y-DNA in Genealogy

Y-DNA: Three Periods of Ancestry

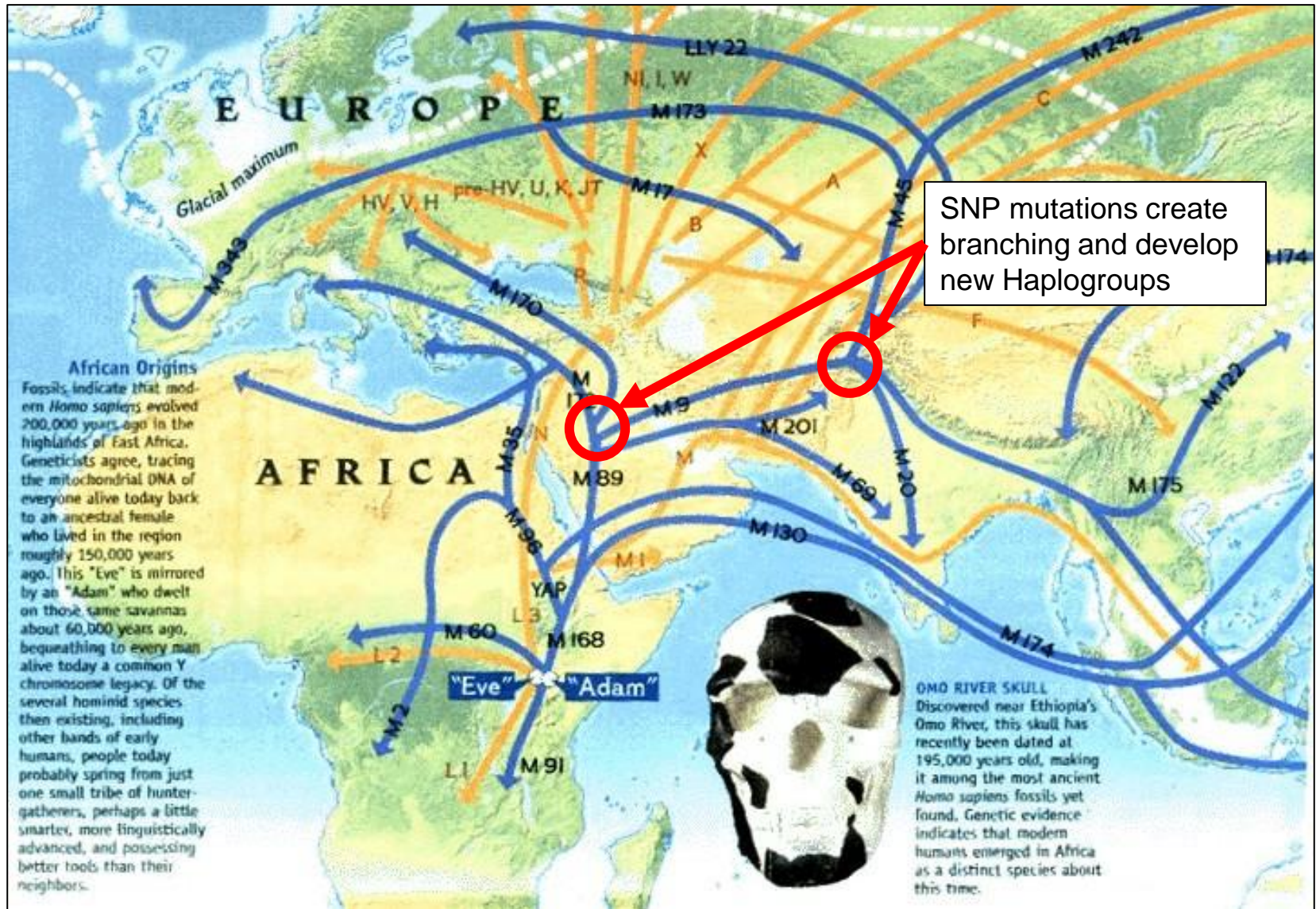


Note: Borrowed with permission from David Vance

Haplogroups

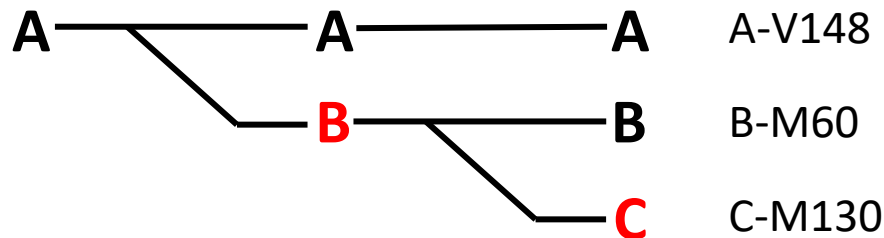
- **Genetic group** of people who share a **common ancestor** on patrilineal or matrilineal line
- Haplo (haploid) = single (refers to single copy)
- **Y-DNA & mtDNA** Haplogroups are different
- Haplogroups are defined by **SNPs (mutations)**
 - All descendants will carry that mutation
 - Main branch has sub-branches or “**subclades**”
- **Y-DNA phylogenetic tree**
 - History of human relatedness and migration.
 - Unlike autosomal DNA, which mixes within a population, Y-DNA unambiguously traces a family’s male line.

