Genetic comparison of Human and Neanderthal mtDNA

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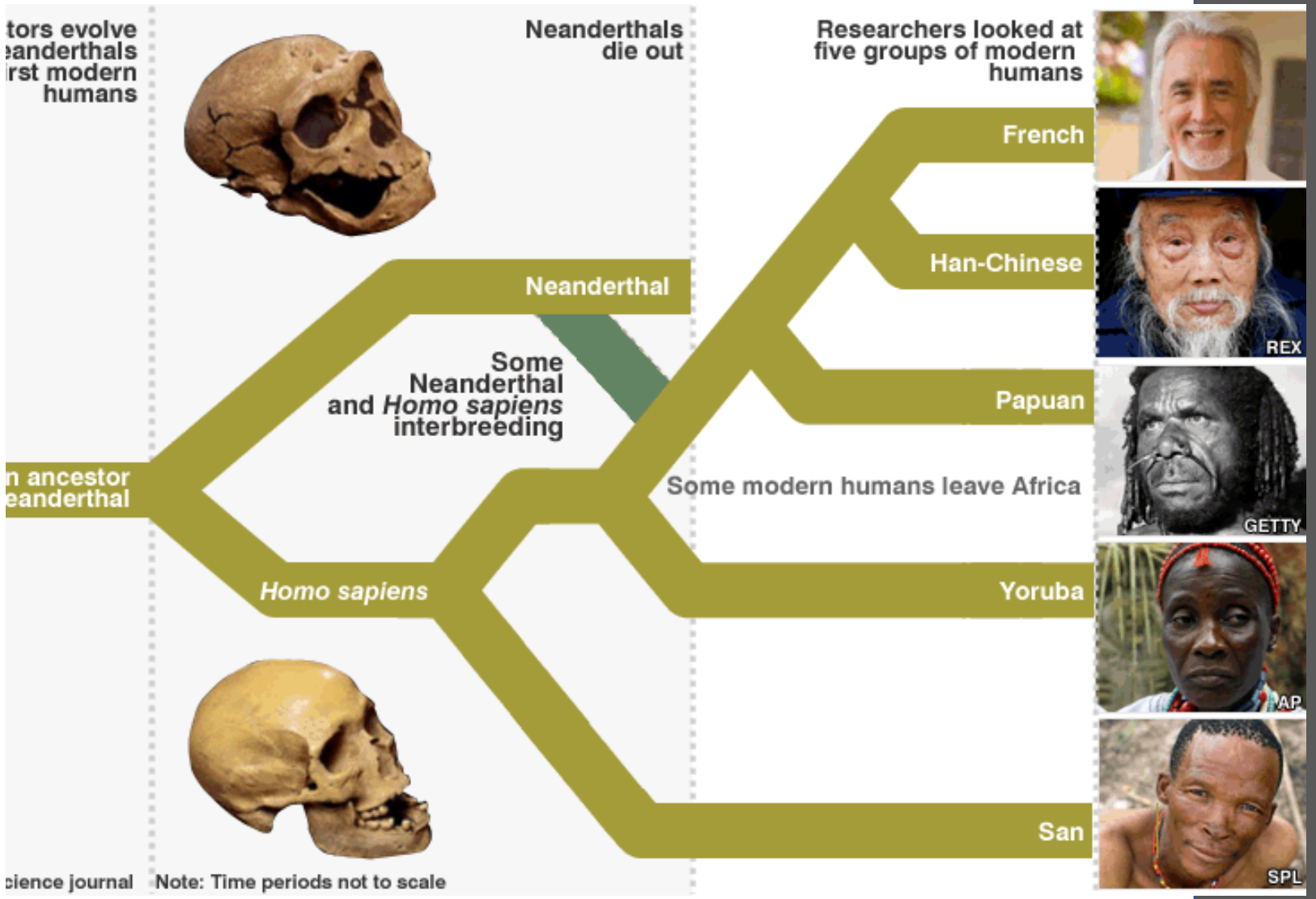
Contents

Neanderthals

- Lived side by side with *H. sapiens* (that's us)
- Latest common ancestor: *Homo erectus*
- Evolved in Eurasia about 600.000 years ago
- Extinction: 30.000 years ago
- Related to Humans?

