

Where Do We Come From?

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1. Construct an evolutionary tree based on human mtDNA data ([data](#)). Don't forget bootstrap support/posterior probabilities.

Sequences were aligned using UGENE v.41, MAFFT algorithm ([fasta alignment file](#)).

A tree was built using iqtree2, using PHYLIP Neighbor Joining build method with bootstrapping enabled (fig. 1) and then visualized using iTOL.

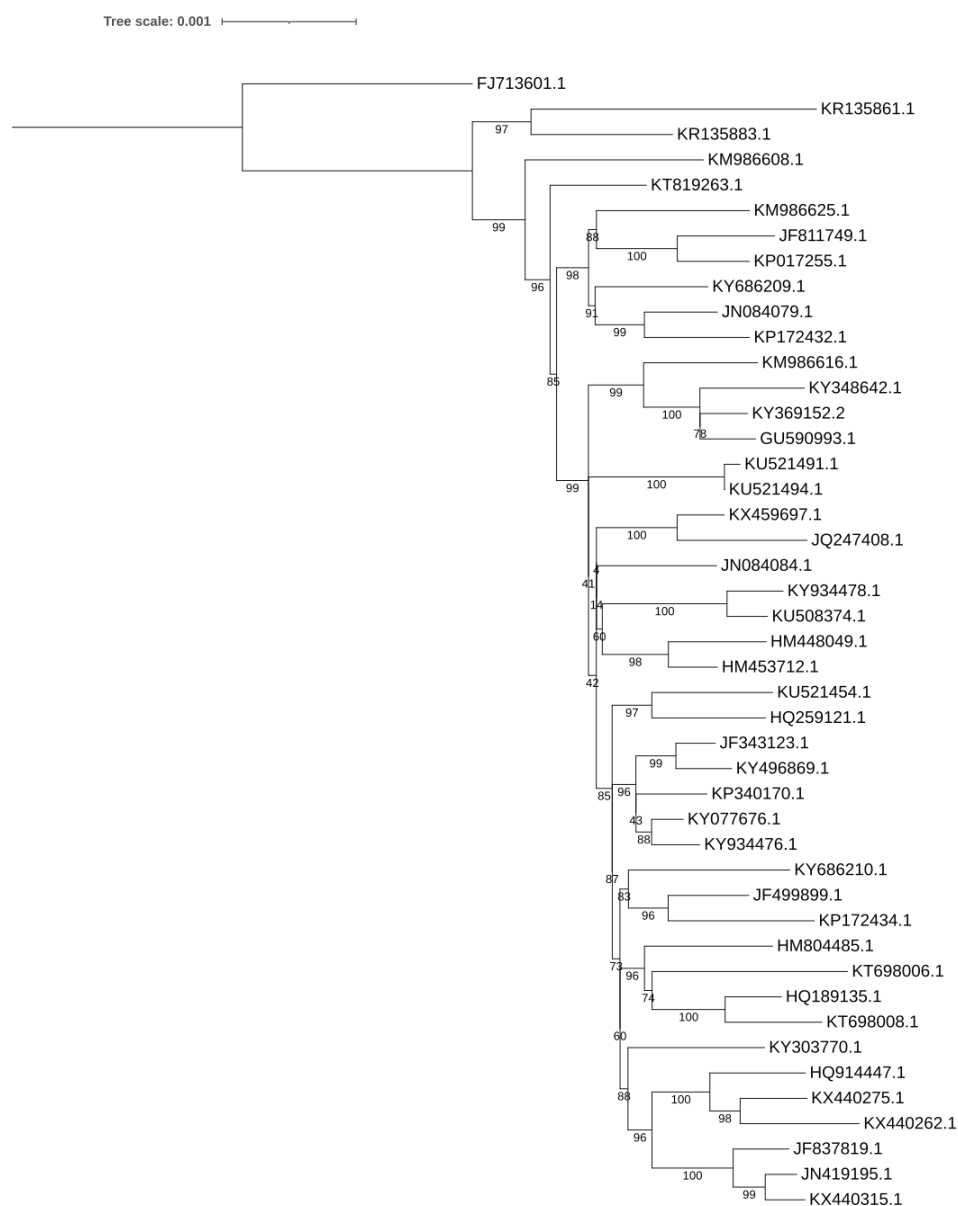


Fig 1. Evolutionary tree based on 45 human mtDNA sequences

2. Use the multiple alignment you constructed and estimate how old is Mitochondrial Eve. How old is the most recent ancestor of all non-Africans?