SNP Branching of Haplogroups

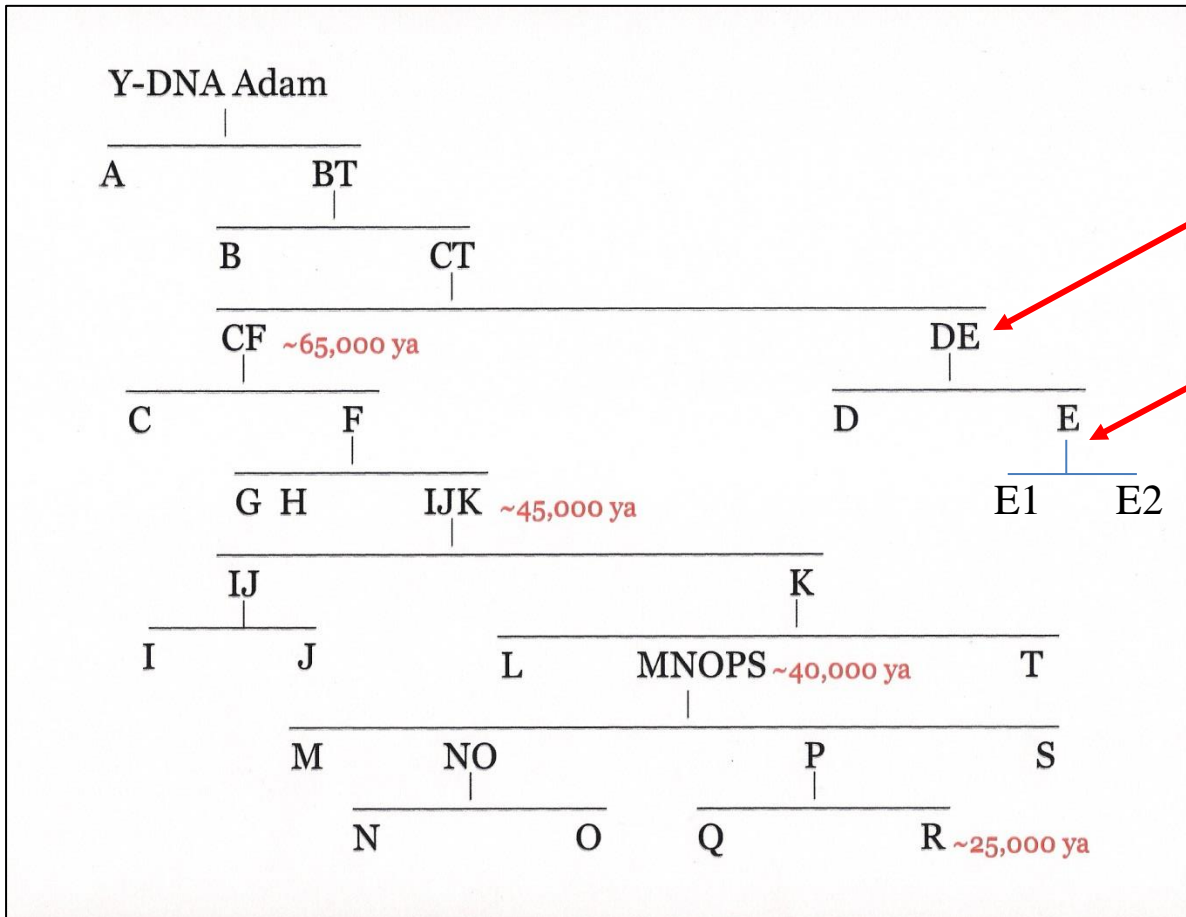


Y-DNA SNP Tests

- **Single Nucleotide Polymorphism (SNP)**
- Also called **Y Haplogroup** Test
- Used for **Patrilineal Deep Ancestry**
- Each **subclade** has a SNP of its own
- First mutation split Haplogroup A into A and B
- Each mutation divided tree into finer branches
- Defined by **Terminal SNPs**



Y-DNA Haplogroups



SNP mutation
divides Branch

Each Haplogroup
has Subclades

Y DNA STR Matching

- STRs were used to determine male relatedness
- Increased from 12 to 11, now 700 in BigY
- Relationships determined by the **first 111 STR markers**, not the additional STR markers
- Results above 111 markers not available on the public project pages
- “Every family group who is participating in Y DNA testing wants to discover markers that delineate between various male lines descending from a specific progenitor.”*

*The Big Y Test Increases Again to Big Y-700, DNAeXplained – Genetic Genealogy, Posted on January 30, 2019 by [robertajestes](#)

Y-DNA STR Matches

The screenshot shows the FamilyTreeDNA interface for Y-DNA matches. At the top, there are navigation links: Home, Results & Tools, Family Tree, and Group Projects. The user's name, Andrew Ho..., and kit number, N45041, are visible in the top right. The page title is "Y-DNA Matches". Below the title, there are two view options: "Detail View" and "Table View", with "Table View" selected and circled in red. There is also an "Exact Search" checkbox and a search bar. Below the search bar, there are filters for the number of markers tested: "111 Markers (6)", "67 Markers (20)", "37 Markers (13)", "25 Markers (17)", and "12 Markers (41)". The "111 Markers (6)" filter is circled in red. There is also a "Filter" button and an "Export CSV" button. The main content is a table with the following columns: Name, Markers Tested, Genetic Distance, Big Y STR Diff, Y Haplog, Paternal Country of Origin, Paternal Earliest Known Ancestor, and Actions. The first row of the table has "1 step" circled in red. A callout box is overlaid on the table, containing the text: "Two views: Detail & Table Number of Markers Comparison: In 111 differences difference of 1 Terminal SNP".

FamilyTreeDNA Home Results & Tools Family Tree Group Projects Add Ons & Up Andrew Ho... Kit No. N45041

Y-DNA Matches Help

Detail View Table View Exact Search Search All

111 Markers (6) 67 Markers (20) 37 Markers (13) 25 Markers (17) 12 Markers (41) Filter Export CSV

Name	Markers Tested	Genetic Distance	Big Y STR Diff	Y Haplog	Paternal Country of Origin	Paternal Earliest Known Ancestor	Actions
[Redacted]	1 to 700	1 step	3 of 642	E-BY5856	Unknown Origin		[Icons]
[Redacted] chreiter	1 to 700	2 steps	4 of 632	E-BY5856	Germany	Johann Hochreutter, b. ca 1654 d. 15 Apr 1719	[Icons]
[Redacted] am T. er	1 to 700	3 steps	3 of 579	E-BY5856	Germany	Johann Hochreutter, b. ca 1654 d. 15 Apr 1719	[Icons]
[Redacted] ochreiter	1 to 700	4 steps				Johann Baptist Hochreiter ca 1828 Bavaria	[Icons]
[Redacted] ochreither	1 to 700	5 steps				Johann Hochreutter b ca 1654 d 1719	[Icons]
[Redacted] rrence er	1 to 700	5 steps	4 of 633	E-FT123780	Germany	Johann Hochreutter B: ca 1654 D: 1719	[Icons]

Two views:
Detail & Table
Number of Markers Comparison:
In 111 differences difference of 1
Terminal SNP

Big Y Results

- **Big Y introduced in 2014**
 - Provided deep SNP testing
- **Big Y 500 introduced in 2017**
 - Provided +389 STRs beyond 111 markers
 - Free Upgrade to Big Y testers
- **Big Y 700 introduced in 2019**
 - Provided +200 more STRs
 - Must pay and retest for additional STRs

Big Y Test

- Big Y introduced in **2014**
- **GOAL**: Read all of the Y chromosome that was useful for genealogical purposes
- Huge **Impact** on Y-DNA Science

Chromosome Y has roughly 57,200,000 nucleotides or base pairs (*bp*).