Neanderthals and Humans

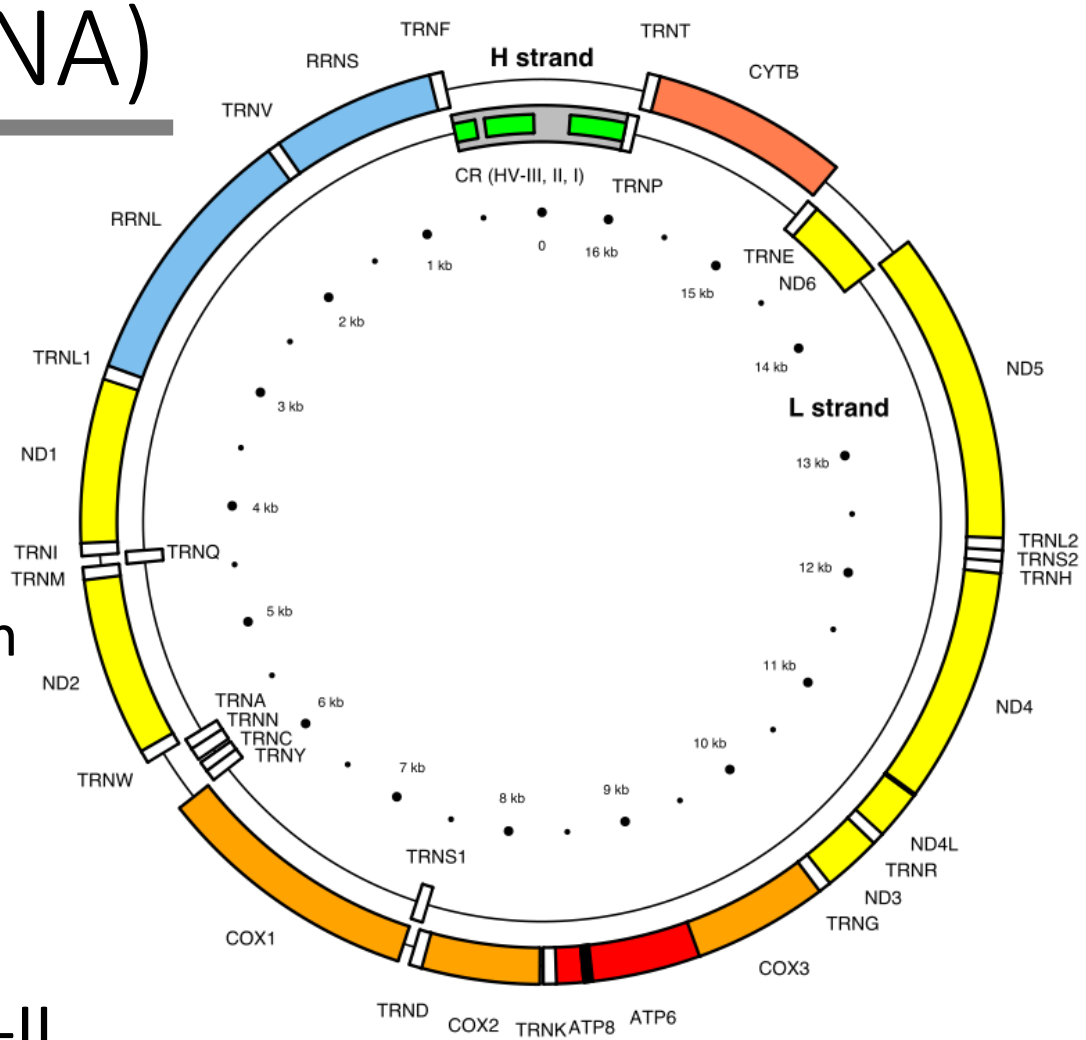
- About 202 differences in mtDNA compared to humans
- Geneflow from Neanderthals to Humans
- Gene mixing estimated at 1.15% to 1.3% in autosomes