From <https://www.nature.com/articles/s41598-021-84583-1#Sec2>, right now mtDNA mutation rate is about 4.33×10^{-8} and 40 000 years ago was 1.91×10^{-8} . Assuming average mutation rate over last 100 000 years is about 1.91×10^{-8} , from the tree diameter of 0.0063212186 we estimate the age of mitochondrial Eve to be around 165 000 years. In the same manner, the age of the last common ancestor of all non-Africans is estimated to live around 142 000 years ago.

3. Add five Neanderthal samples ([data](#)) and three Denisovan samples ([data](#)) to the set of *Homo sapiens* samples and construct the resulting evolutionary tree. What is the age of the most recent Neanderthal-modern human ancestor?

Five Neanderthal samples and three Denisovan samples were added, all sequences were re-aligned using UGENE v.41 with MAFFT algorithm ([result_file](#)).

A tree was built using iqtree2, using PHYLIP Neighbor Joining build method with bootstrapping enabled (fig. 2) and then visualized using iTOL.

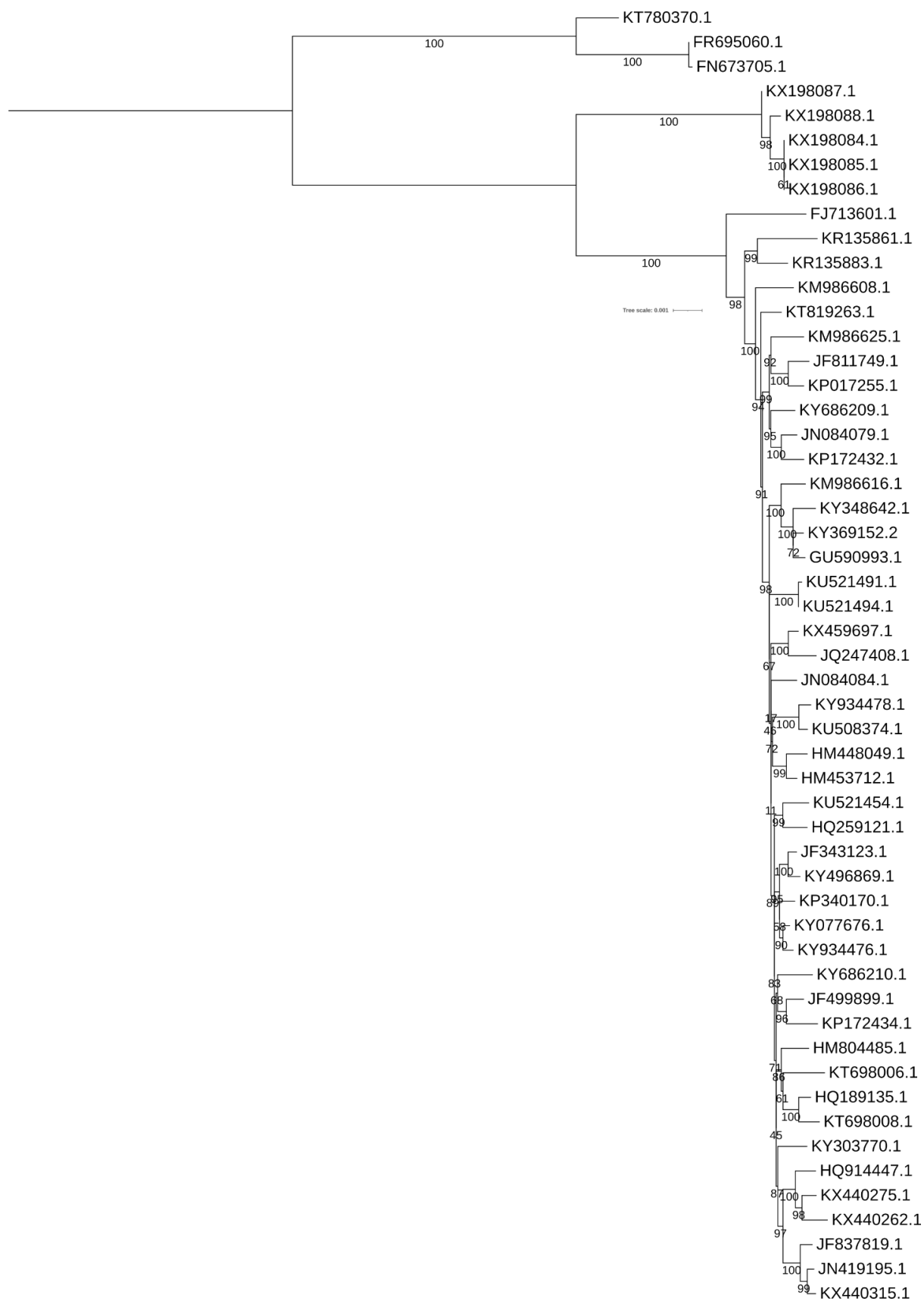


Fig 2. Evolutionary tree based on 53 mtDNA sequences: 45 human, 5 neanderthals and 3 Denisovans

Within the same estimation framework as above, we estimate the last common ancestor of all considered specimens to live around 850 000 years ago and the last common ancestor of Neanderthals and Homo sapiens to live around 420 000 years ago.

Our evolutionary tree and age estimations appeared to be in agreement with the evolutionary tree, obtained from mtDNA sequences in (van Holstein 2016) (fig 3).

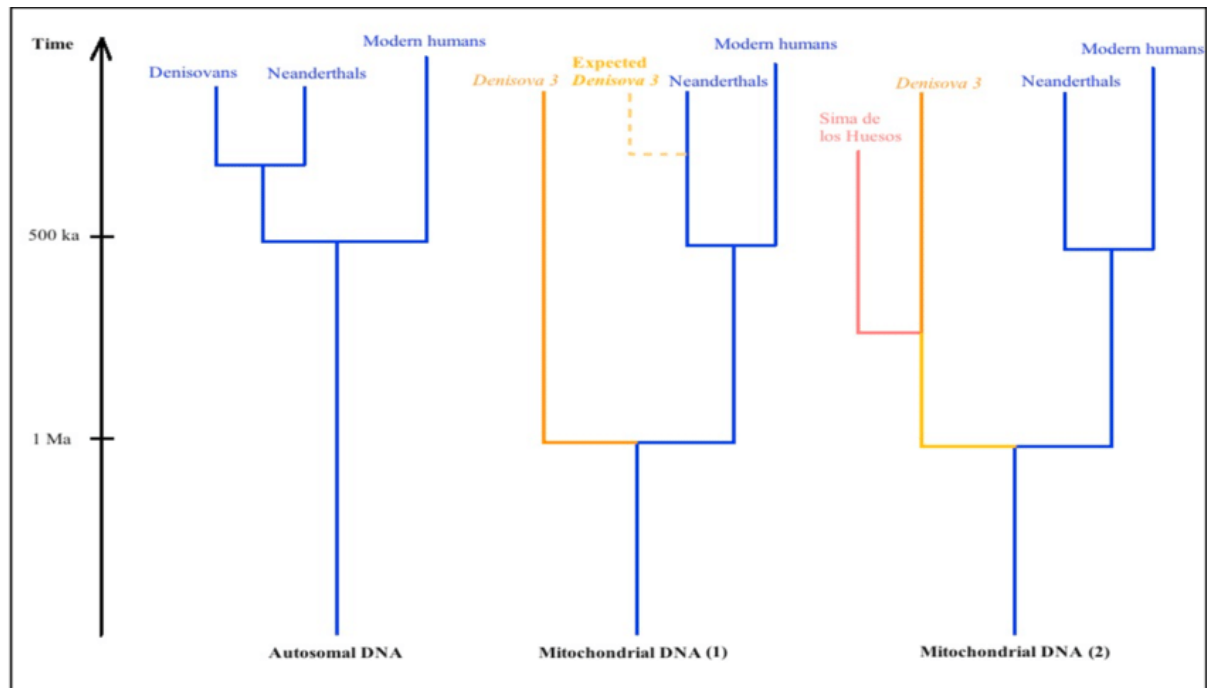


Fig 3. Phylogenetic trees showing discrepancies between Denisova autosomal and mtDNA
Autosomal DNA