Roughly 23.6 Mbp of chromosome Y (white) are genealogically relevant

*Genealogically relevant regions (white) are those that are passed intact from father to son with high fidelity
Other regions are either a) highly repetitive sequence (black: inaccessible to NGS sequencing technology)
or, b) subject to recombination with chrX (grey; pseudo autosomal regions PAR1 and PAR2)
and therefore of limited utility for genealogical applications.**

*Big Y-700 White Paper, Family Tree DNA, March 22, 2019

New SNP Research

- Revealing thousands of **new SNPs**
- Y-DNA Tree has finer details (**more subclades**)
- In past, SNPS represented mutations that happened thousands of years ago
- New SNPS in the past 100-500 years
- Currently 25,000 SNPs, could reach 250,000
- More **geographic** granularity
- Possible “**Family SNPs**”

Big Y 700 Improvements

- New Chemistry
 - More uniform coverage of Y chromosome
 - Quality reads of regions previously unavailable
 - Provides more consistent results
 - Provides better coverage, fewer no-reads
 - Allows for more STRs to be accessed and reliably read

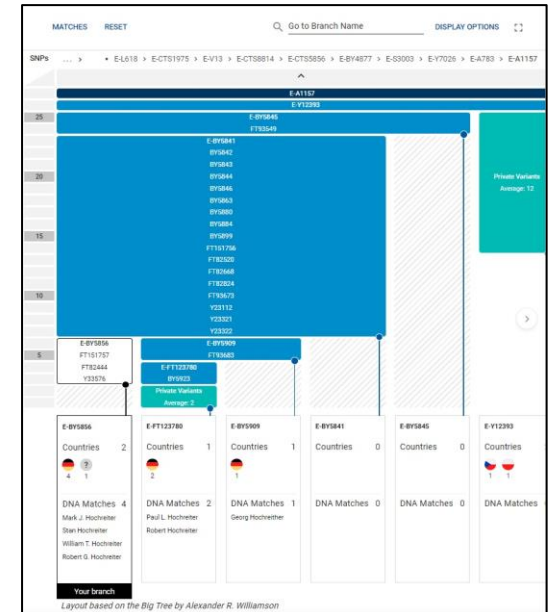
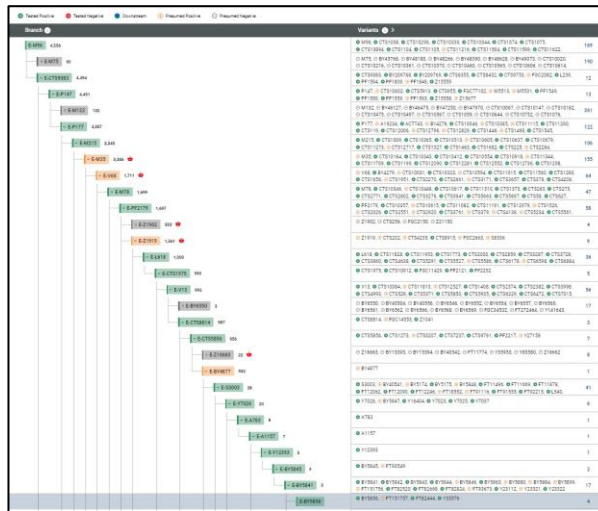
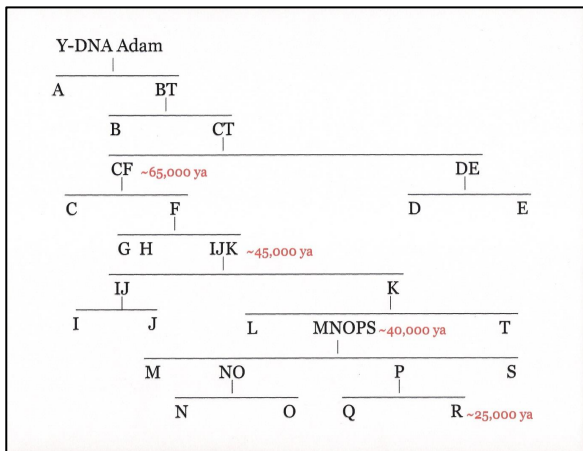
Big Y Tools

- These tools provide the means to compare your results to others who took Y-DNA tests to explore your terminal SNP and ages of various mutations.

The screenshot displays the 'Paternal Line Ancestry' section of a website, specifically the 'Y-DNA Results & Tools' page. At the top right, there are navigation buttons for 'Y12', 'Y25', 'Y37', 'Y67', 'Y111', and 'Big Y-700'. Below the title, a subtitle reads 'Follow the migration paths of your paternal line's ancestors, and connect with your Y-DNA matches.' The completion date is 'Results Completed: March 3, 2007', and a 'Helpful Information' link is available. A row of tool buttons includes 'Y-DNA Matches', 'Migration Maps', 'Haplotree & SNPs', and 'Discover™ Haplogroup Reports', with a 'See More' button below. The 'Big Y' section, completed on 'July 16, 2019', features buttons for 'Block Tree', 'Discover™ Haplogroup Reports', 'Big Y Matches', 'Results', 'Y-STR Results', and 'Discover™ Globetrekker' (marked as 'NEW').

New Big Y Block Tree

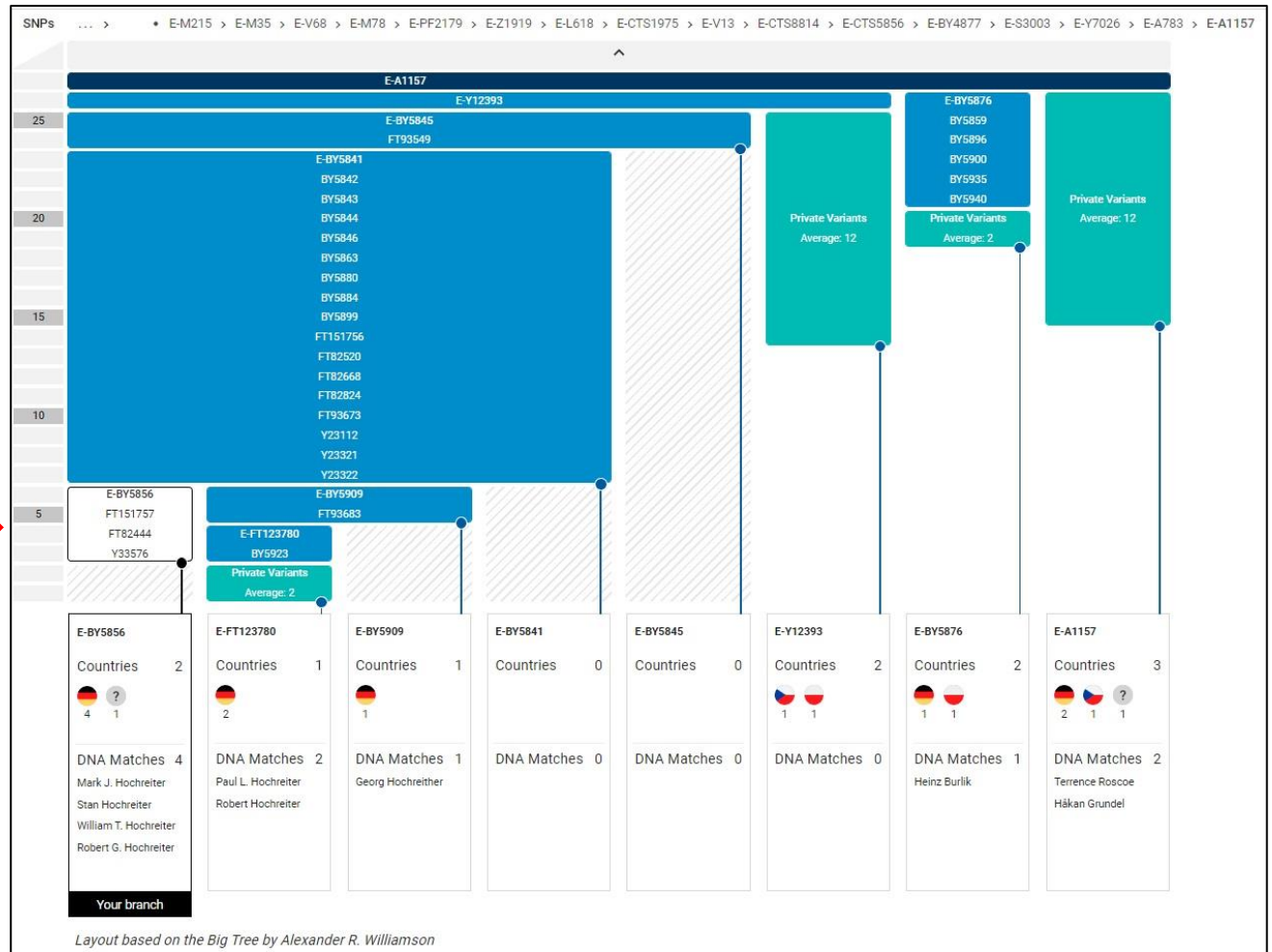
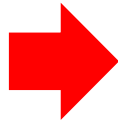
- Personalized Tree showing all your SNPs from ancestral (original value) to derived (mutated state)