Genetic Analysis

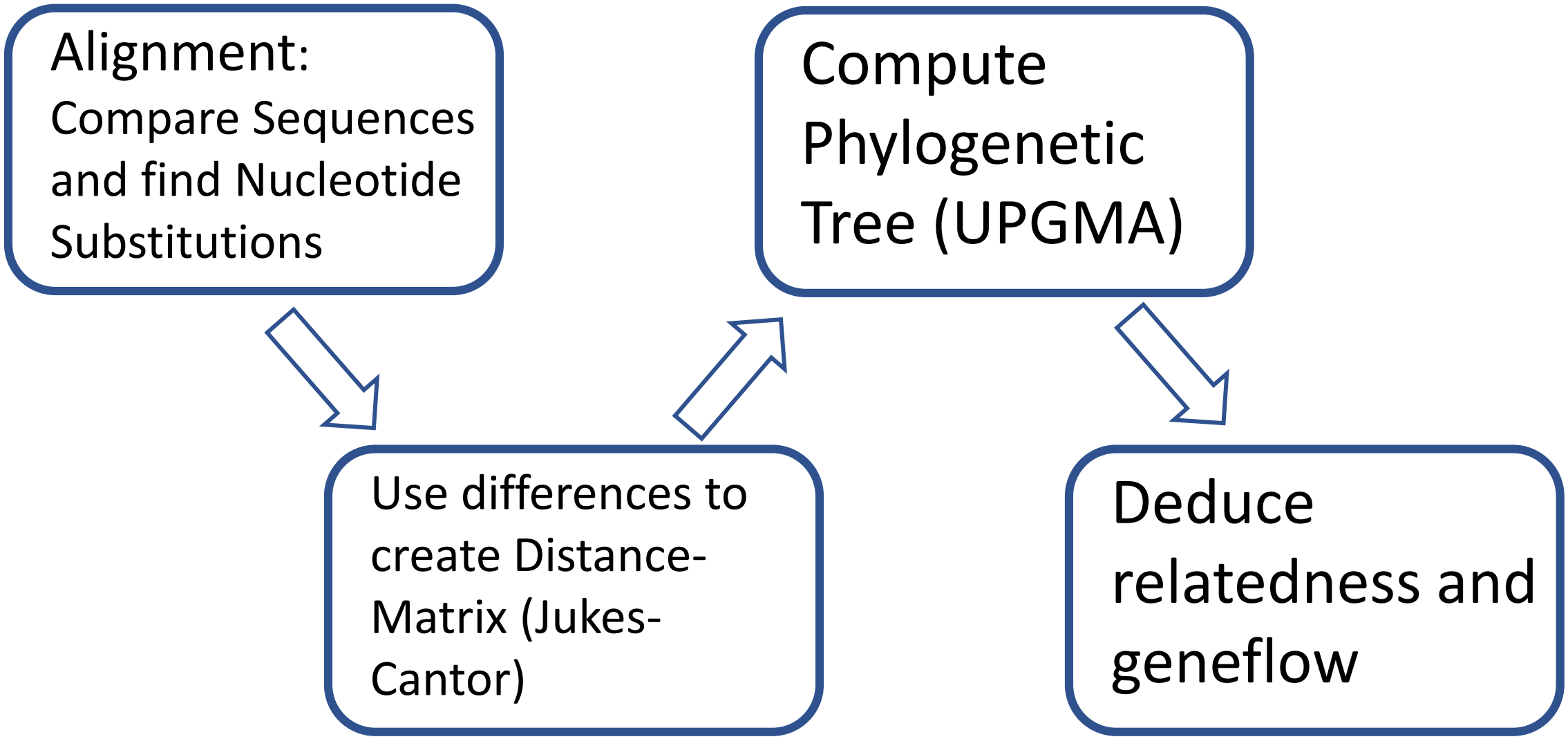
Mitochondrial DNA (mtDNA)

- 16,569 base pairs form 37 genes
- Maternally inherited
  - → No recombination
  - → mutations only through evolution
- Coding Region and Control Region
- Region of interest
  - → Control Region HV-I and HV-II



