Genetic Genealogy at the Library

Rob Spencer
Mystic and Noank Library
April-May 2023

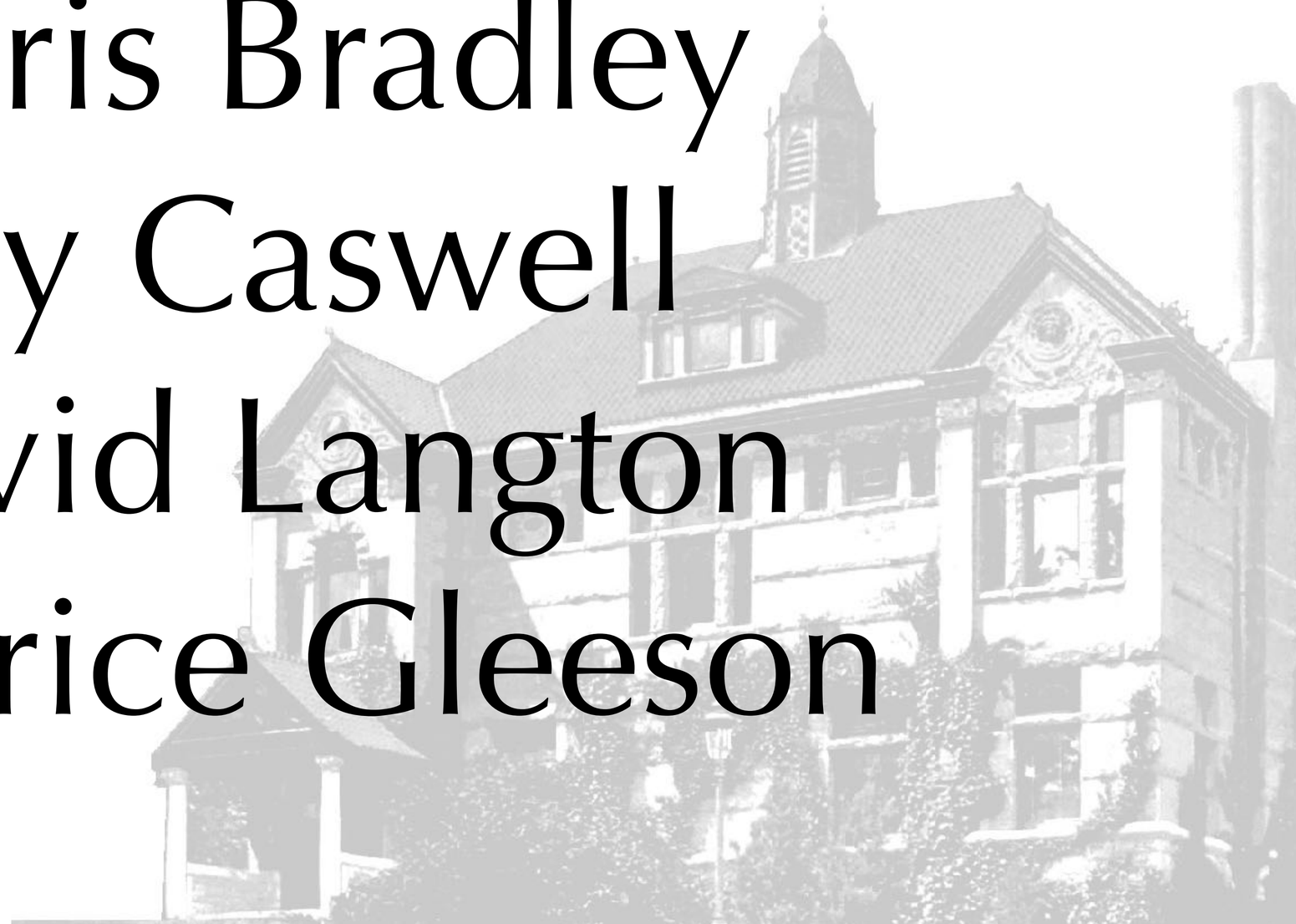
Thanks to

Chris Bradley

Ery Caswell

David Langton

Maurice Gleeson



Three Sessions

5:30-7 PM Tues April 18

Limits of paper genealogy

Typical goals - and yours?

DNA

- structure, replication, mutation
- inheritance: autosomal, Y, mitochondrial
- mutations
- forensic use
- privacy
- choosing a test