Big Y Block Tree Features

Distance, Years & SNPs

The general consensus is that a **SNP generation** is someplace, on average, between **80 to 140 years**. Each SNP represents one grey block



Big Y SNP Matching

Big Y - Results ? Help

Named Variants Private Variants **Matching**

Understanding Your Terminal SNP Matches

Our Big Y Block Tree uses a block diagram of the Y-DNA Haplotree to show the relationship between you and other Big Y testers. View information about how you and other testers match and to potentially find more matches.

[View Big Y Block Tree](#)

About Analyzed Variants

Total # of variants considered for matching = **1,189,781**
Number of matching, non-matching, and no call variants will total up to 1,189,781 for each pair of samples

[Visit our Help Center to learn more.](#)

Match Name ⓘ	Non-Matching Variants ⓘ	Shared Variants ⓘ	Match Date
<input type="text" value="Name Search"/>	<input type="text" value="SNP Name Search"/>		<input type="text" value="Match Date Search"/>
Robert Hochreiter ✉ 💬	BY5856, BY5909, BY6371, Y33576, BY227601, FT82444, FT93683, FT123780, 9700324	553465	9/10/2019
Mr. William T. Hochreiter ✉ 💬	RS201037639, BY28839, BY26320, BY26321, FGC28437, BY26322, BY26323, BY26364, BY27110, BY227922, FGC77964	455784	7/15/2019
Robert George Hochreiter ✉ 💬	CTS12458, 12273535, BY26985, BY26986, RS201037639, BY28839, BY26364, BY26736, RS933917739, RS9633271, BY227922	447604	7/15/2019
Mr. Heinz Burlik ✉ 💬	BY4056, BY5845, BY5842, BY5843, BY5863, BY5856, BY5844, F11558, BY5841, BY5896, BY5859, 16087012, BY5855, BY5858, BY5857, BY5856	455054	7/15/2019

The Matching tab displays your Big Y terminal SNP matches. Your terminal SNP determines the terminal (final) subbranch (on the Y-DNA Haplotree) to which you belong. A person is considered a match if they have 30 or fewer differences in SNPs with you.

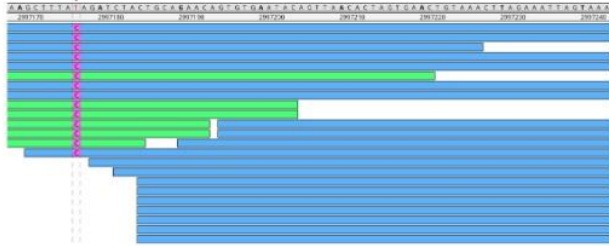
SNP Named Variants

Big Y - Results ? Help

Named Variants Private Variants Matching Download Files

SNP BY101 Genotype C Reference T Confidence High Position 2997177

Forward Read Reverse Read Low Quality Medium Quality High Quality



Y-Chromosome Browsing Tool

The Y-Chromosome browsing tool allows you to view forward and reverse reads for any SNPs in your profile.


To view your results, click on the SNP name within the left-most column of the table below.

The Named Variants tab displays your SNPs that are on the list of ~400,000 known SNPs against which Big Y data is compared.

SNP Name ⓘ	Derived? ⓘ	On Y-Tree? ⓘ	Reference ⓘ	Genotype ⓘ
<input type="text" value="SNP Name Search"/>	Yes (+) ▾	Show All ▾	Show All ▾	Show All ▾
A1157	Yes (+)	Yes	G	T
A13102	Yes (+)	No	A	A
A13510	Yes (+)	No	T	A
A16460	Yes (+)	No	G	C
A18095	Yes (+)	No	T	G
A18725	Yes (+)	No	T	A
A18919	Yes (+)	No	G	A
A20016	Yes (+)	No	T	C
A2465	Yes (+)	No	G	G

SNP Private Variants

Big Y - Results ? Help

Named Variants **Private Variants** Matching Download Files 

SNP BY101 Genotype C Reference T Confidence High Position 2997177






■ Forward Read ■ Reverse Read ■ Low Quality ■ Medium Quality ■ High Quality

Y-Chromosome Browsing Tool

The Y-Chromosome browsing tool allows you to view forward and reverse strands for any SNPs in your profile.

To view your results, click on the SNP name with

The Private Variants tab displays your SNP markers that are not on the list of ~400,000 known SNPs

Position 	Reference 	Genotype 
<input type="text" value="Position Search"/>	Show All 	Show All 

No Private Variants

Y-Chromosome Browser Tool



FamilyTreeDNA Discover

FamilyTreeDNA Home Discover™

Big Y Experience
E-BY5856

Example: R-M222
Search another haplogroup

Haplogroup Story

- Country Frequency
- Notable Connections
- Migration Map
- Globetrekker **NEW**
- Ancient Connections
- Time Tree
- Ancestral Path
- Suggested Projects
- Scientific Details
- Compare
- About

Your Haplogroup Story: E-BY5856

[Share Page](#) [Help](#)

The Y chromosome is passed from father to son remaining mostly unaltered across generations, except for small traceable changes in DNA. By tracking these changes, we constructed a family tree of humankind where all male lineages trace back to a single common ancestor who lived hundreds of thousands of years ago. This human tree allows us to explore lineages through time and place and to uncover the modern history of your direct paternal surname line and the ancient history of our shared ancestors.

The E-BY5856 Story

E-BY5856's paternal line was formed when it branched off from the ancestor **E-BY5841** and the rest of mankind around 1700 CE.

The man who is the most recent common ancestor of this line is estimated to have been born around 1850 CE.

He is the most recent paternal line ancestor of all members of this group.