Genetic Analysis

Genealogical DNA-Testing



Experimental procedure

Genetic Distances

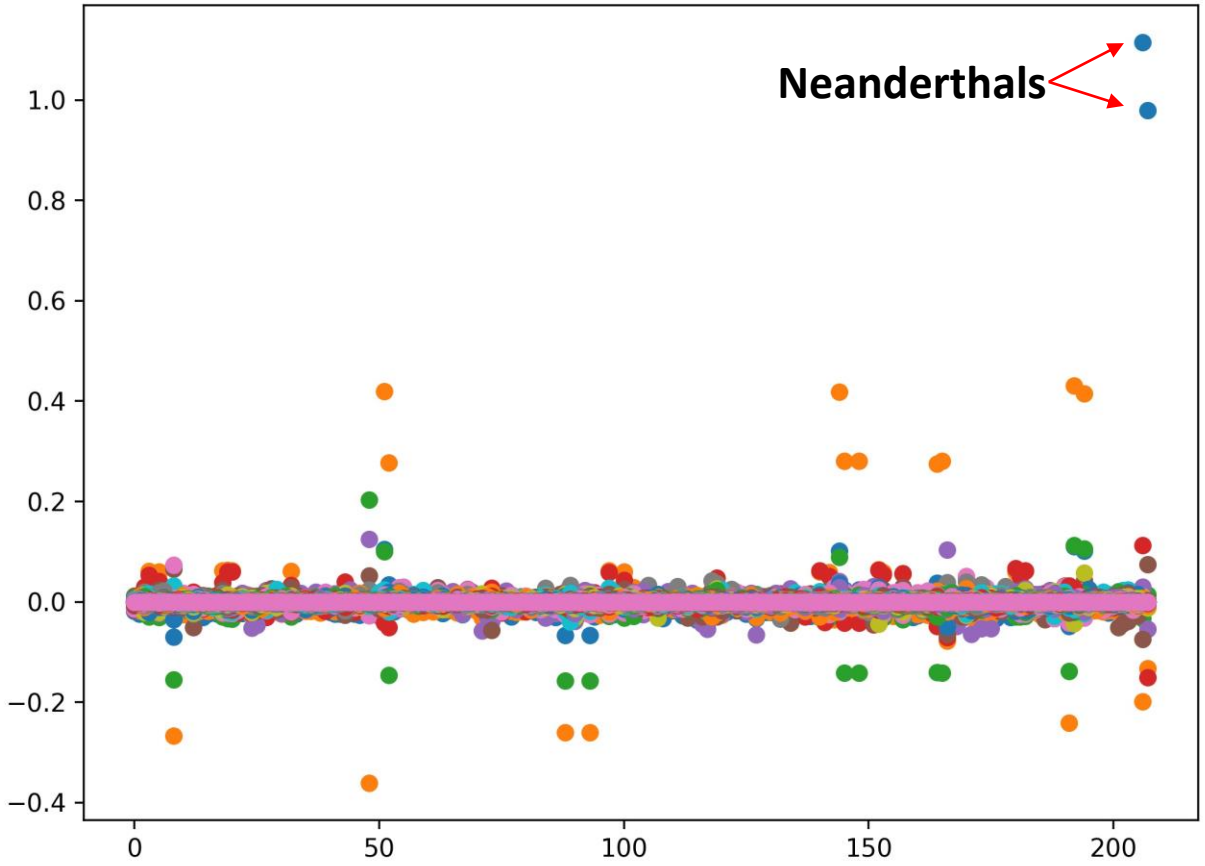
Calculated mean distances…

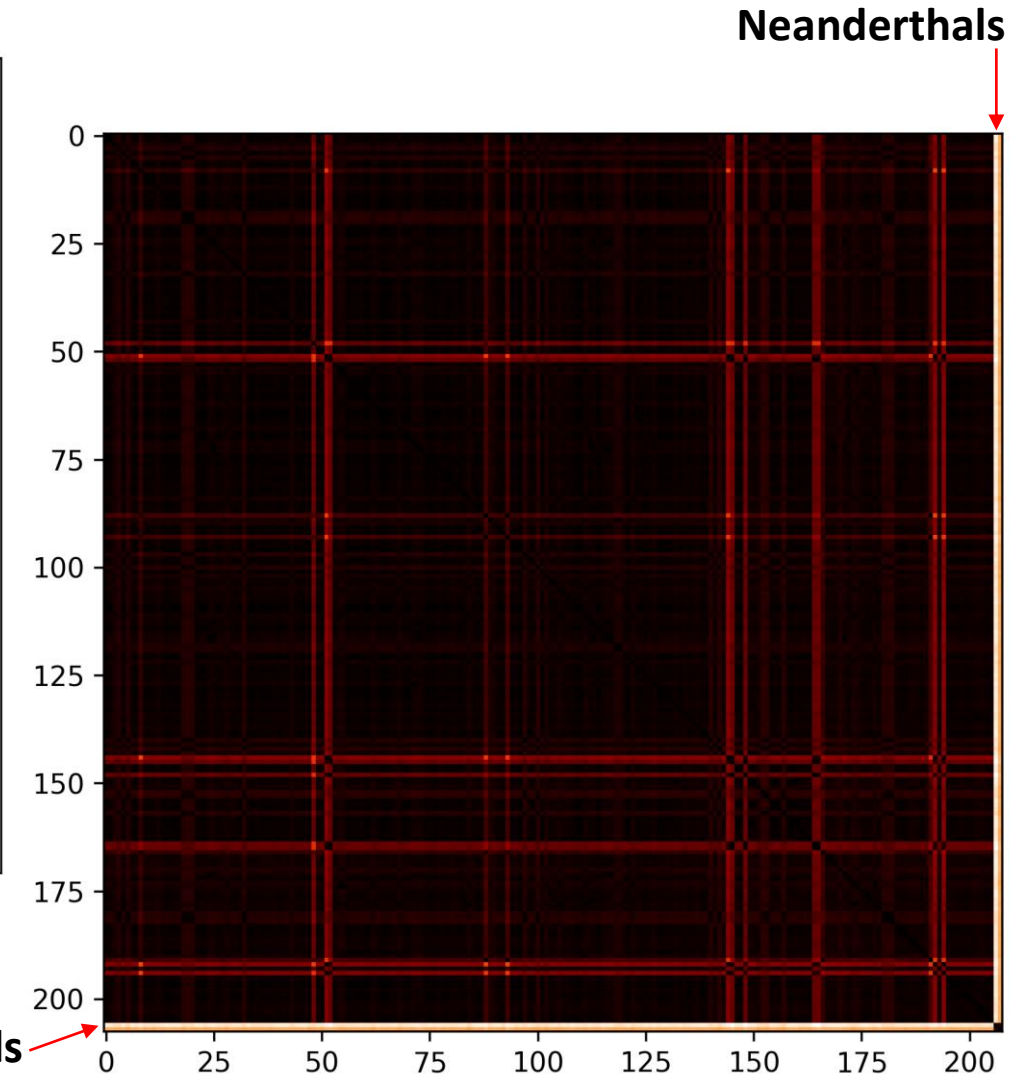
- among any two H. sapiens: **0.0890**
- between Neanderthal and any modern human: **1.0739**

```
[[0.         0.02601417 0.06961516 ... 0.04374418 1.15120154 0.99861976]
 [0.02601417 0.         0.07266085 ... 0.03478884 1.15120154 1.01045433]
 [0.06961516 0.07266085 0.         ... 0.07266085 1.12598908 0.99861976]
 ...
 [0.04374418 0.03478884 0.07266085 ... 0.         1.12598908 0.99861976]
 [1.15120154 1.15120154 1.12598908 ... 1.12598908 0.         0.13260893]
 [0.99861976 1.01045433 0.99861976 ... 0.99861976 0.13260893 0.        ]]
```