5:30-7 PM Mon April 24

Autosomal DNA

colonial to modern

bridging gaps

American immigration

- fertility, documentation
- westward migration

geography and ethnicity

personal case studies

5:30-7 PM Mon May 1

Mitochondrial and Y DNA

prehistoric to feudal

Neanderthals, Out-of-Africa, Beaker invasion

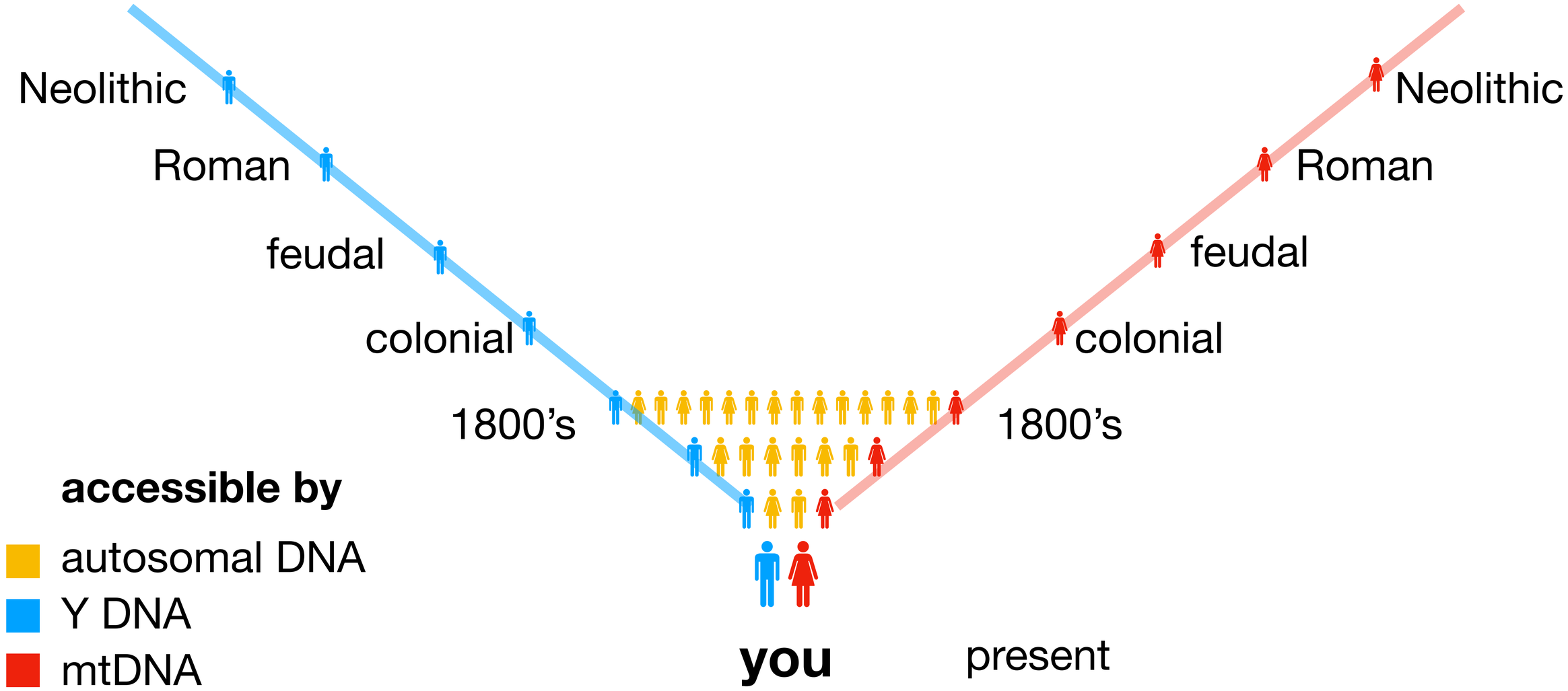
Women survived, men died

Origin of surnames

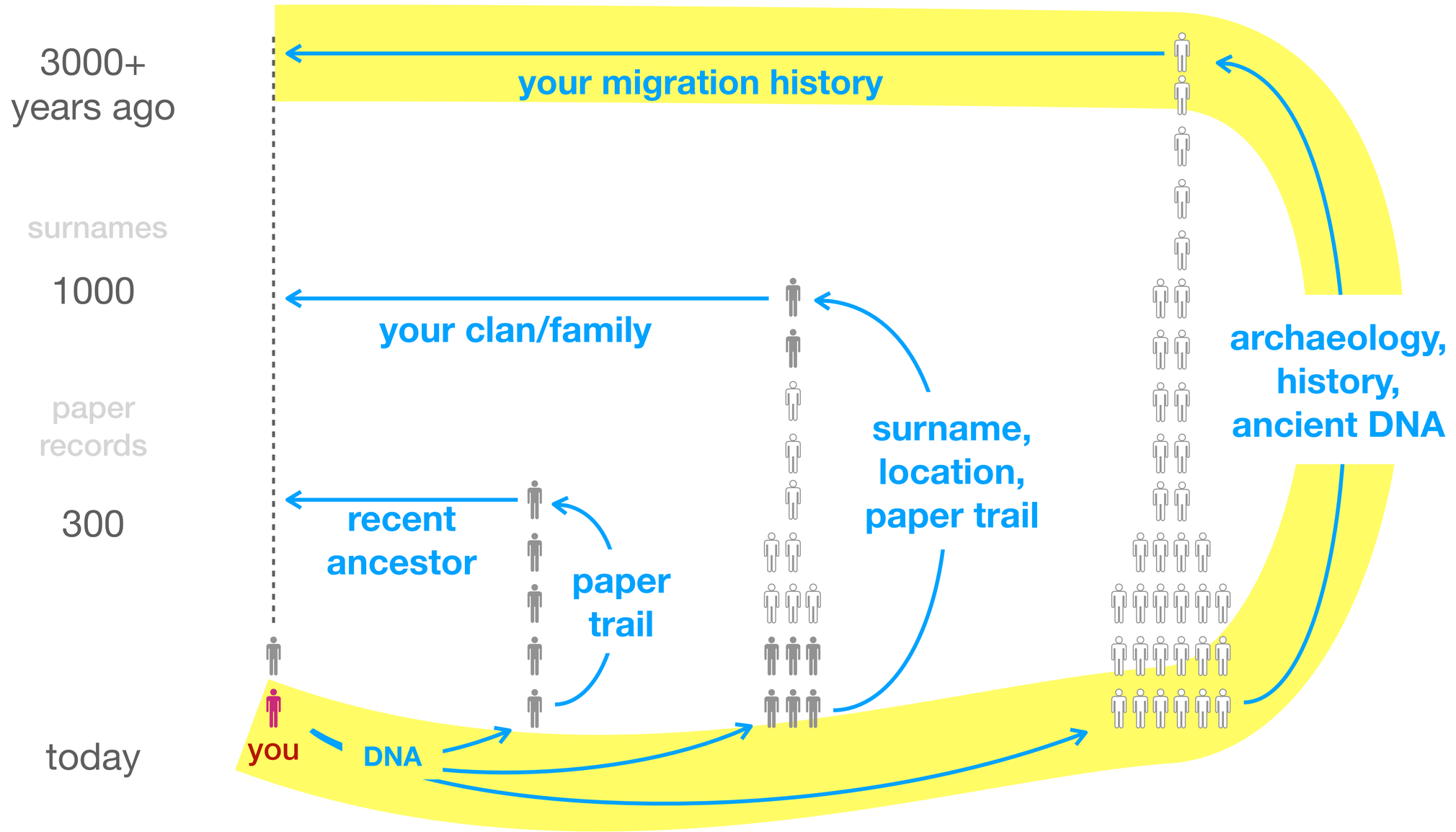
Finding clans and families

personal case studies

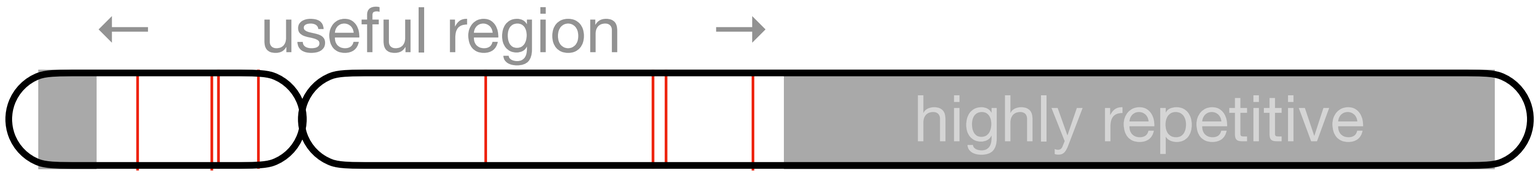
Y and mtDNA

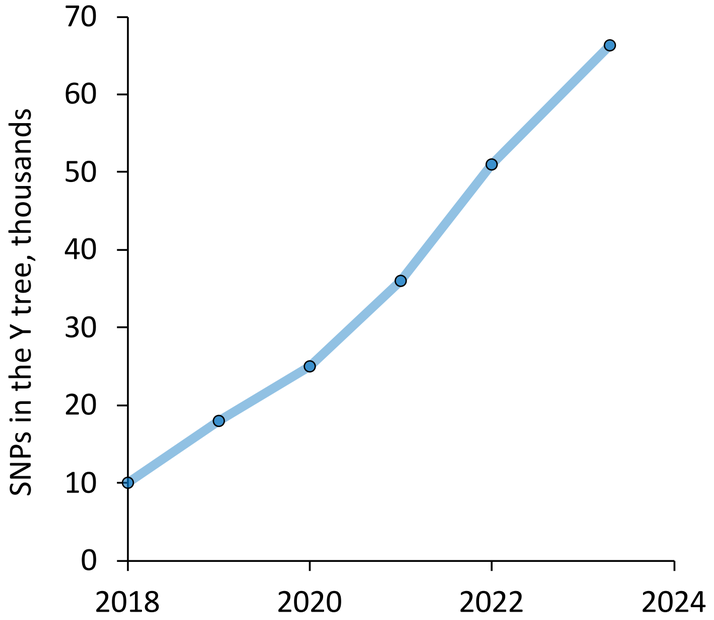

Neolithic
Roman
feudal
colonial
1800's
Neolithic
Roman
feudal
colonial
1800's
accessible by
autosomal DNA
Y DNA
mtDNA
you
present

Y and mtDNA can establish ancestry over long timescales



Y Chromosome





24 million useful basepairs

48,000 men have had their Y chromosome sequenced

80-90 years between SNPs

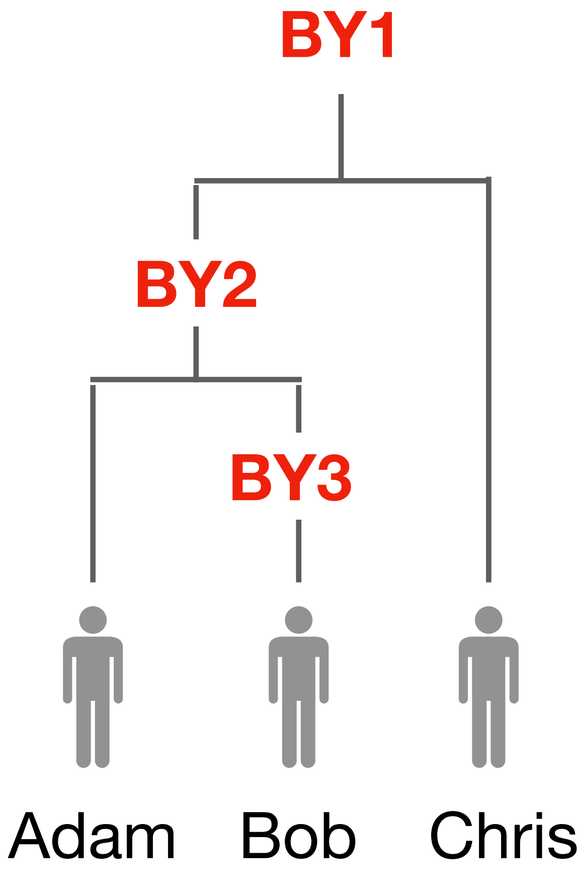
Every man has ~2500 SNPs different from Y Adam

SNPs Generate a Tree

DNA markers (SNPs) encode a **tree** that shows their history. Trees are inferred from the pattern of SNPs:

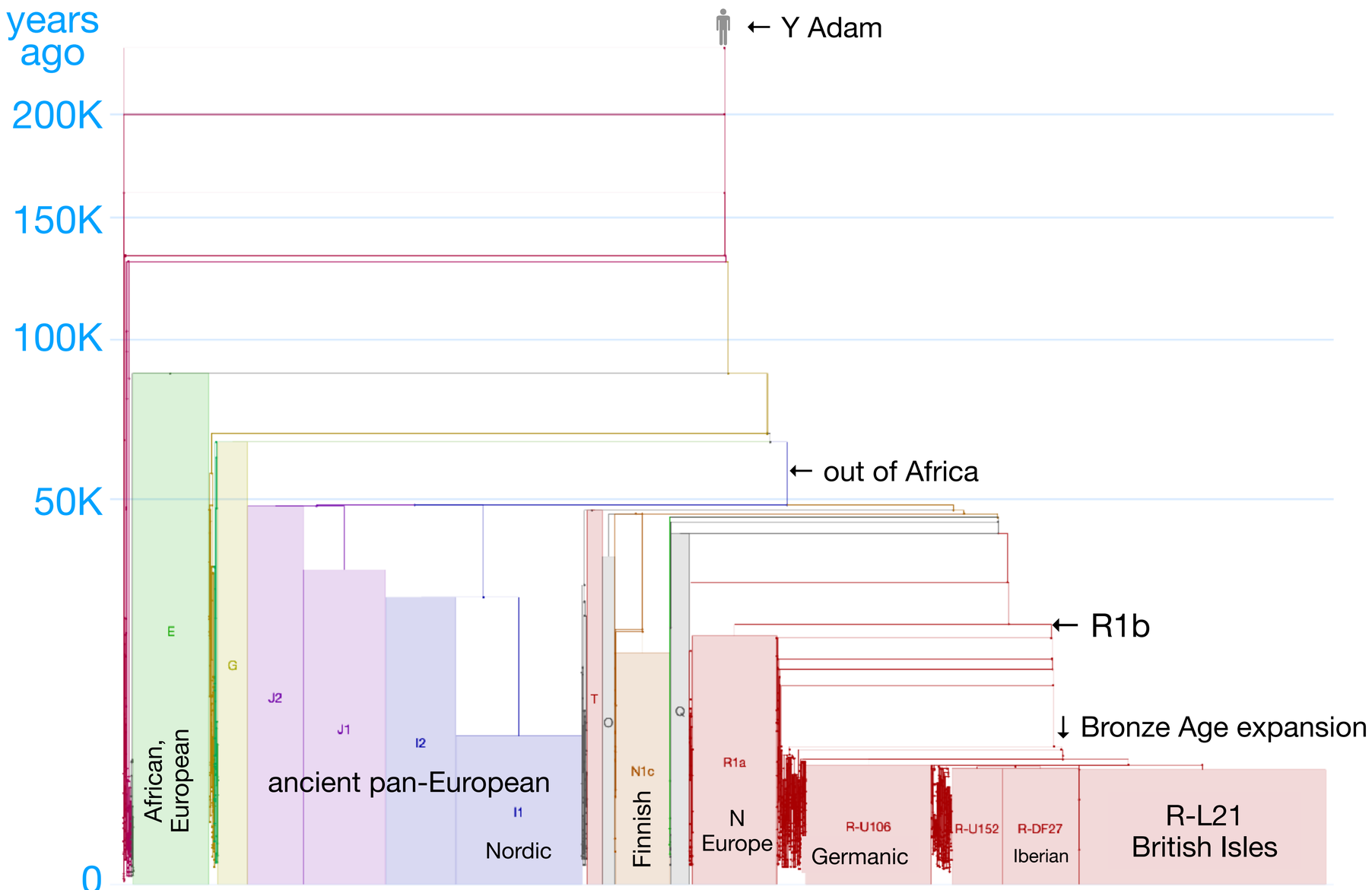
	SNPs Observed
Adam	BY1, BY2
Bob	BY1, BY2, BY3
Chris	BY1

There is only one tree geometry consistent with this pattern:



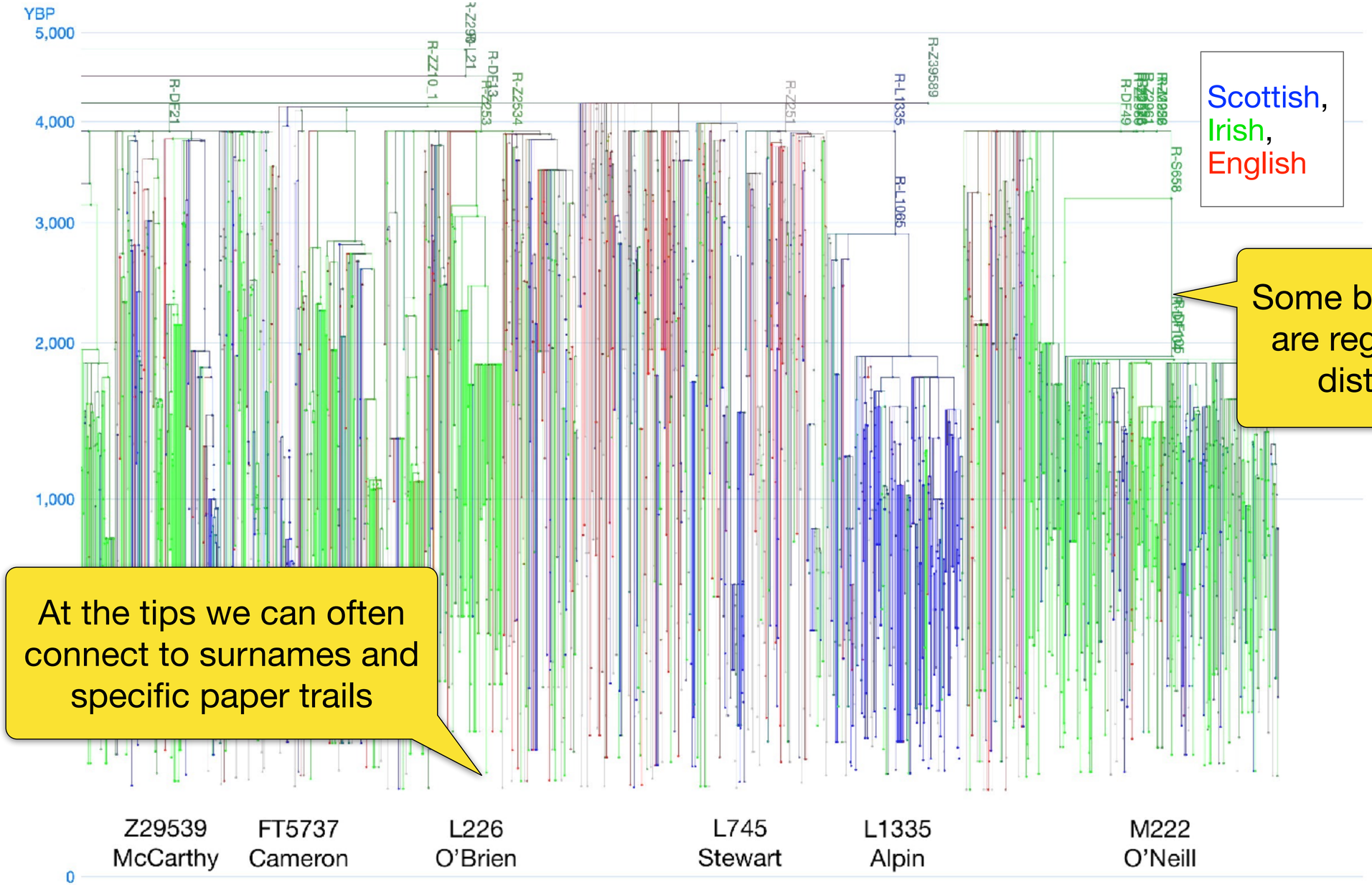
The Y Haplotree

237,000 contributors 39,000 branch points 28,000 terminal SNPs

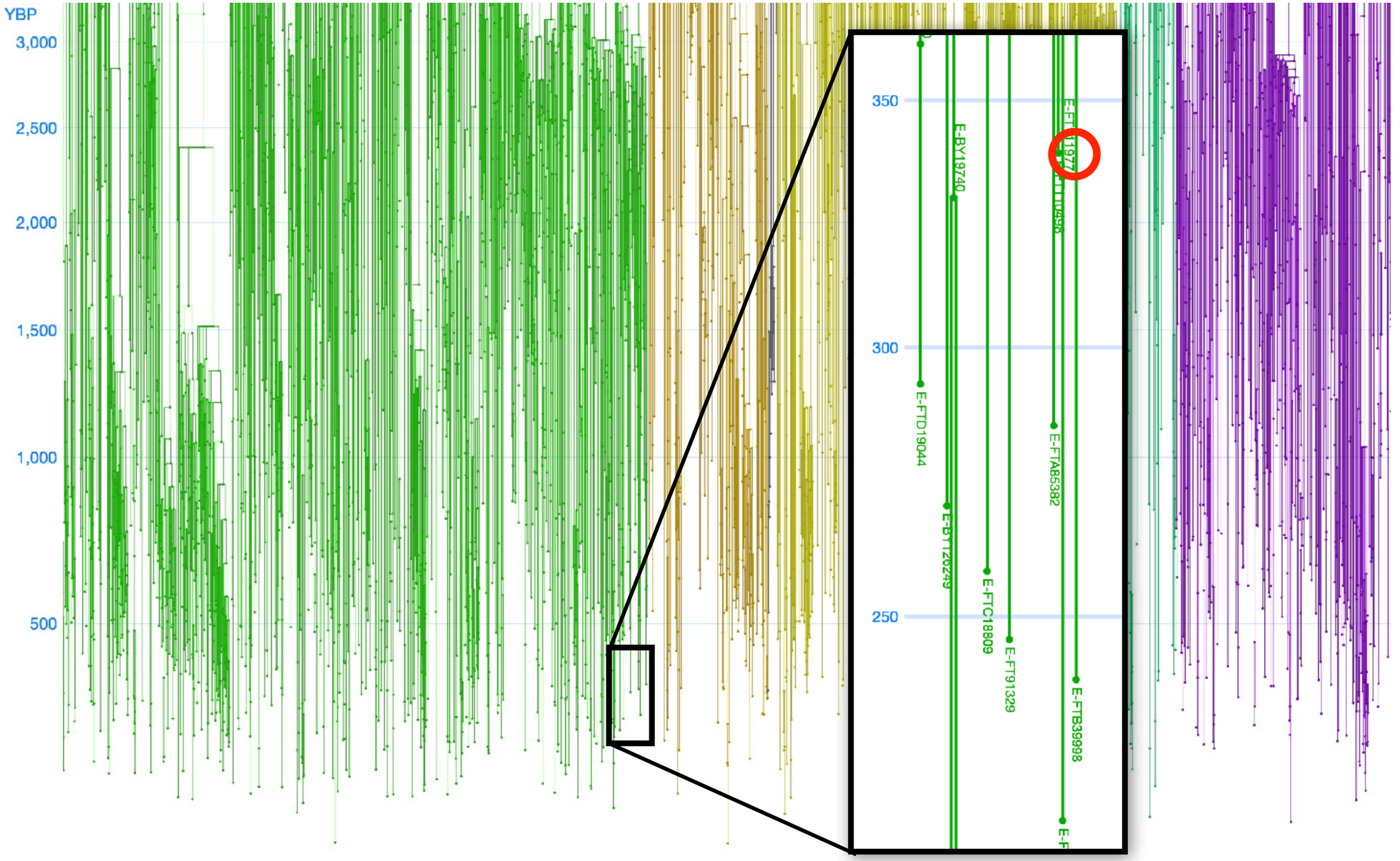


We see only men who DNA test; we're missing half of humanity: India, China, SE Asia, Africa

R-L21: the Beaker Invasion of Britain



Zooming in…

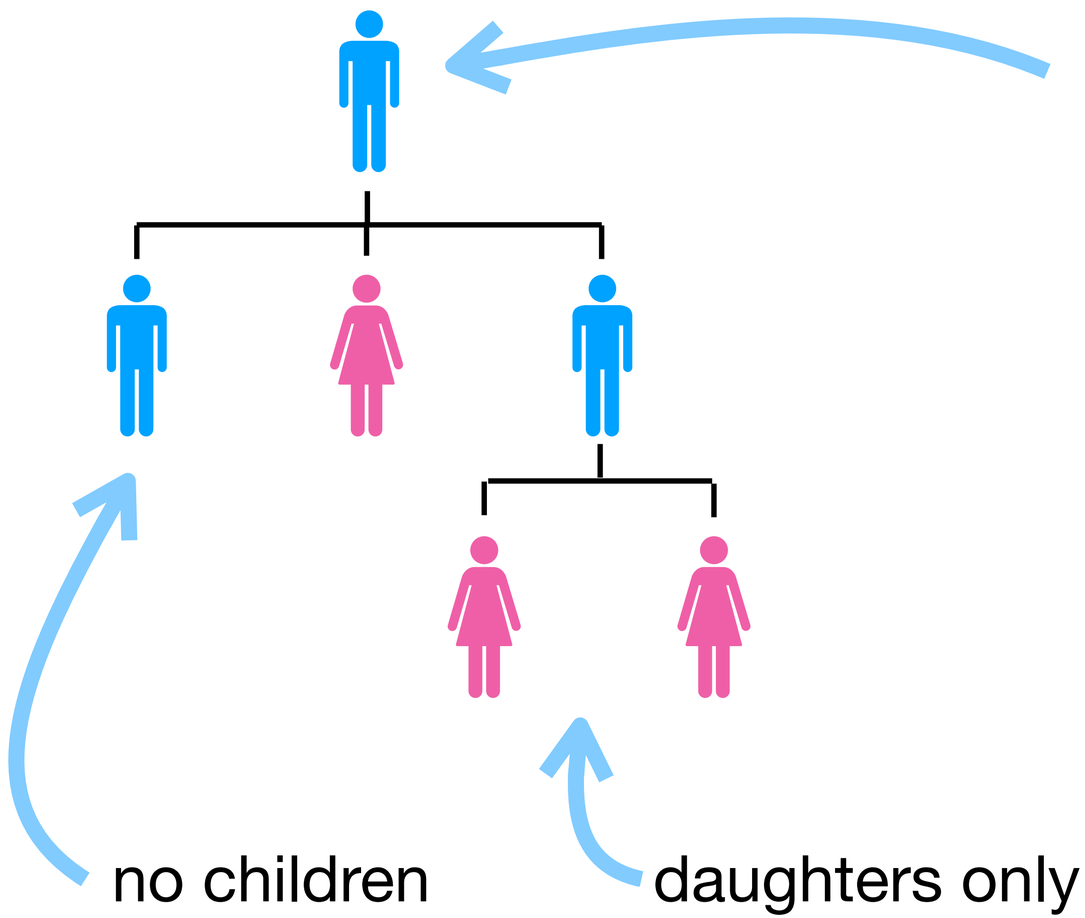


As more men test, they split and extend the tree.

New SNPs are added mostly at the tips.

For many men, the Y tree now overlaps their paper genealogy.

Extinction of Y Lineages



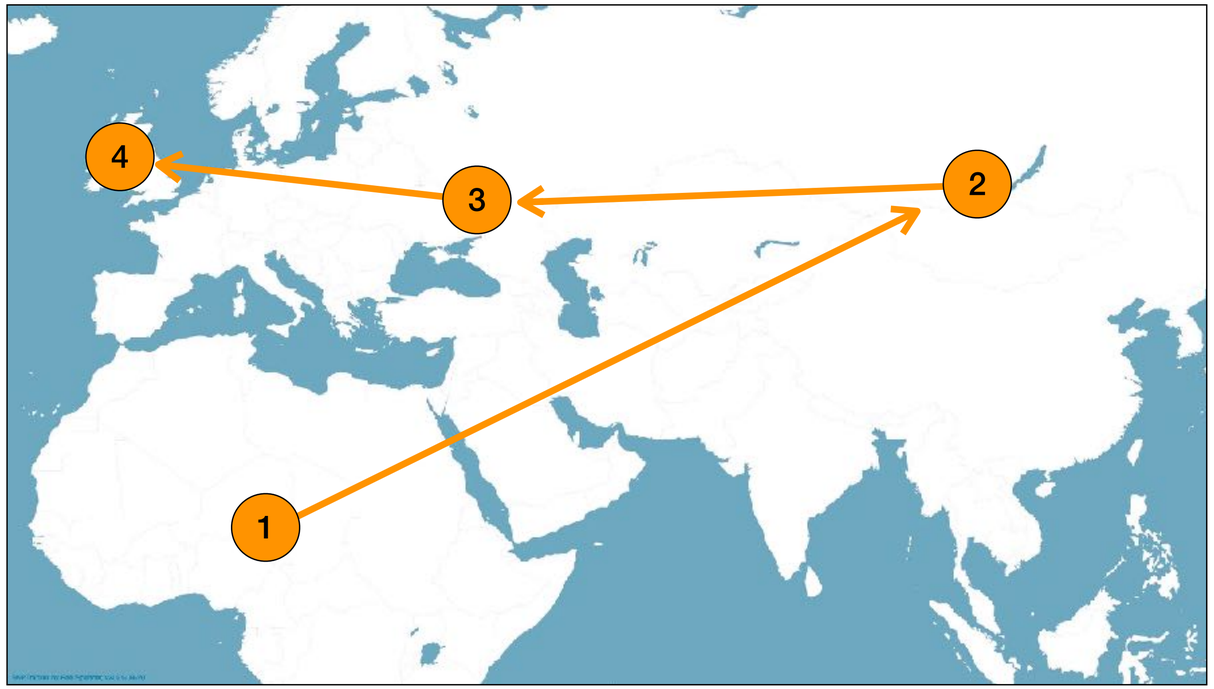
His Y chromosome is lost forever.

Such extinctions are very common: historically 80-90% of Y lineages go extinct within ~6 generations.

SNPs can be mapped

A SNP mutation occurs to a specific man at a specific time and place.
Putting SNPs on the map traces the great migrations.