There are 5 DNA tested descendants, and they specified that their earliest known origins are from:

- Germany
- 1 from unknown countries

But the story does not end here! As more people test, the history of this genetic lineage will be further refined. Ask your **matches or group project members** who haven't yet tested with Big Y to join you in discovering new insights about your shared ancestry.

[Share your result](#)

Descendants of E-BY5856 are from these countries

Country	Count
Germany	4
Unknown Country	1

Your Haplogroup Badges

- Modern Age
- Big Y Confirmed

Discover Sources

You already have the Big Y test!

Your haplogroup information will change and be refined over time as more people test their Y-DNA. We are always adding more connections and features so check back often to see what new information is available!

You can also discover more about your other ancestral paternal lineages by testing the Y-DNA of your maternal grandfather, uncles, and genetically male cousins.

Where does this information come from?

FamilyTreeDNA Y-DNA Database

The longest-running, largest, and most comprehensive Y-DNA database with hundreds of thousands of testers from 200 different countries around the world.

Phylogenetics

The FamilyTreeDNA Y-DNA Haplotree is the largest and most comprehensive phylogenetic Tree of Humankind based on the largest database of high-coverage Y-DNA sequences. It is curated by phylogenetic specialist Michael Sager.

Ancient DNA

Thousands of ancient DNA samples spanning tens of thousands of years of human history from archaeological remains from all corners of the world.

Population Genetic Studies

Thousands of genomes from hundreds of studies of present-day individuals from around the world, including many populations from parts of the world that are otherwise underrepresented in DNA testing databases.

TMRC Algorithm

The state-of-the-art FamilyTreeDNA algorithm for inferring age estimates for the Y-DNA Haplotree. Developed together with Iain McDonald.

FamilyTreeDNA Group Projects

Citizen science research performed by volunteers for thousands of different projects, each specializing in research of different lineages, surnames, and regions of the world.

Carlos Quiles

Dr. Carlos Quiles runs the Indo-European.eu website and has collected and curated a large list of ancient DNA samples and associated metadata, some of which has been used for this website.

Genographic Project

National Geographic's global, citizen science project that helped map ancient human migration. The Project team employed dozens of international scientists and data from over one million people. Although the Project ended in 2020, the research continues.

The Community

This project would not be possible without all the testers, each one providing one more piece to the great puzzle of human history.

Discover Country Frequency



Country Frequency Map For Haplogroup E-BY5856

This is where your direct paternal haplogroup is most commonly found today based on self-reported information from hundreds of thousands of Y-DNA testers and participants in academic studies.

Hover your cursor over or click each country to learn more! You can also find more details in the Table view.

Country Frequency Map For Haplogroup E-BY5856



[Map](#) [Table](#)



* Based on self-reported earliest known direct paternal countries of origin from participants.

Country Frequency Table For Haplogroup E-BY5856

[Map](#) [Table](#)

Country	Number of Tested Descendants	Haplogroup Frequency
 Germany	4	< 1%
 Unknown Origin	1	

* Based on self-reported earliest known direct paternal countries of origin from participants.

Discover: Other SNPs



Your Y-DNA Haplogroup Report for E-V13

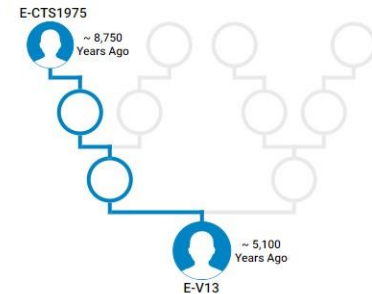
The Y chromosome is passed from father to son remaining mostly unaltered across generations, except for small traceable changes in DNA. By tracking these changes, we constructed a family tree of humankind where all male lineages trace back to a single common ancestor who lived hundreds of thousands of years ago. This human tree allows us to explore lineages through time and place and to uncover the modern history of your direct paternal surname line and the ancient history of our shared ancestors.

The E-V13 Story

Haplogroup E-V13 represents a man who is estimated to have been born around 5,100 years ago, plus or minus 750 years.

That corresponds to about 3050 BCE with a 95% probability he was born between 3809 and 2401 BCE.

E-V13's paternal line was formed when it branched off from E-CTS1975 and the rest of mankind about 8,750 years ago, plus or minus



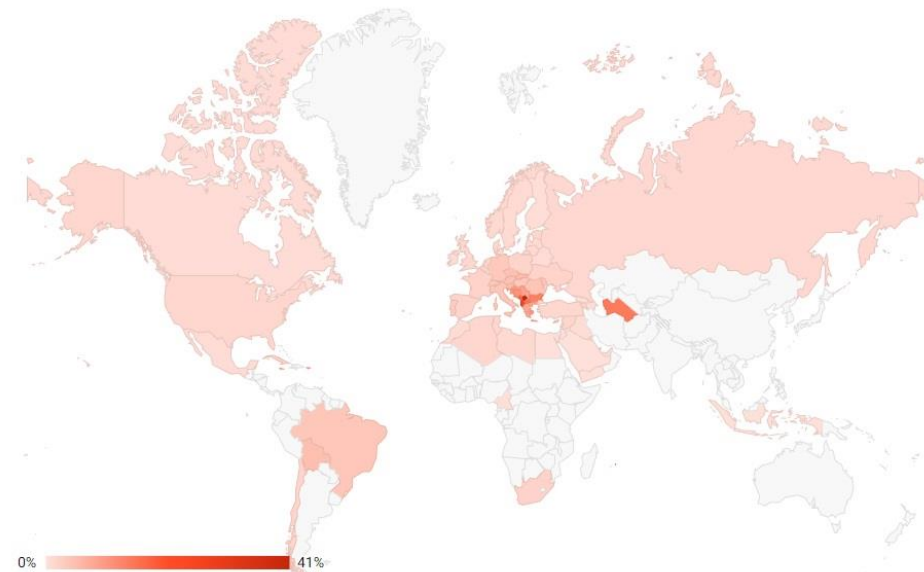
E-V13 descendants are from these countries:

- Germany: 293 Testers
- England: 224 Testers
- United States: 144 Testers
- Other Countries: 77 Countries

** Based on self-reported earliest known direct paternal countries of origin from participants.*

Country Frequency Map For Haplogroup E-V13

Map Table



** Based on self-reported earliest known direct paternal countries of origin from participants.*


at least 2 lineages known as
...ts, and they have
...om Germany, England,
...lineage might be further

Discover Migration



The Estimated Migration Route

All human male lineages can be traced back to a single common ancestor in Africa who lived around 230,000 years ago, nicknamed Y-Adam. Here we show the estimated migration route from Y-Adam to your ancestral haplogroup E-V13 (estimated to 5,100 years ago) and his descendants found in ancient DNA from archaeological remains.

Click the  icons on the map to learn more!