Experimental procedure

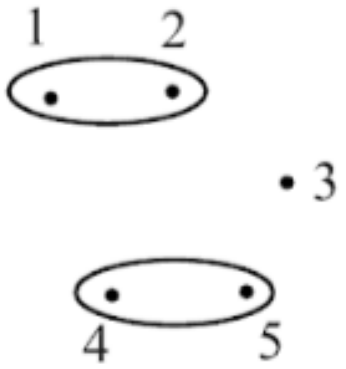
Genetic Distances

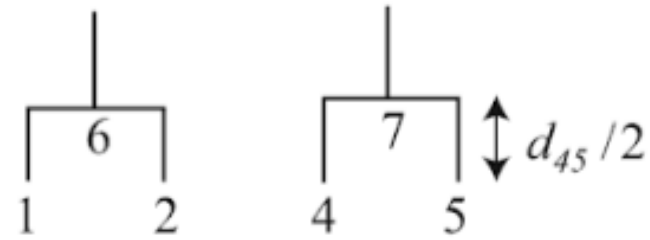


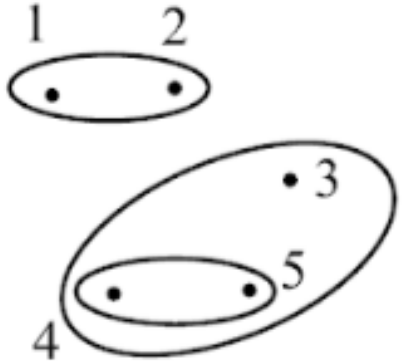