Y Adam	Mal'ta Boy	Steppe herder	Irish founder
A-PR2921	R-M207	R-L23	R-DC782
240,000 BCE	22,000 BCE	4500 BCE	900 CE

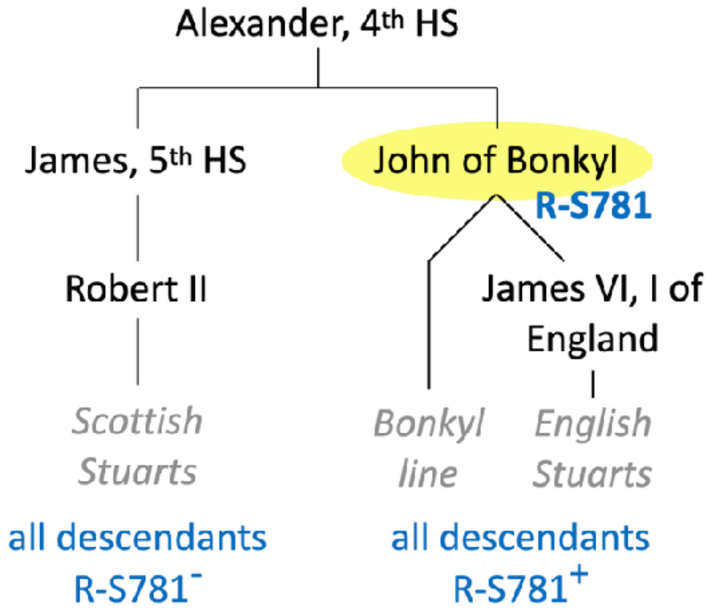


SNPs have Dates

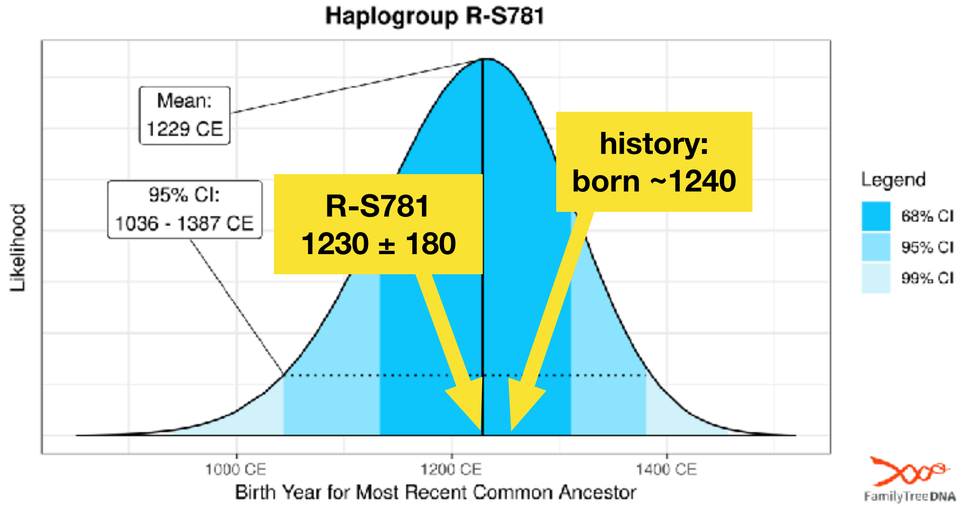
The appearance of new SNPs individually unpredictable but on average occurs at a known rate.

With enough data, this means that we can assign a date to every branch-point on the Y or mt tree.

SNP dates revolutionize archaeology.

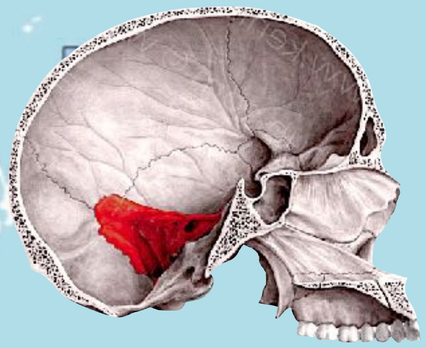


When we have solid history and descendant DNA testing for a man, his brother, and 2 or more sons, we can assign a SNP precisely.