Y-DNA Haplogroups:

Y-Adam

A

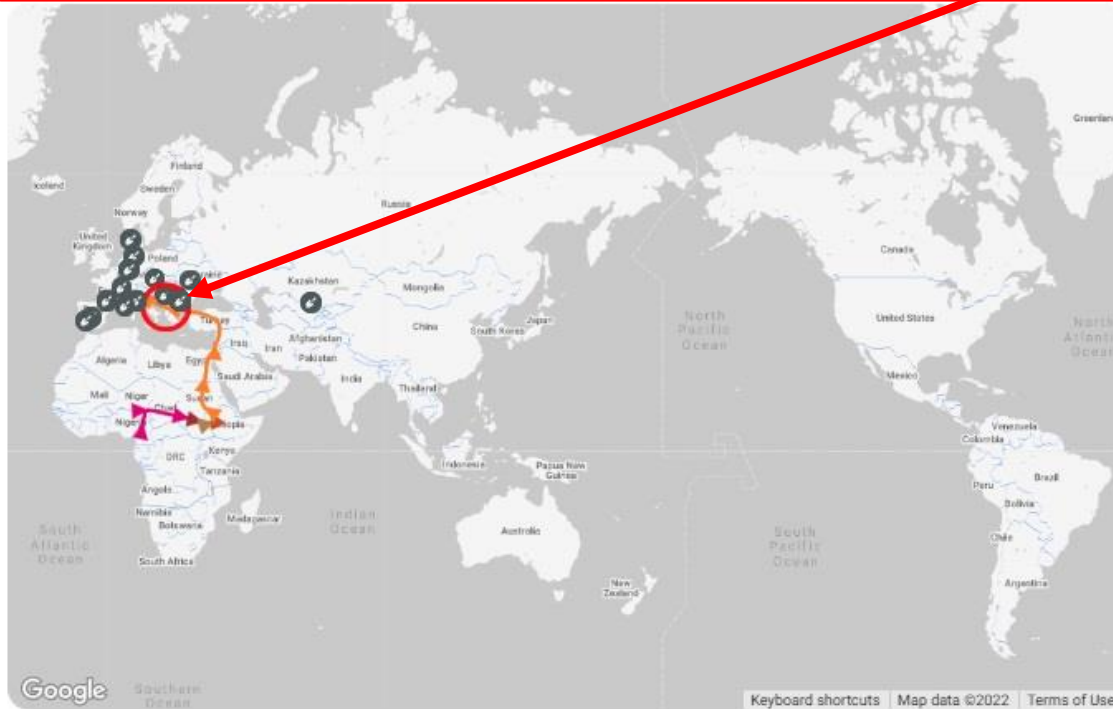
BT

CT

DE

E

E-V13



Globetrekker

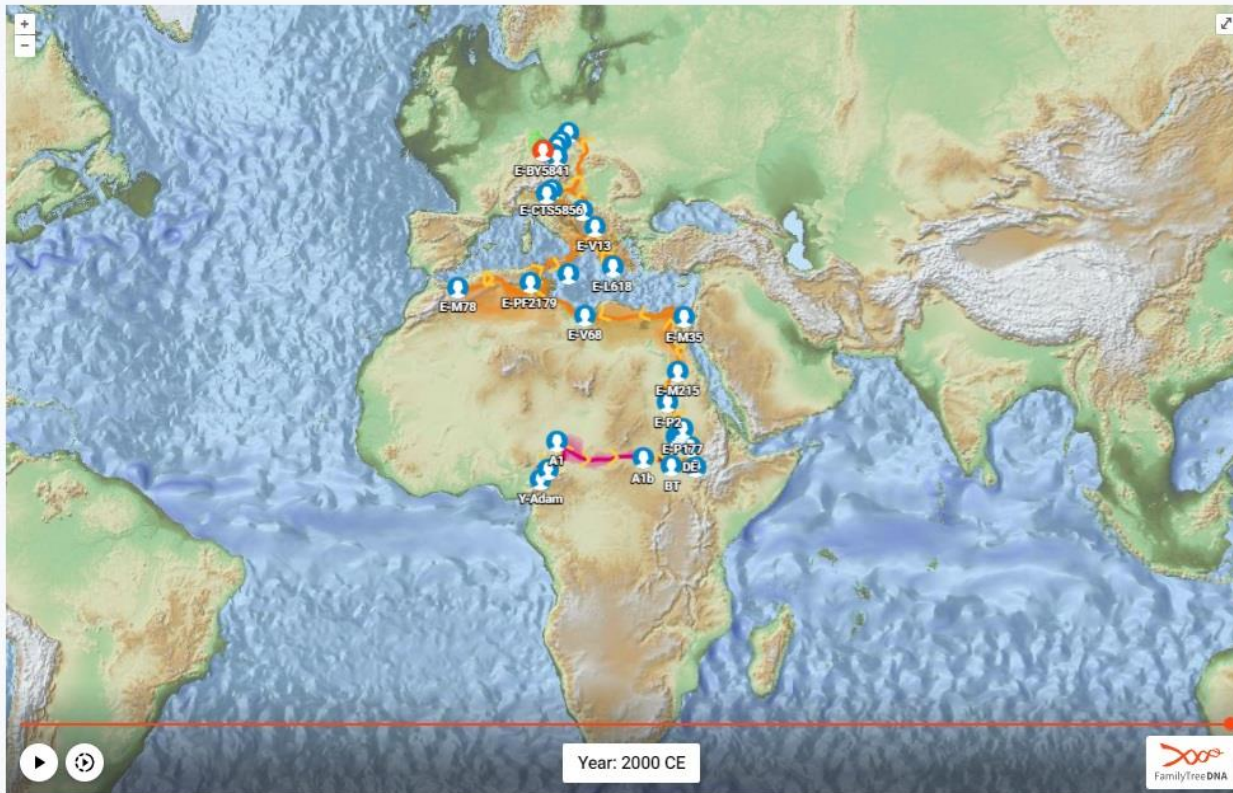
Globetrekker BETA

[Help](#)

Globetrekker estimates geographical ancestor locations and migrations across the world based on the largest database of high-coverage Y-DNA sequences, ancient DNA results from archaeological remains, and user-reported ancestral locations. These are best estimates and will change over time as more people test their Y-DNA and provide information about their paternal line ancestry.

[View more](#) [Release Announcement](#) [Please let us know your thoughts](#) [Caveats](#)

Display Options Simplify Lines Ancient Connections Reset Show Legend



Timeline

Discover Ancient Connections



Ancient Connections

Here are some ancient relatives from your direct paternal line based on DNA testing of archaeological remains from around the world.

- Krakauer 5
- Kapitan Andreevo 20185
- Kapitan Andreevo 20183
- Kapitan Andreevo 20180
- Karatau 1
- Crypta Balbi 107
- Collegno 38
- Sepultura 9
- Árpád 53
- San Nicola 1
- Cancelleria 1219
- Kapitan Andreevo 20181
- Naissus 6764
- Pla de l'Horta 6-1172
- Bogøvej 12077
- Ellwangen 18
- Glinoe197
- Rozovo 19500
- Granada 7457
- Sant Julià 15-1796

You (E-BY5856) and Krakauer 5 (E-S3003)

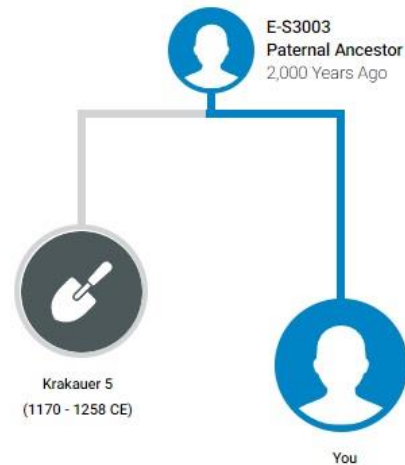
share a common direct paternal line ancestor (E-S3003) who lived around 50 CE (2,000 years ago).