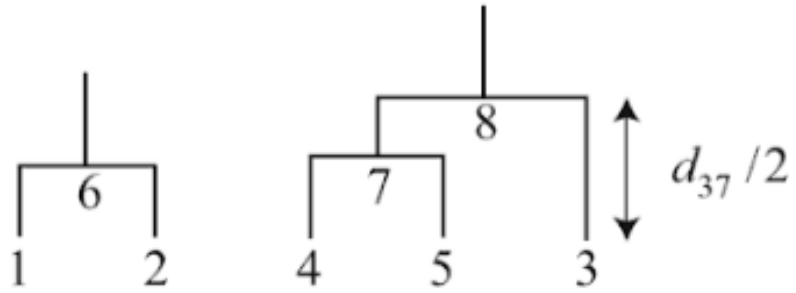
Experimental procedure

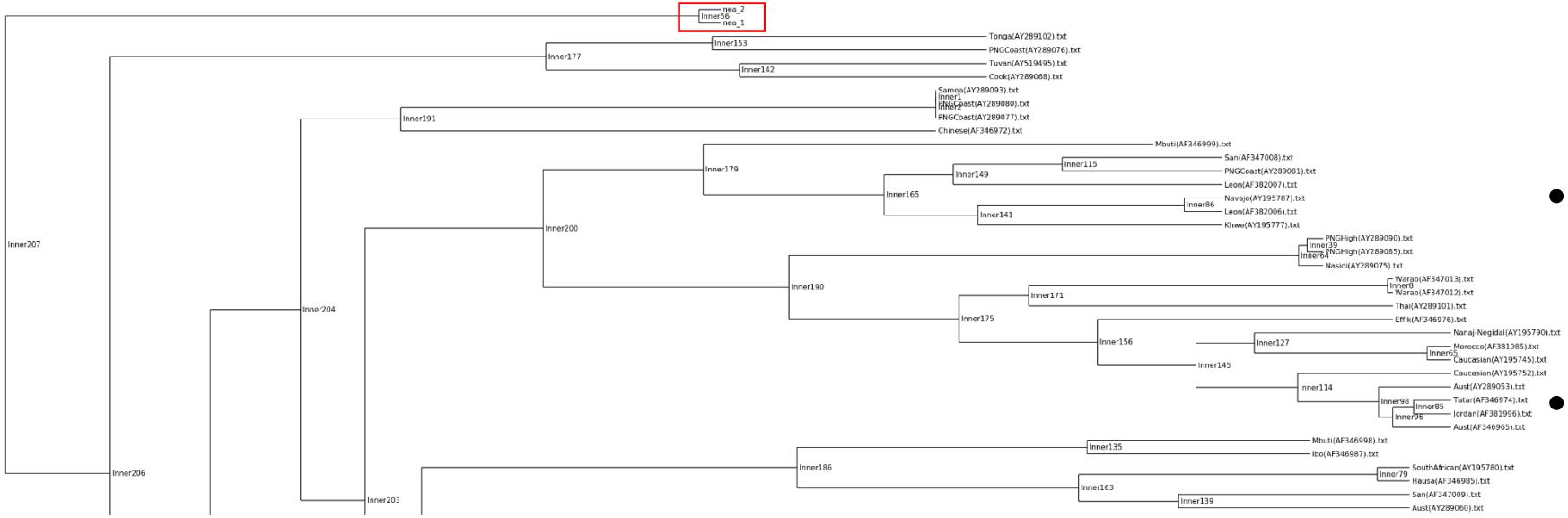
UPGMA