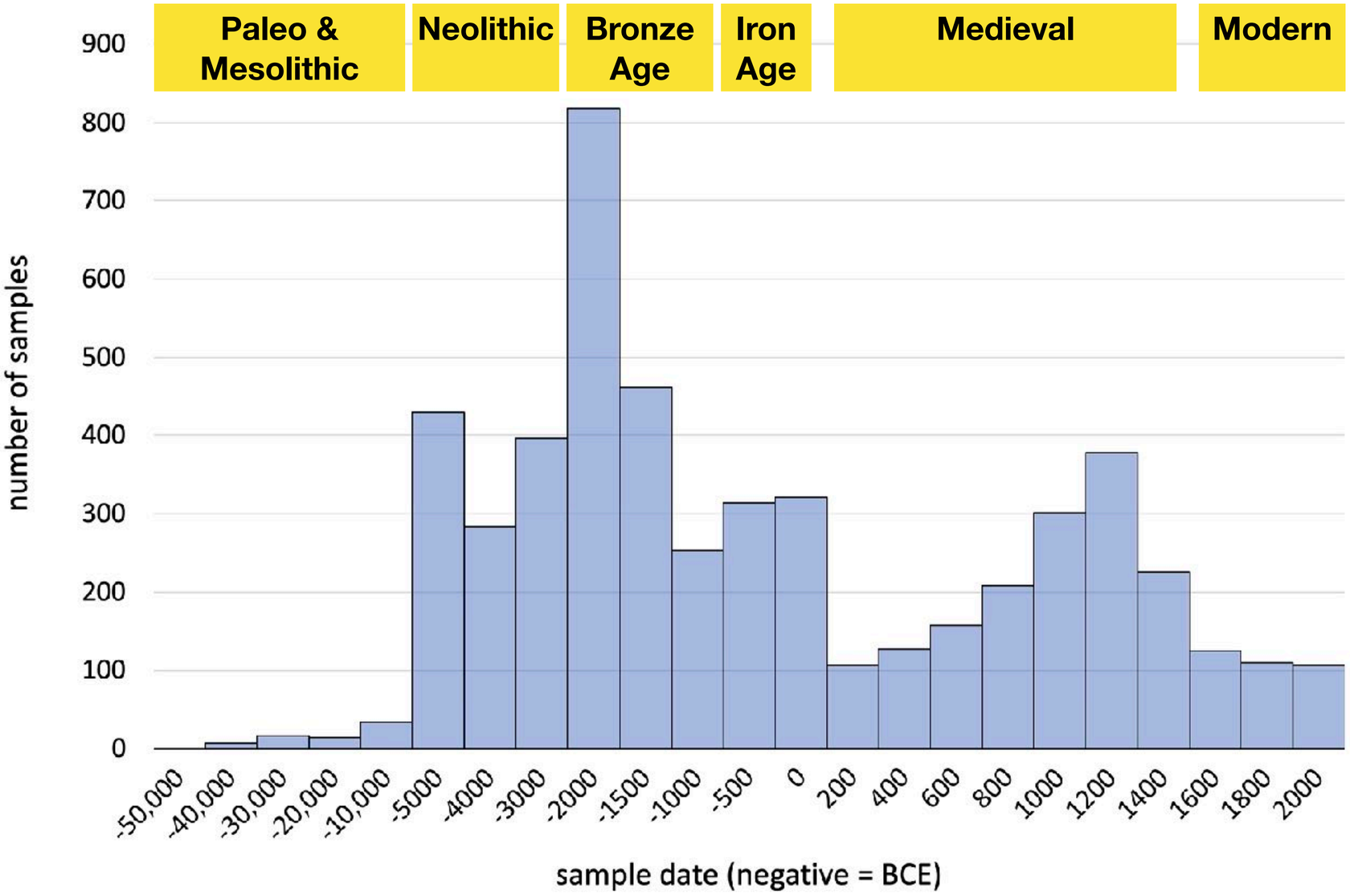
Origins and Migrations

Ancient DNA

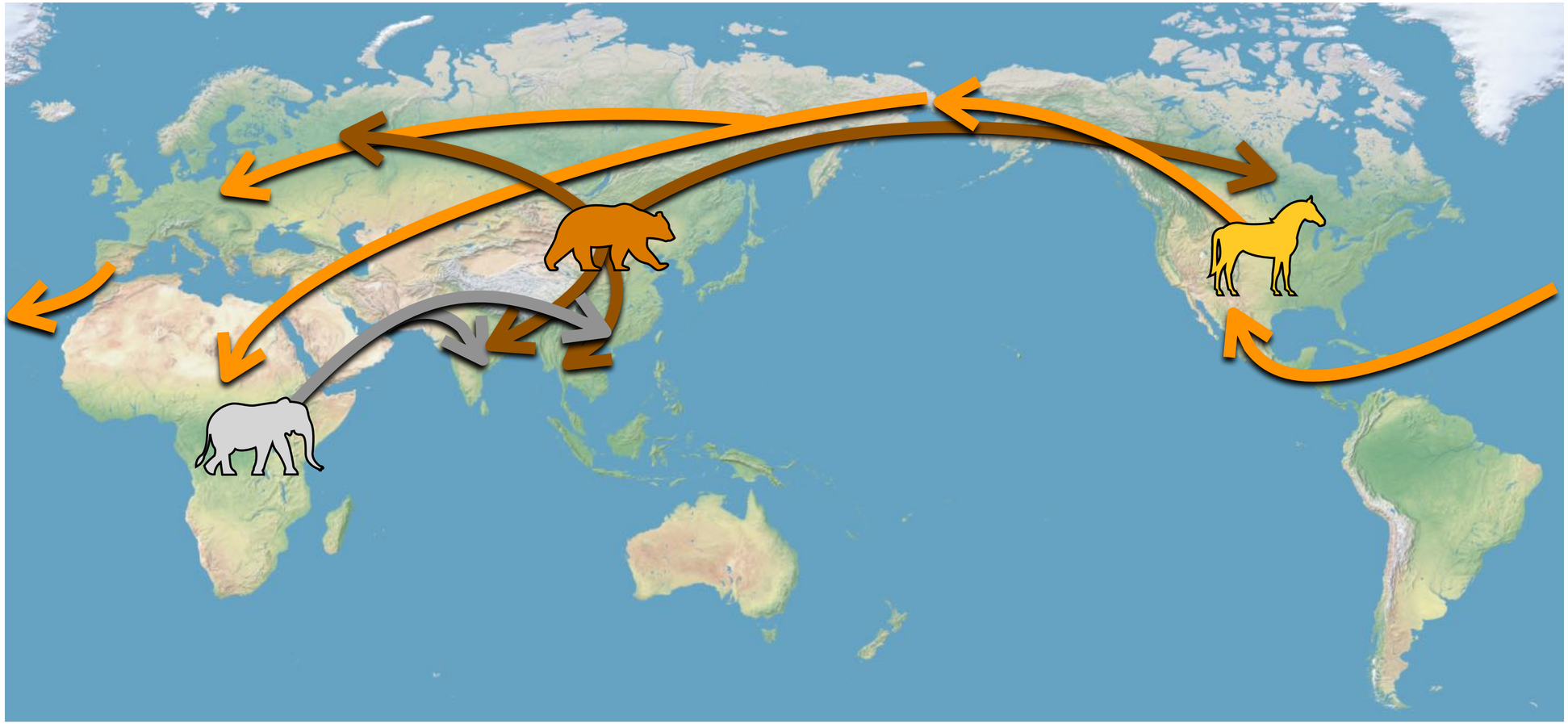


14,000 mtDNA, 5200 Y DNA, 10,000 aDNA
~2500 added per year

Sampled Eras

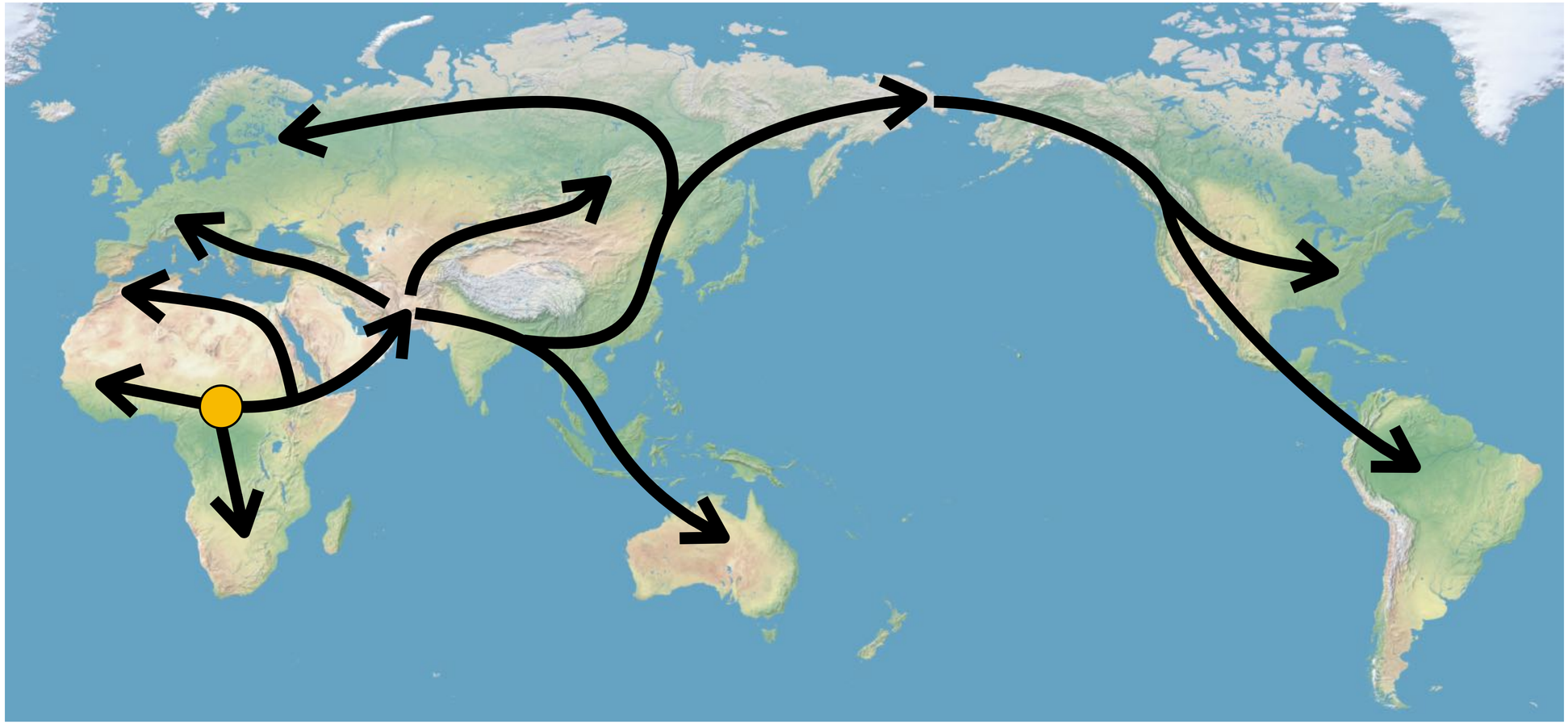


Great Migrations



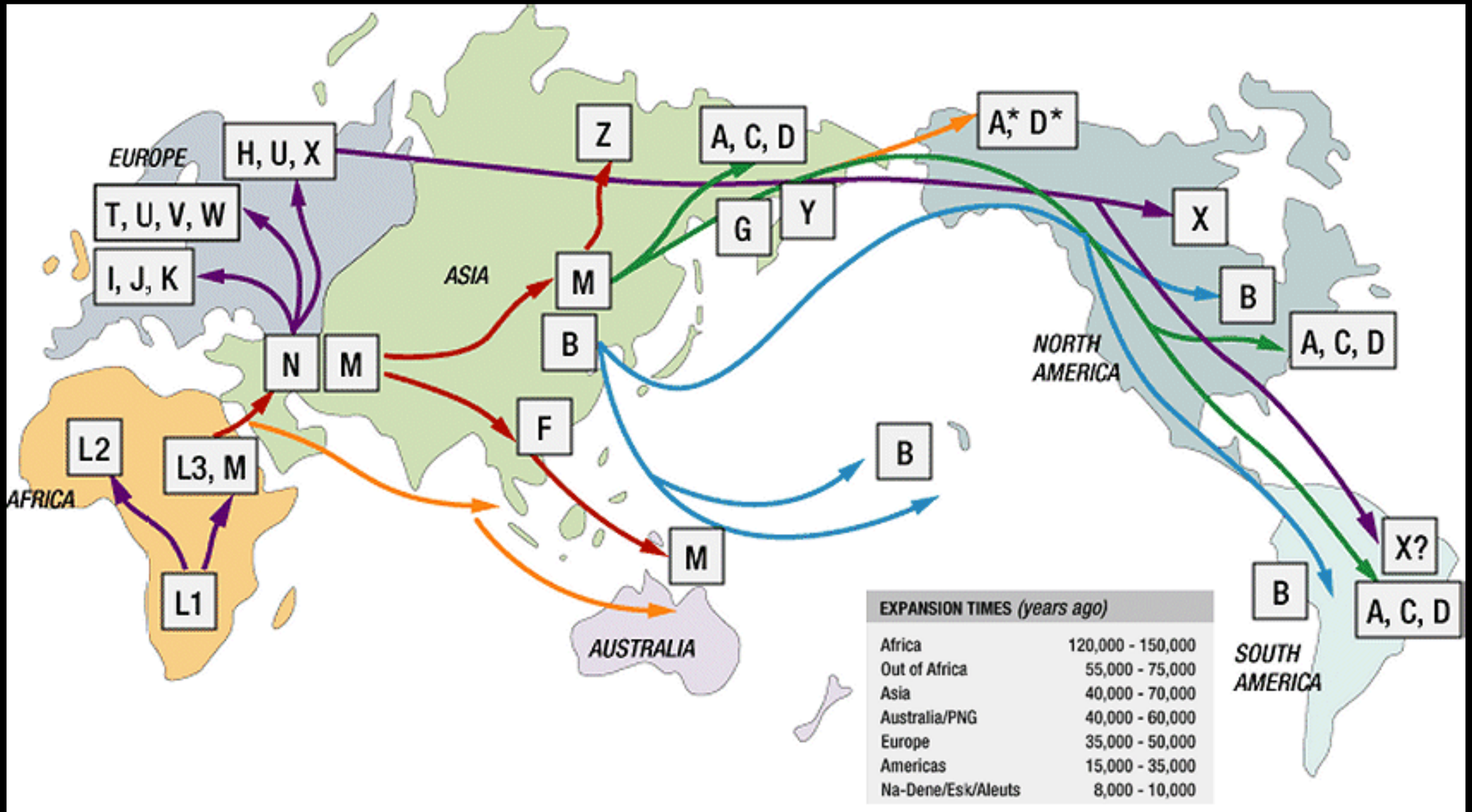
Horses, elephants, camels, bears, and great cats
each spread worldwide from one location,
long before humans.

Great Human Migrations

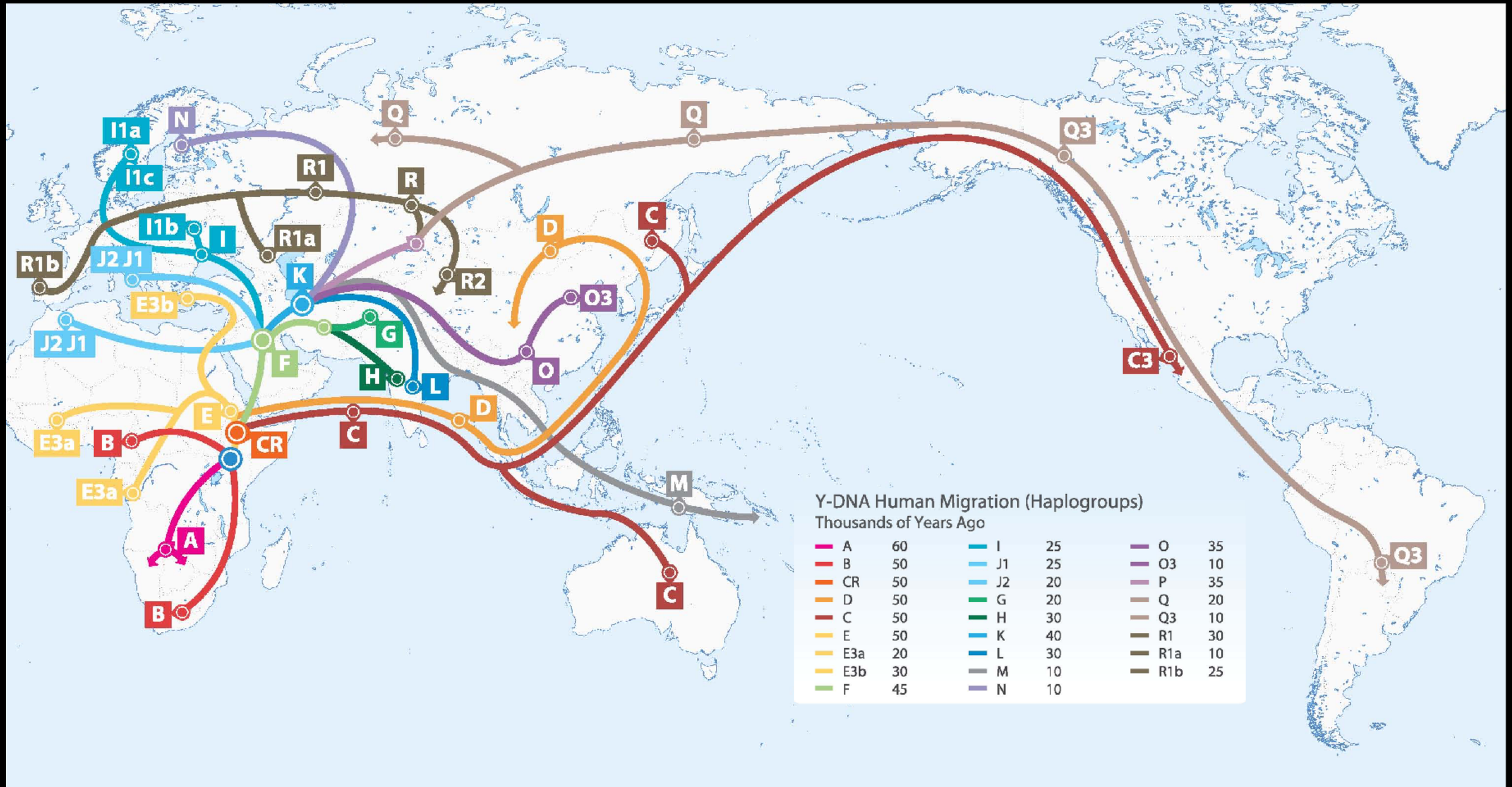


The broad paths are well known.
The interesting thing is to make it personal.