Krakauer 5 was a 10-12 year old boy who lived between 1170 and 1258 CE during the Medieval Age and was found in the region now known as Saxony-Anhalt, Germany.

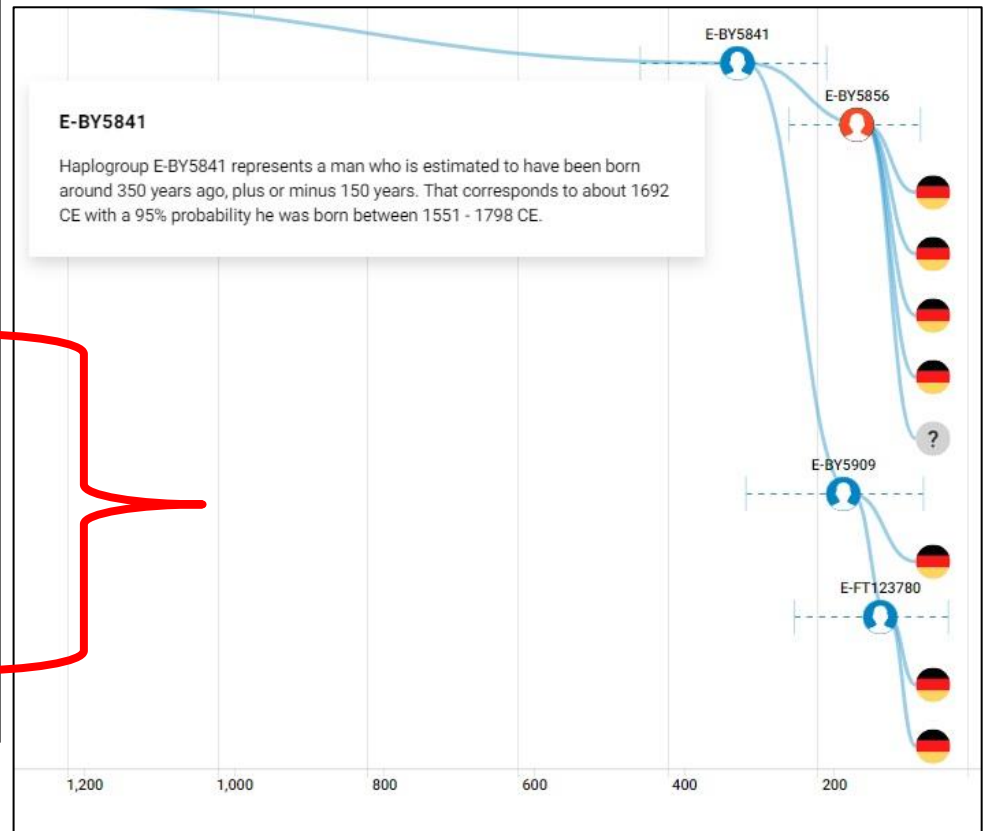
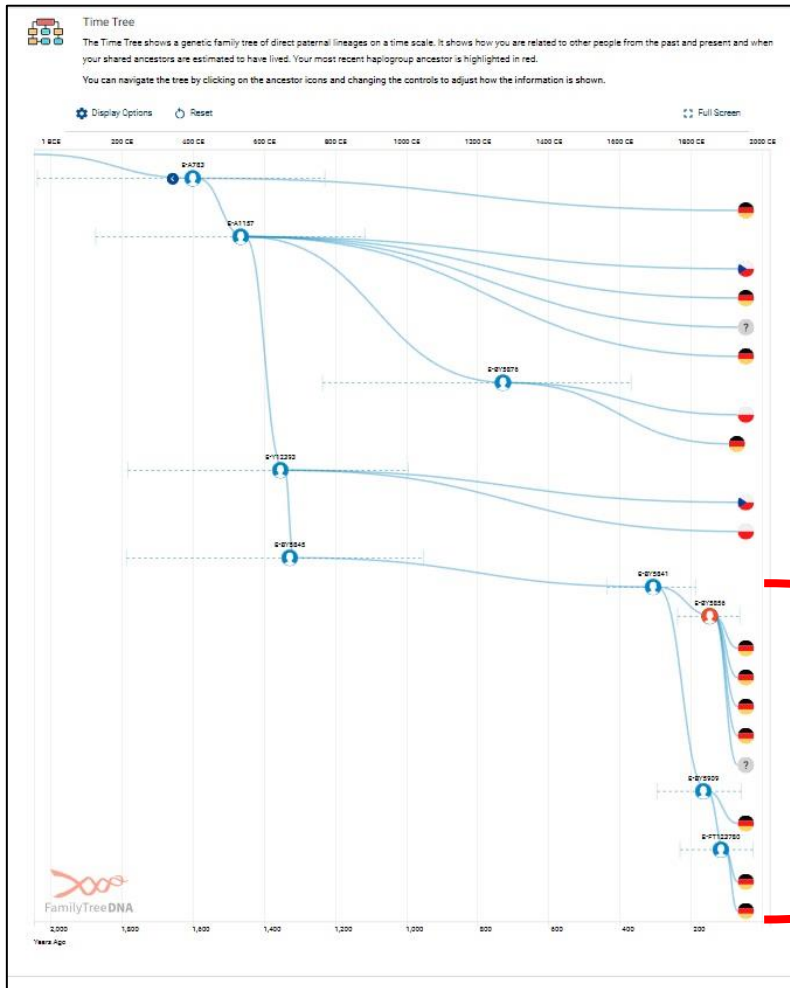
He was associated with the Medieval Germany cultural group.

His direct maternal line belonged to mtDNA haplogroup H23*.