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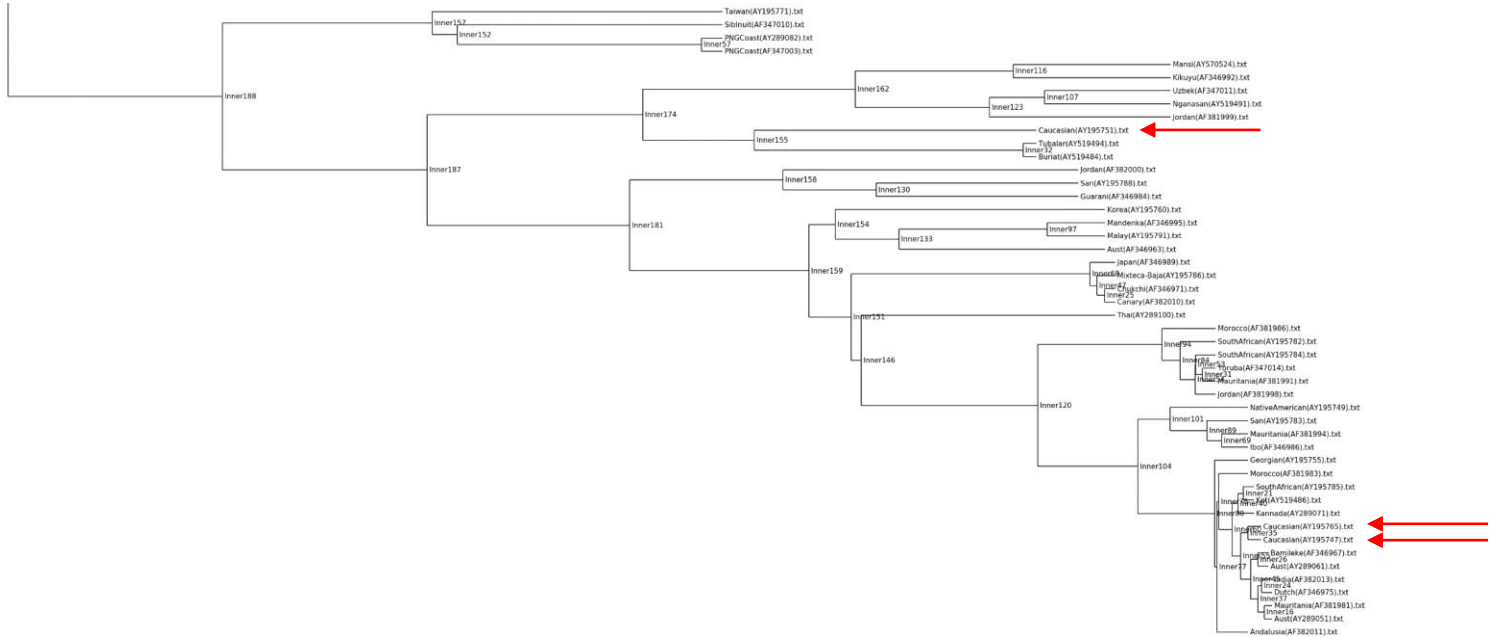
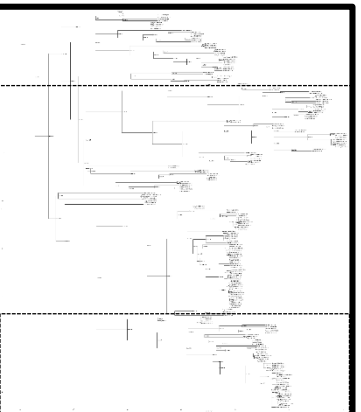
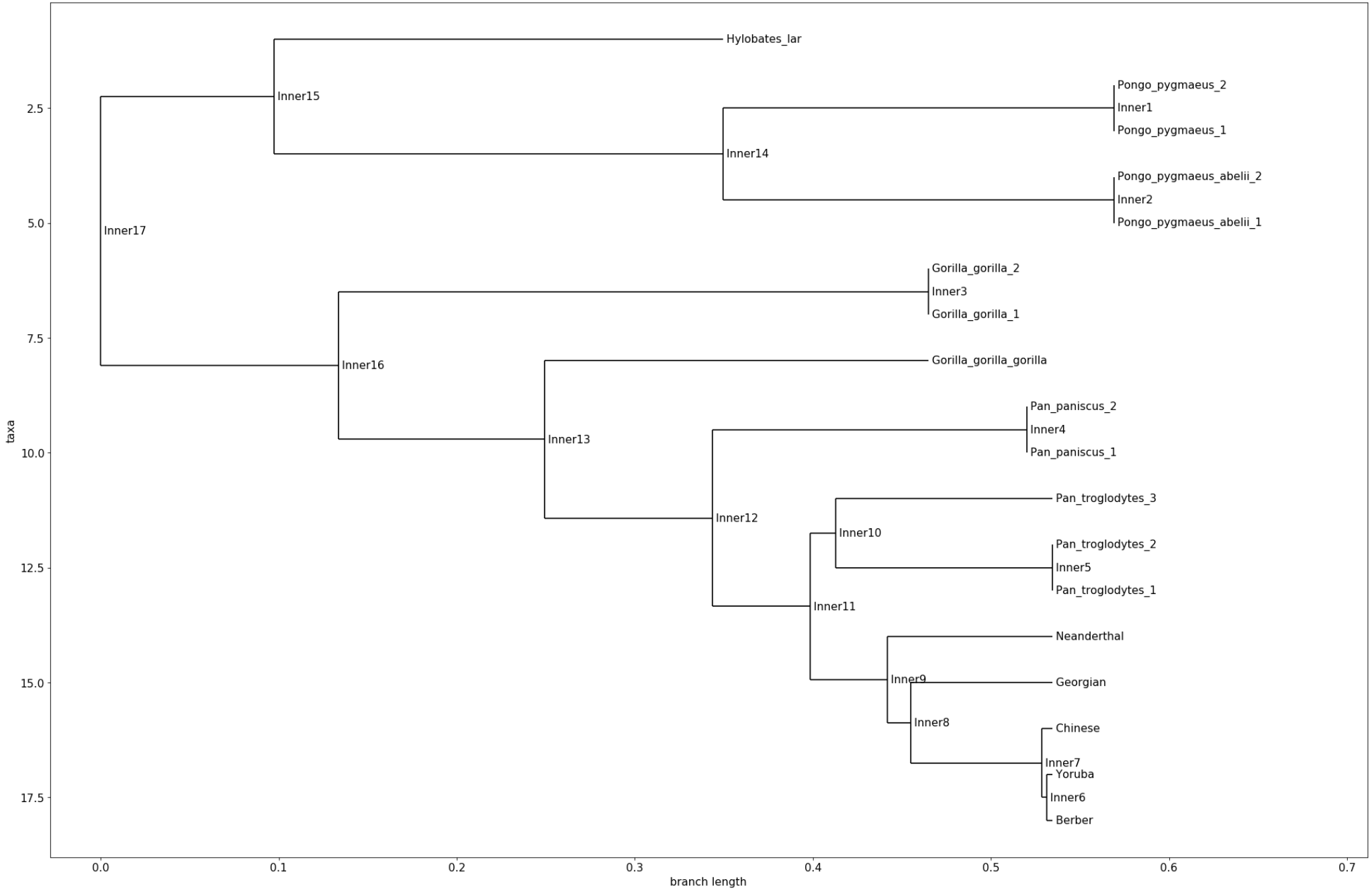