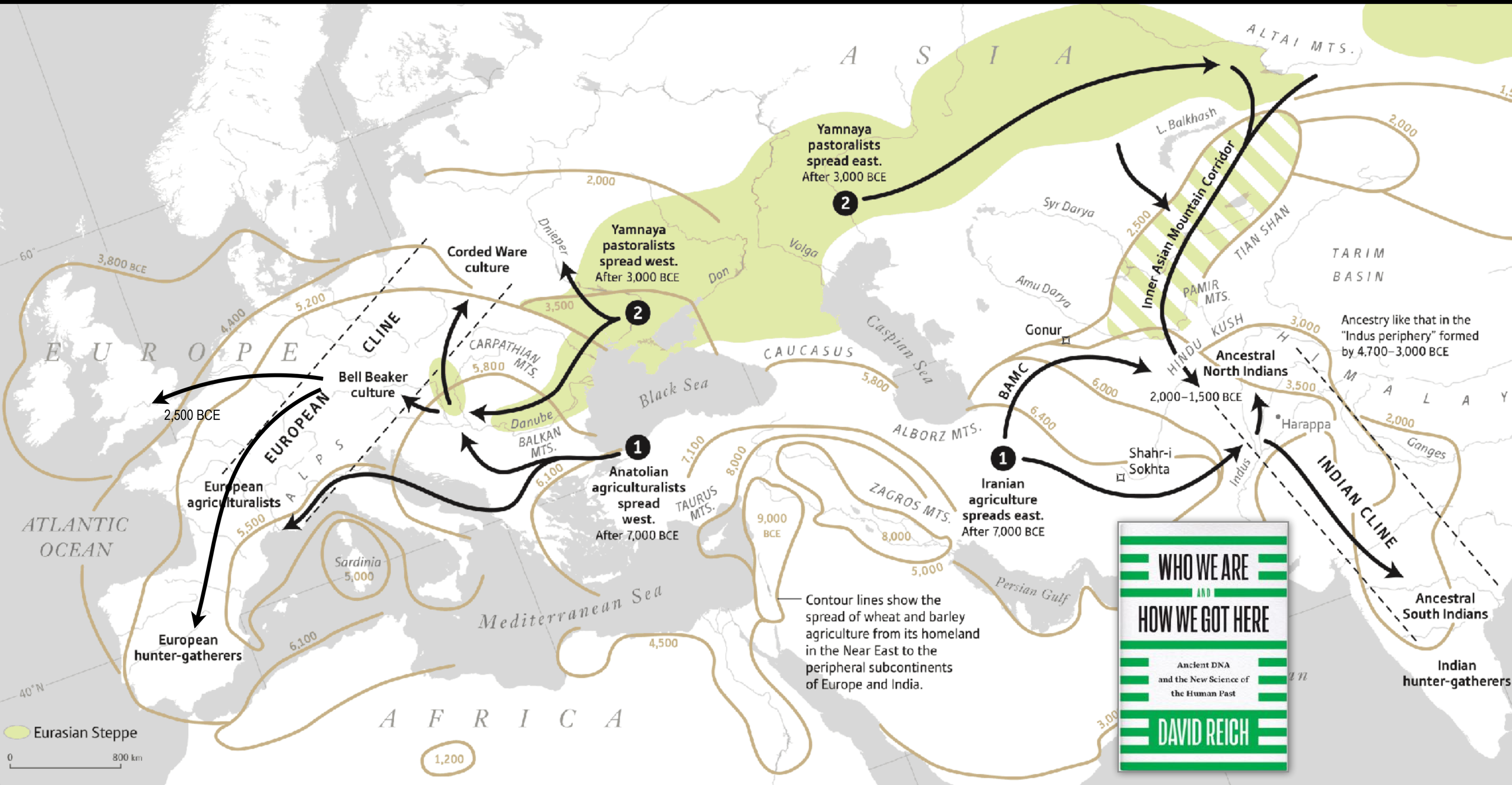
Migrations by mtDNA Haplogroups



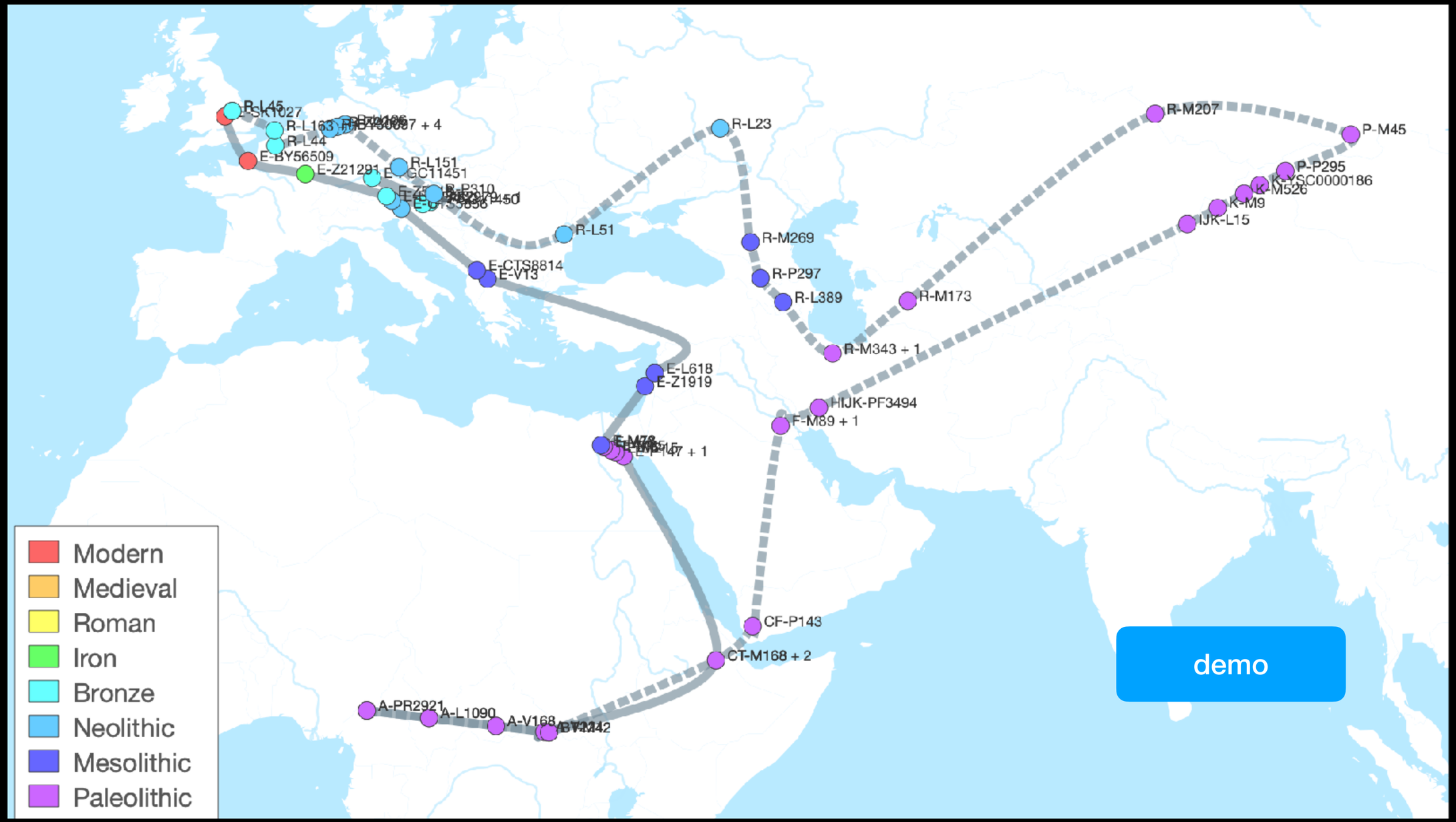
Migrations by Y DNA Haplogroups



DNA Rewrites Anthropology

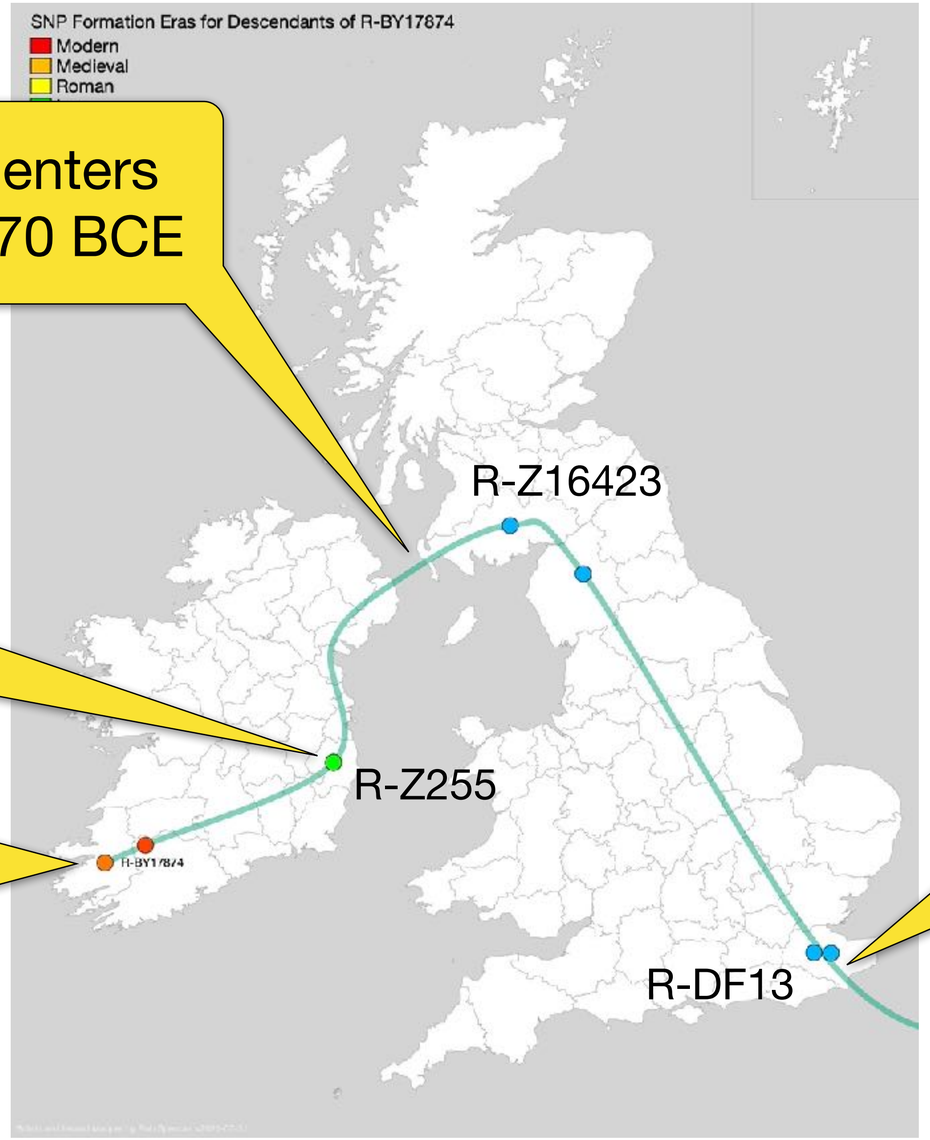


Personal Track



Combining Y DNA and Census Data

When DNA testers attach their surnames to their SNPs,
19th century census data can localize surnames.