Reference: *KRA005* from *Parker et al.*



Discover Time Tree

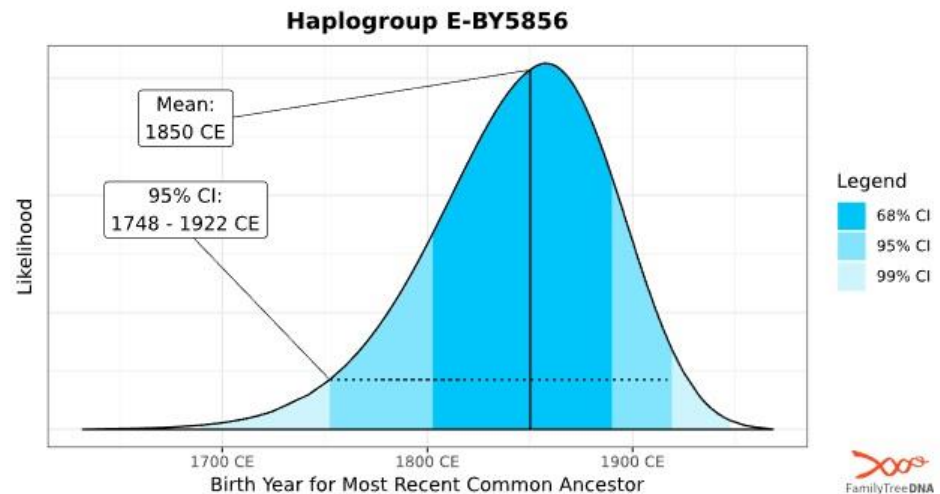


Discover Age Estimate

Age Estimate Variants

The FamilyTreeDNA Time to Most Recent Common Ancestor (TMRCA) estimate (Beta) is calculated based on SNP and STR test results from many present-day DNA testers. The uncertainty in the molecular clock and other factors is represented in this probability plot, which shows the most likely time when the common ancestor was born amongst the other statistical possibilities.

Confidence Interval	Years Before Present	Calendar Date
99%	338 - 72	1684 - 1950 CE
95%	274 - 100	1748 - 1922 CE
68%	219 - 132	1803 - 1890 CE



Rob Spencer's SNP Tracker

The screenshot shows the SNP Tracker web application interface. At the top, there is a search bar containing the SNP ID "J-FT260302" and a "Go" button. A dropdown menu is open, showing a list of examples including "E-M81, J2, R1b Iberian". The main area features a map of Europe and the Mediterranean region with a path of SNPs. A legend in the bottom left identifies time periods: Modern (red), Medieval (orange), Roman (yellow), Iron (green), Bronze (cyan), Neolithic (blue), Mesolithic (purple), and Paleolithic (magenta). A text box in the bottom center provides information about the "Ancient North Eurasian" component. On the right, a "Map Options" panel is visible with various checkboxes.

SNP Tracker J-FT260302 Go

Map Timelines SNPs Discussion History

Enter specific SNP

Y or mt SNP

SNP Tracker was developed by Rob Spencer, a population geneticist. It loads data from FTDNA's BigY database.

Ancient North Eurasian (42,000 to 20,000 years ago) Q R A C

In archaeogenetics, the term Ancient North Eurasian is the name given to a West-Eurasian ancestral component that represents a lineage ancestral to the people of the Mal'ta-Buret' culture and populations closely related to them, such as from Afontova Gora and the Yana Rhinoceros Horn Site, and populations descended from them. ANE ancestry has spread throughout Eurasia and the Americas in various migrations since the Upper Paleolithic, and more than half of the world's population today derives between 5 to 40% of their genomes from the Ancient North Eurasians. Significant... [more...](#)

Map Options

- Zoom to Europe
- Show
- Show Events
- Show
- Show Descendants
- Smooth Path
- Show Uncertainty
- Show Borders
- Show Topography
- Show Rivers

Code version 2022-04-20; Y tree updated 2022-08-30; mt tree updated 2022-08-30

Rob Spencer's SNP Tracker



SNP Tracker by5856

Map Timelines **SNPs** Discussion History Sources

y SNP Path to E-BY5856

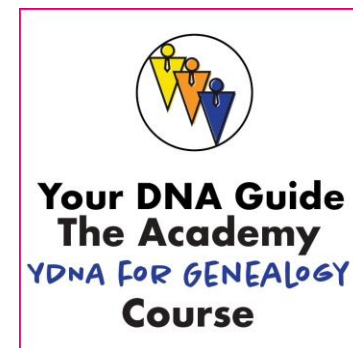
SNP	years before present	95% CL	BCE/CE	era	number of descendants	location information
A-PR2921	240,000	5%	240,000 BCE		226,322	↓
A-L1090	200,000	5%	200,000 BCE		226,311	
A-V168	160,000	6%	160,000 BCE		226,261	🇩🇪 1
A-V221	130,000	7%	130,000 BCE		226,098	
BT-M42	130,000	7%	130,000 BCE		225,748	↓
CT-M168	88,000	8%	86,000 BCE		225,036	↓
DE-M145	88,000	8%	86,000 BCE		19,090	🇩🇪 1
E-M96	69,000	9%	67,000 BCE		18,701	🇩🇪 31, 🇺🇸 21, 🇧🇪 5, 🇮🇹 4, 🇩🇪 4
E-CTS9083	61,000	10%	59,000 BCE		17,964	
E-P147	52,000	10%	50,000 BCE		17,962	↓
E-P177	49,000	11%	47,000 BCE		17,665	🇩🇪 1, 🇮🇹 1, 🇩🇪 1, 🇧🇪 1, 🇮🇹 1, 🇩🇪 1
E-M215	41,000	12%	39,000 BCE		12,428	🇩🇪 5, 🇮🇹 1
E-M35	34,000	13%	32,000 BCE		12,409	↓
E-V68	26,000	15%	24,000 BCE		5,720	🇩🇪 2, 🇮🇹 1, 🇩🇪 1, 🇧🇪 1, 🇨🇭 1
E-M78	20,000	17%	18,000 BCE		5,683	🇩🇪 23, 🇮🇹 18, 🇩🇪 16, 🇮🇹 12, 🇩🇪 11
E-PF2179	14,000	20%	12,000 BCE		5,422	
E-Z1919	13,000	21%	11,000 BCE		4,663	🇩🇪 1
E-L618	12,000	22%	10,000 BCE		3,861	↓
E-CTS1975	12,000	22%	9600 BCE		3,851	🇩🇪 1
E-V13	8,100	27%	6200 BCE		3,833	↓
E-CTS8814	7,100	28%	5200 BCE		3,204	🇩🇪 1
E-CTS8856	5,300	33%	3300 BCE		3,157	🇩🇪 29, 🇮🇹 12, 🇺🇸 9, 🇩🇪 7, 🇮🇹 7
E-BY4877	5,000	34%	3000 BCE		2,314	🇩🇪 3, 🇮🇹 6
E-S3003	2,600	47%	680 BCE		68	🇩🇪 1, 🇩🇪 1
E-Y7026	2,000	54%	0 CE		40	
E-A783	2,000	54%	0 CE		21	🇩🇪 2, 🇮🇹 1
E-A1157	1,800	57%	190 CE		16	🇩🇪 2, 🇮🇹 1
E-Y12393	1,500	62%	450 CE		10	🇩🇪 1, 🇮🇹 1
E-BY5845	1,000	76%	950 CE		8	
E-BY5841	910	80%	1000 CE		8	
E-BY5856	300	140%	1600 CE		5	🇩🇪 4

Y-DNA Continuing Education

- YDNA for Genealogy (Diahan Southard)

Your DNA Guide: The Academy

<https://www.yourdnaguide.com/ydna-course>



- *The Genealogist's Guide to Y-DNA Testing for Genetic Genealogy*

by David Vance