- Phylogenetic tree of 206 modern humans and 2 neanderthals
- neanderthals are genetically distant from modern humans


Hylobates_lar
Inner15
Pongo_pygmaeus_2
Inner1
Pongo_pygmaeus_1
Inner14
Pongo_pygmaeus_abelii_2
Inner2
Pongo_pygmaeus_abelii_1
Inner17
Gorilla_gorilla_2
Inner3
Gorilla_gorilla_1
Inner16
Gorilla_gorilla_gorilla
Pan_paniscus_2
Inner4
Pan_paniscus_1
Inner13
Pan_troglodytes_3
Inner12
Inner10
Pan_troglodytes_2
Inner5
Pan_troglodytes_1
Inner11
Neanderthal
Inner9
Georgian
Inner8
Chinese
Inner7
Yoruba
Inner6
Berber
taxa
2.5
5.0
7.5
10.0
12.5
15.0
17.5
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
branch length

Conclusion

- **Neanderthal** closely related to **modern humans**, when compared to other primates
- The distance between **Neanderthals** and **Humans** show that they were two different species
- Our results don’t show weather there was a geneflow between the two species
- The split-off of Georgians from the other human groups, indicates that there might be inaccurate measurements. This could potentially be fixed by using different distance matrices.

References

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- https://www.ncbi.nlm.nih.gov/pubmed/20448178
- https://www.eurekalert.org/pub_releases/2016-02/m-egf021616.php
- Richard E. Green et al.: A Complete Neandertal Mitochondrial Genome Sequence Determined by High-Throughput Sequencing
- https://www.theverge.com/2017/10/9/16448412/neanderthal-stone-age-human-genes-dna-schizophrenia-cholesterol-hair-skin-loneliness

Picture Courtesies

- title picture (skulls): hairymuseummat https://www.theverge.com/2017/10/9/16448412/neanderthal-stone-age-human-genes-dna-schizophrenia-cholesterol-hair-skin-loneliness
- Neanderthal skeleton: Claire Houck from New York City, USA - Neanderthal Skeleton
- geneflow picture: http://news.bbc.co.uk/nol/shared/spl/hi/sci_nat/10/neanderthal/img/neanderthals_786.gif
- mtDNA Picture: ***Emmanuel Douzery***