R-ZZ10_1 enters Ireland ~2470 BCE

R-BY519 (230 CE) descendants are Burns, Byrne, Sullivan, Doyle, common in Wicklow

All men with R-BY17874 (1880) have surname Moriarty, found only in Kerry

R-S552 enters Britain ~2580 BCE

DNA Reveals Events and Culture

The Changing Face of Britain

Ancient DNA reveals skin, eye, and hair color

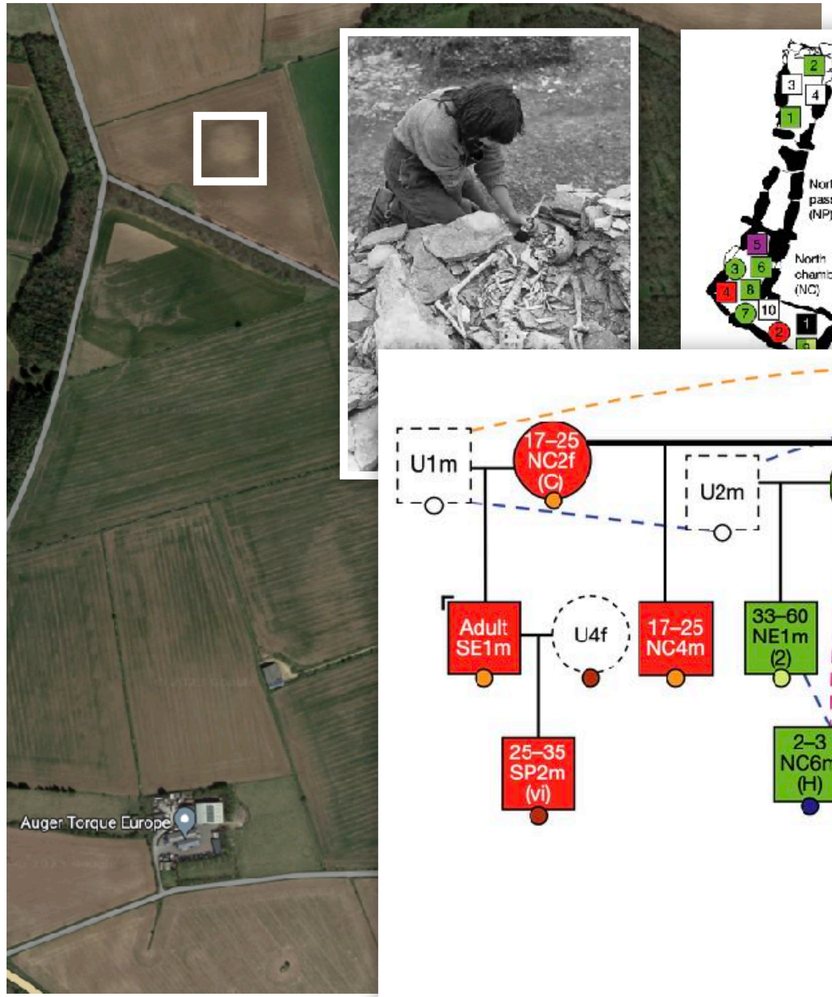
7100 BCE

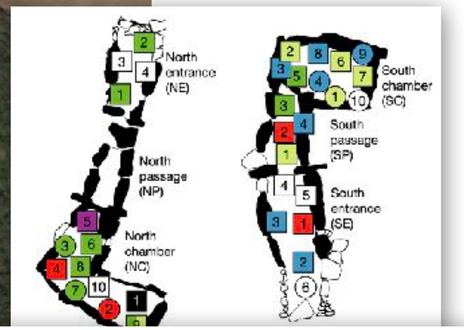
3600 BCE

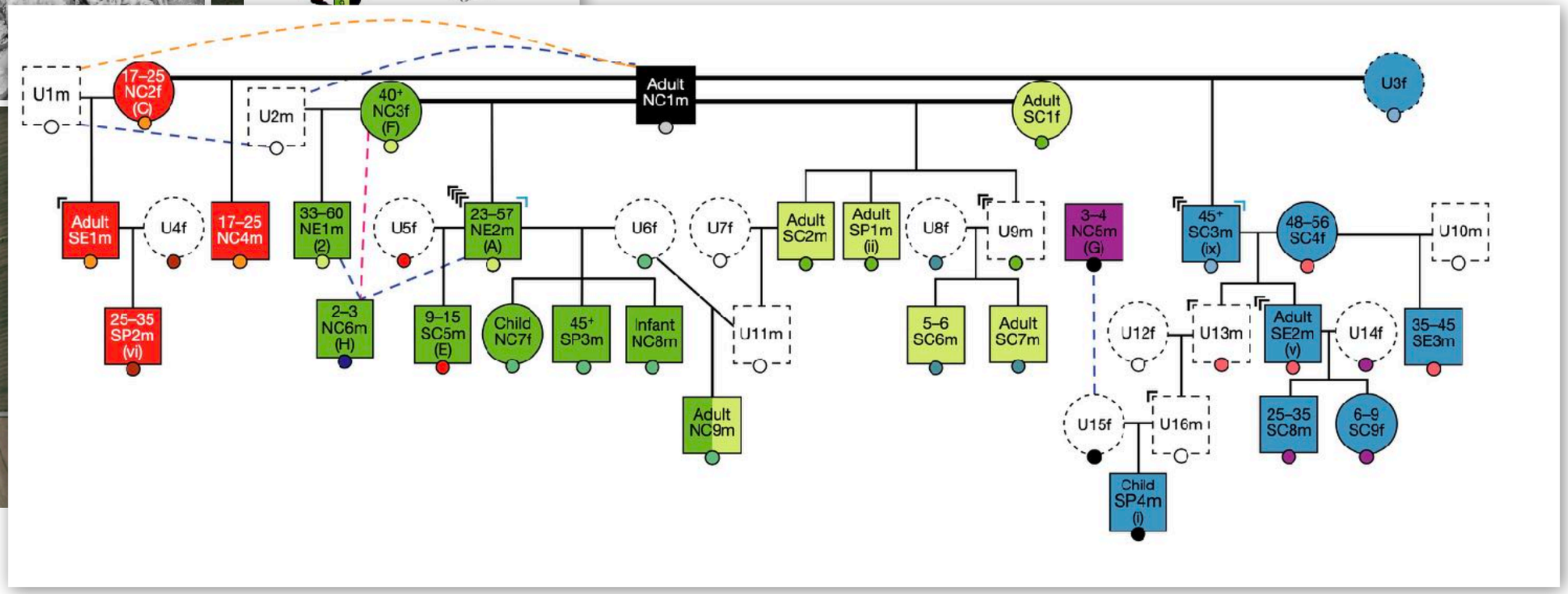
2400 BCE

Neolithic Barrow DNA

1 man, 4 wives, 23 descendants in 5 generations

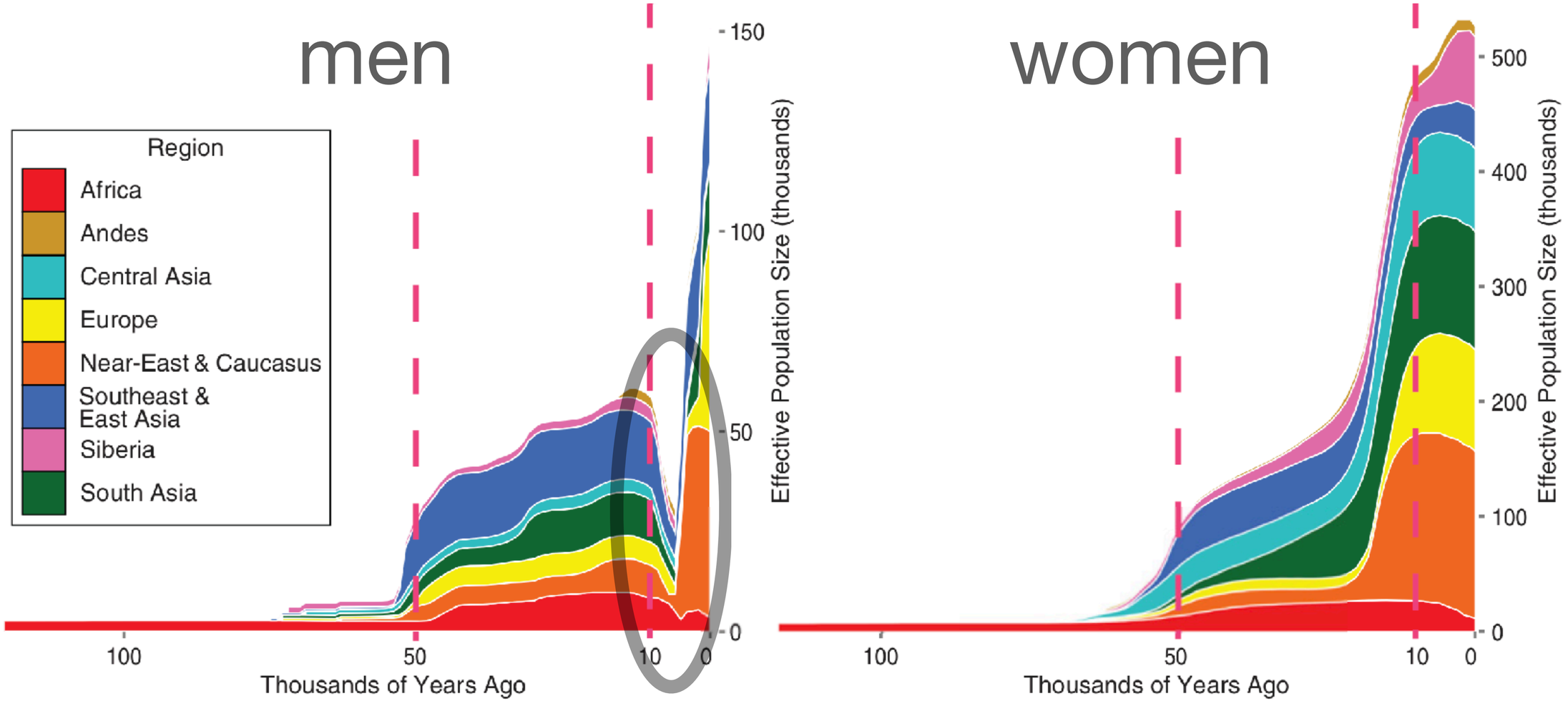






Fowler et al (2022) A high-resolution picture of kinship practices in an Early Neolithic tomb. Nature 601, 584-7.

Men Died. Women Survived.

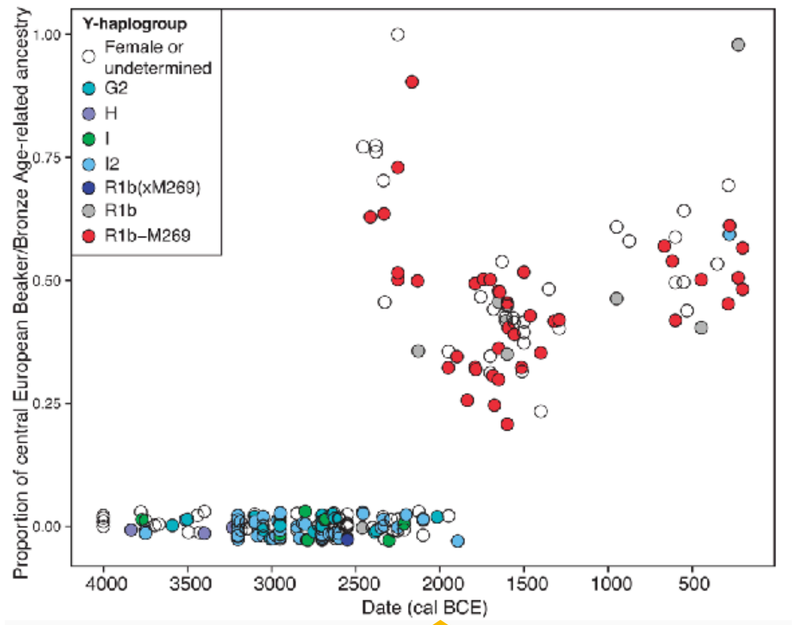


90% died ~3000 BCE

Steppe DNA Replacement

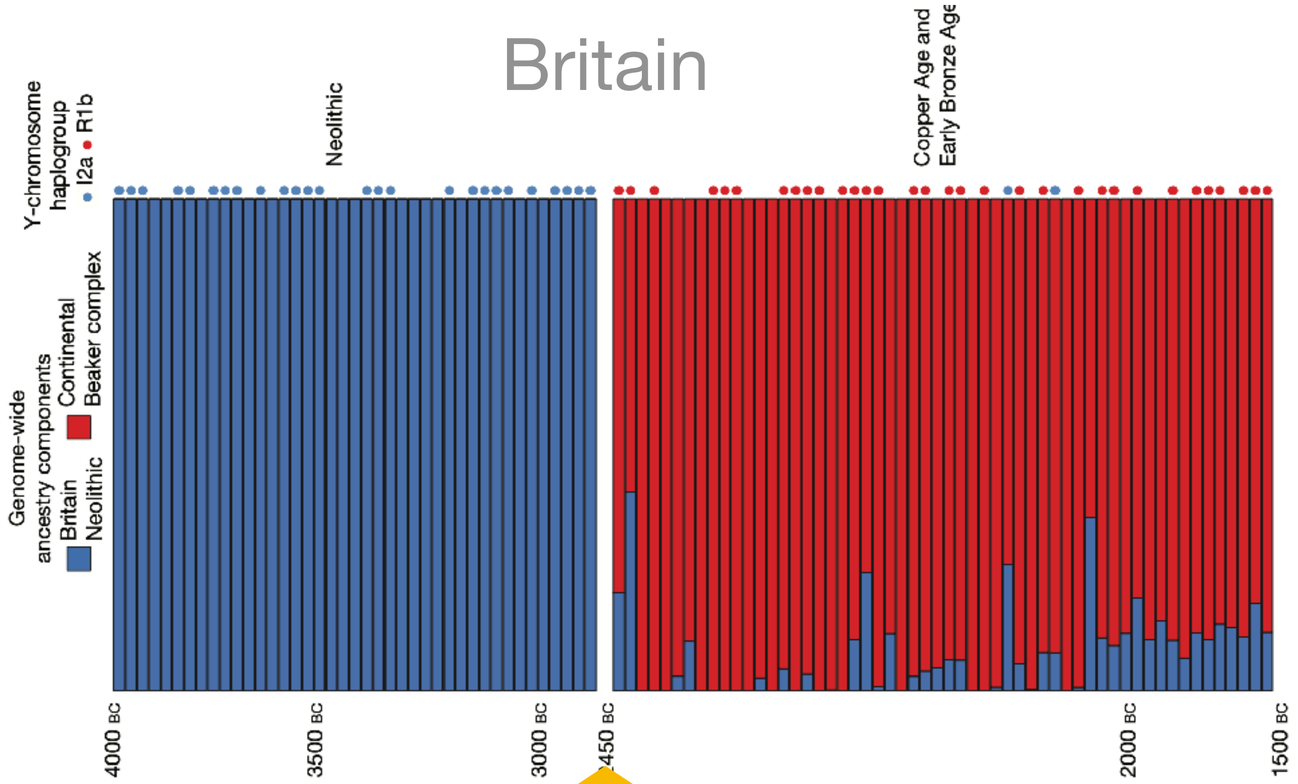
The European Neolithic-to-Bronze Age transition saw near-complete Y DNA replacement.

Iberia



2000 BCE

Britain



2500 BCE

Olalde et al (2019) The genomic history of the Iberian Peninsula over the past 8000 years. Science 363, 1230-4.

Olalde et al (2018) The Beaker phenomenon and the genomic transformation of northwest Europe. Nature 555, 190-6.

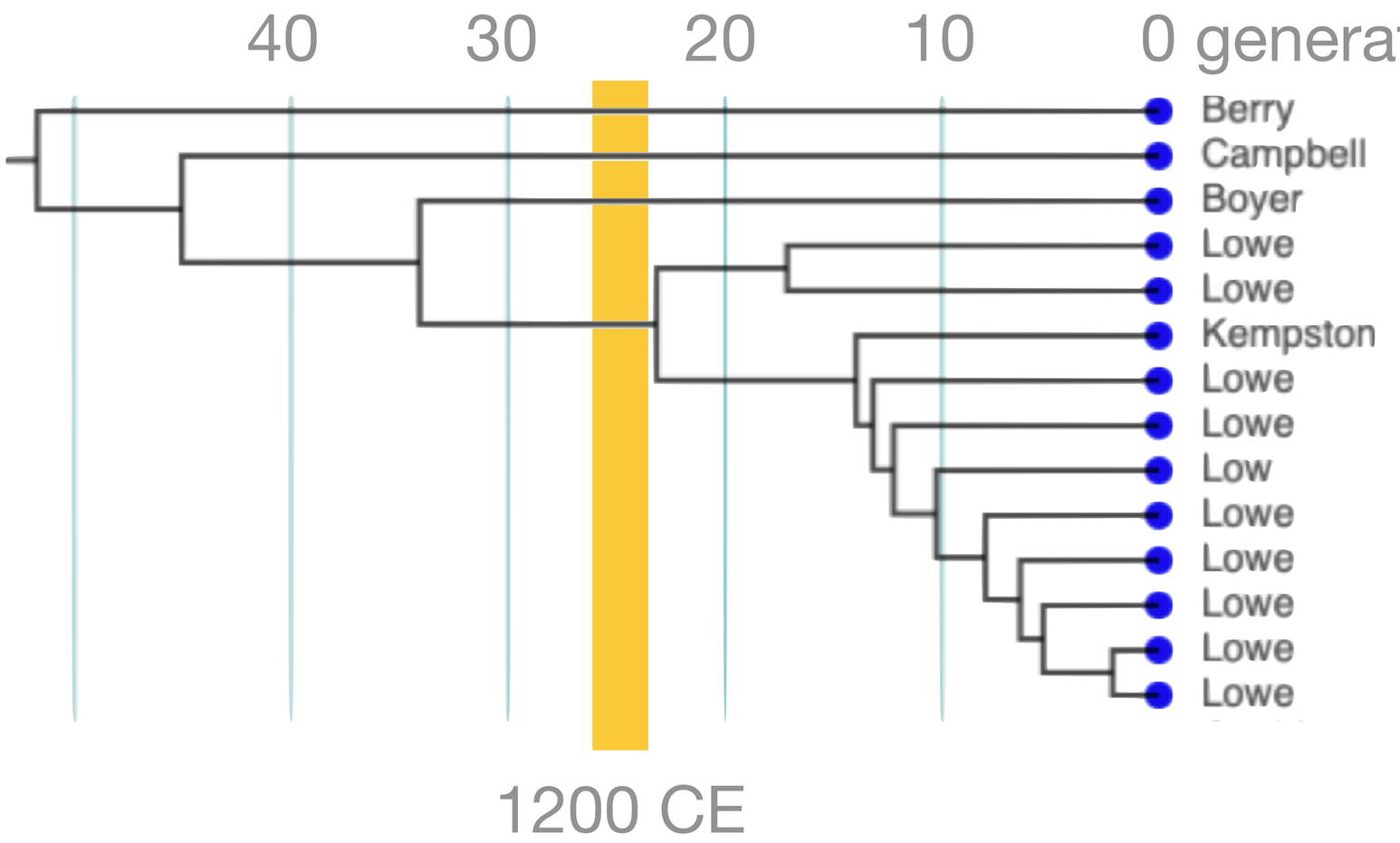
Surnames

Origins of Surnames

Patronymic	O’Brien, Johnson, MacDonald
Occupational	Smith, Hunter, Spencer, Cooper
Geographic	Hill, Burton, Hamilton, Moore
Descriptive	Brown, Young, Gray

Surnames arose in Britain 1066-1400 when the Normans imposed them to manage taxation and land ownership.

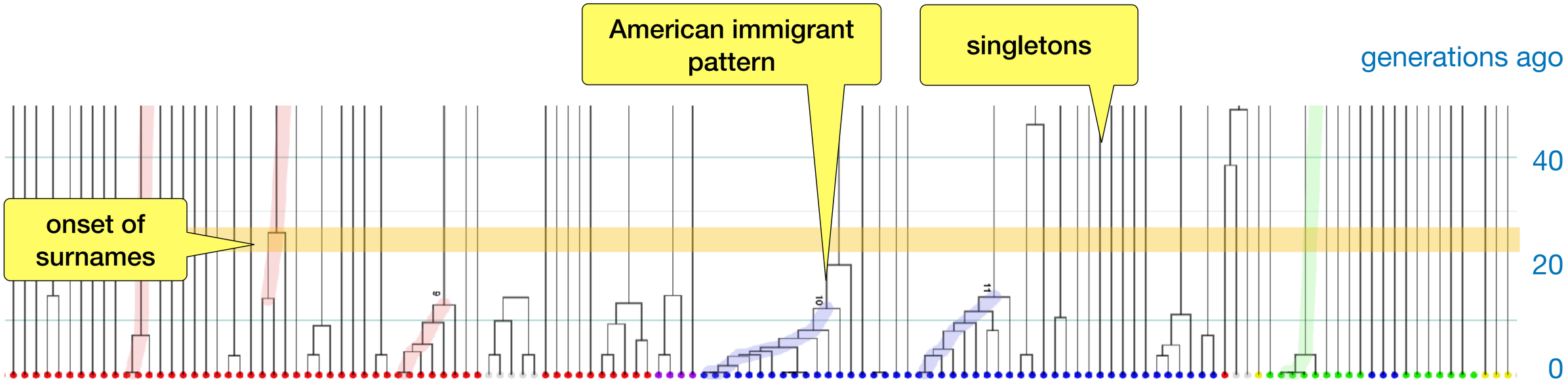
Surnames Arrive ~1200 AD



Surnames *across* a 25 generation barrier will be different, essentially random.

Different surnames *within* a recent group may indicate NPEs.

One surname, many lineages

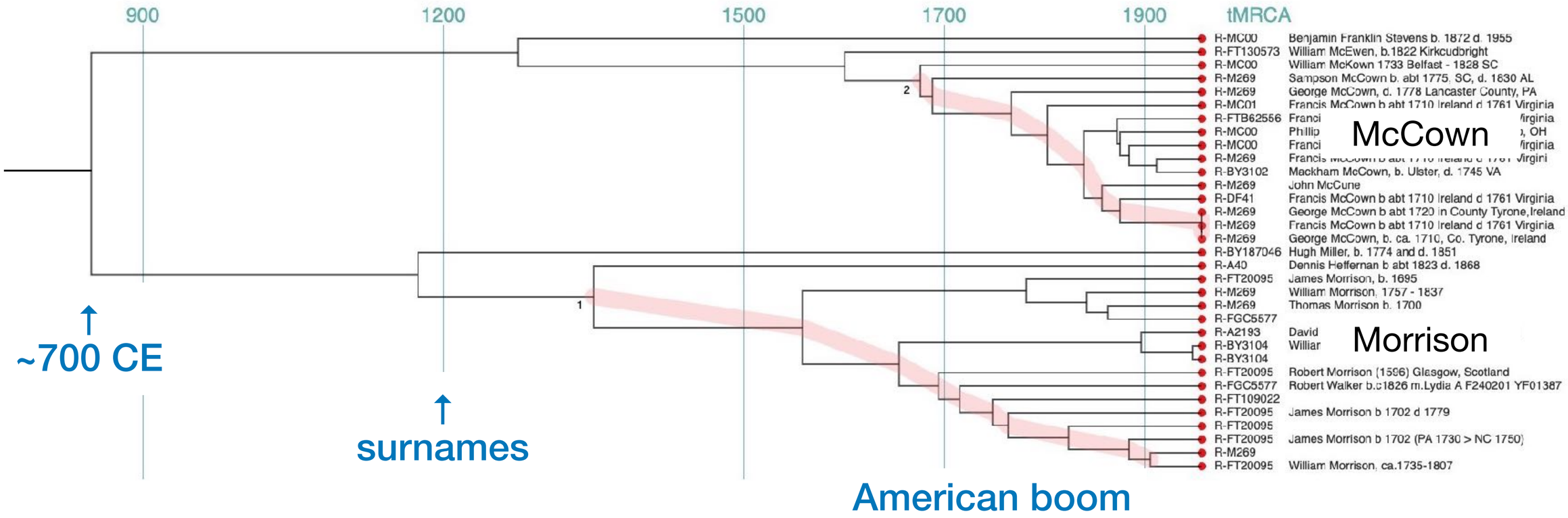


This small sample of men with surname Carter shows the typical pattern of American immigrant clades and many unconnected lineages.

Connections below the surname line indicate descent from a man named Carter. Connections above the line indicate unrelated men with a common skill — building carts.

In any set of N men you will find ~N/2 distinct lineages.

Two Surnames, Common Ancestry



In Scotland about 700 CE, a man has two sons. One has descendants who will later take the surname Morrison. The other's descendants take the surname McCown and move to Ireland.

Each group has a descendant who emigrates to the American colonies and has many descendants there.

Thank you.

Please give the library your feedback.

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http://scaledinnovation.com/gg/gg.html