Fossils within fossils: Using HPC in the classroom to test for ancient hybridization in Neanderthal genomes

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Genetic history of an archaic hominin group from Denisova Cave in Siberia

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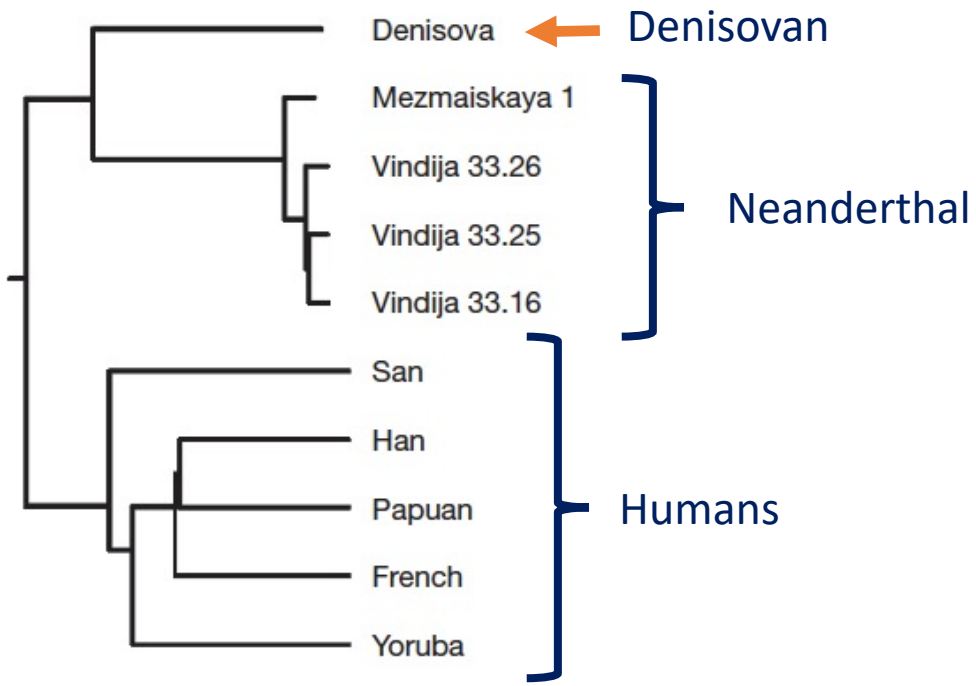
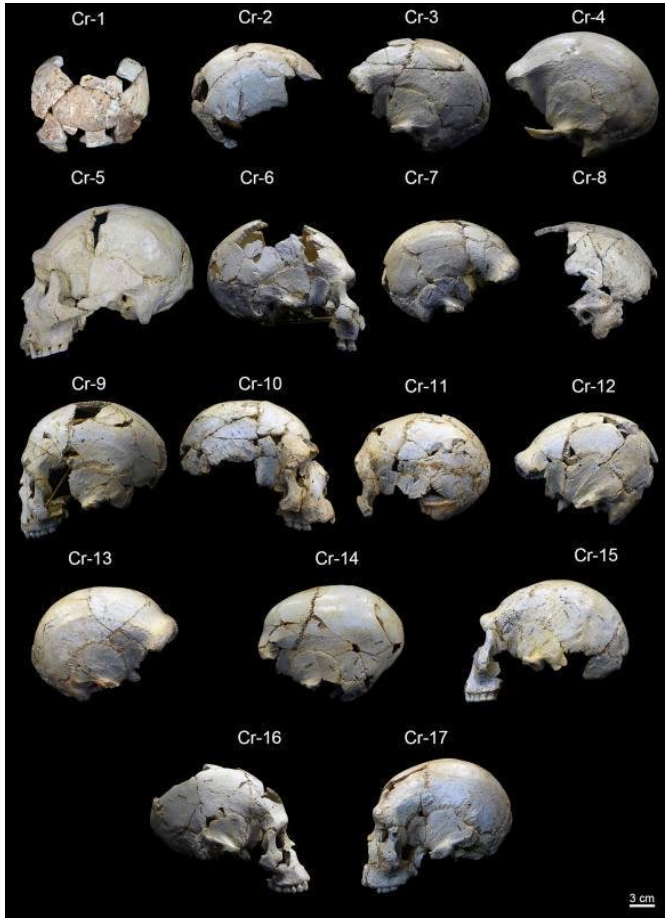


Sima de los Huesos (Pit of Bones)



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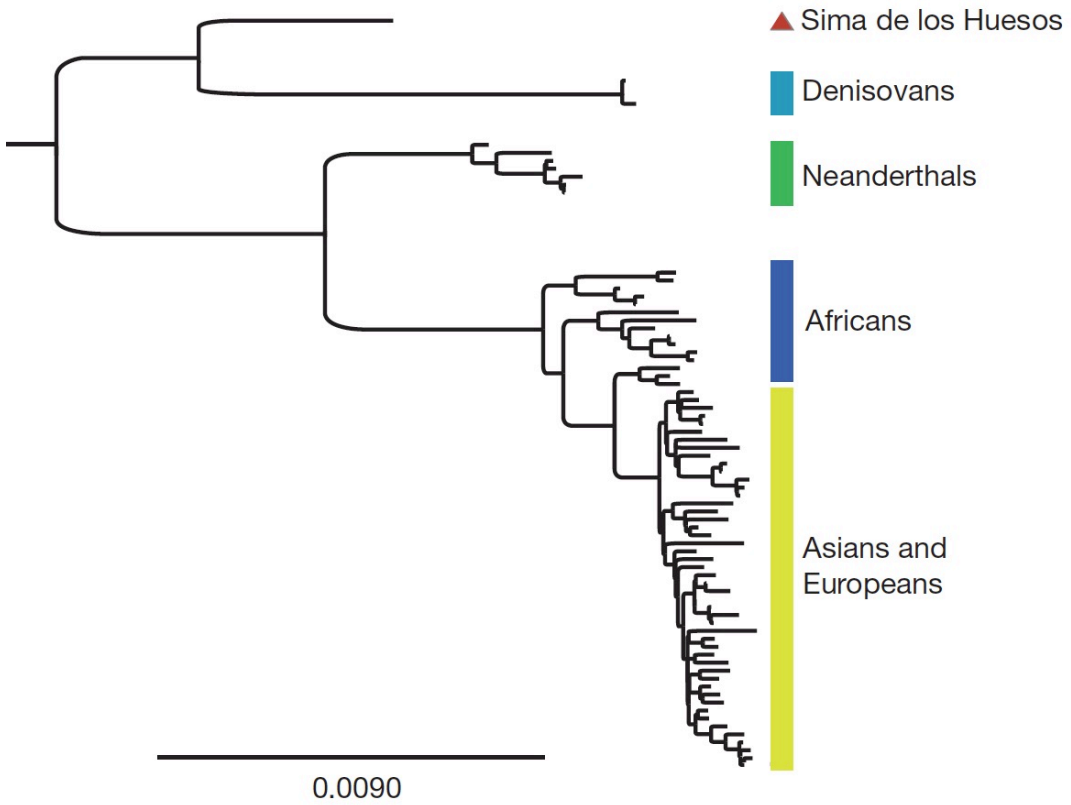
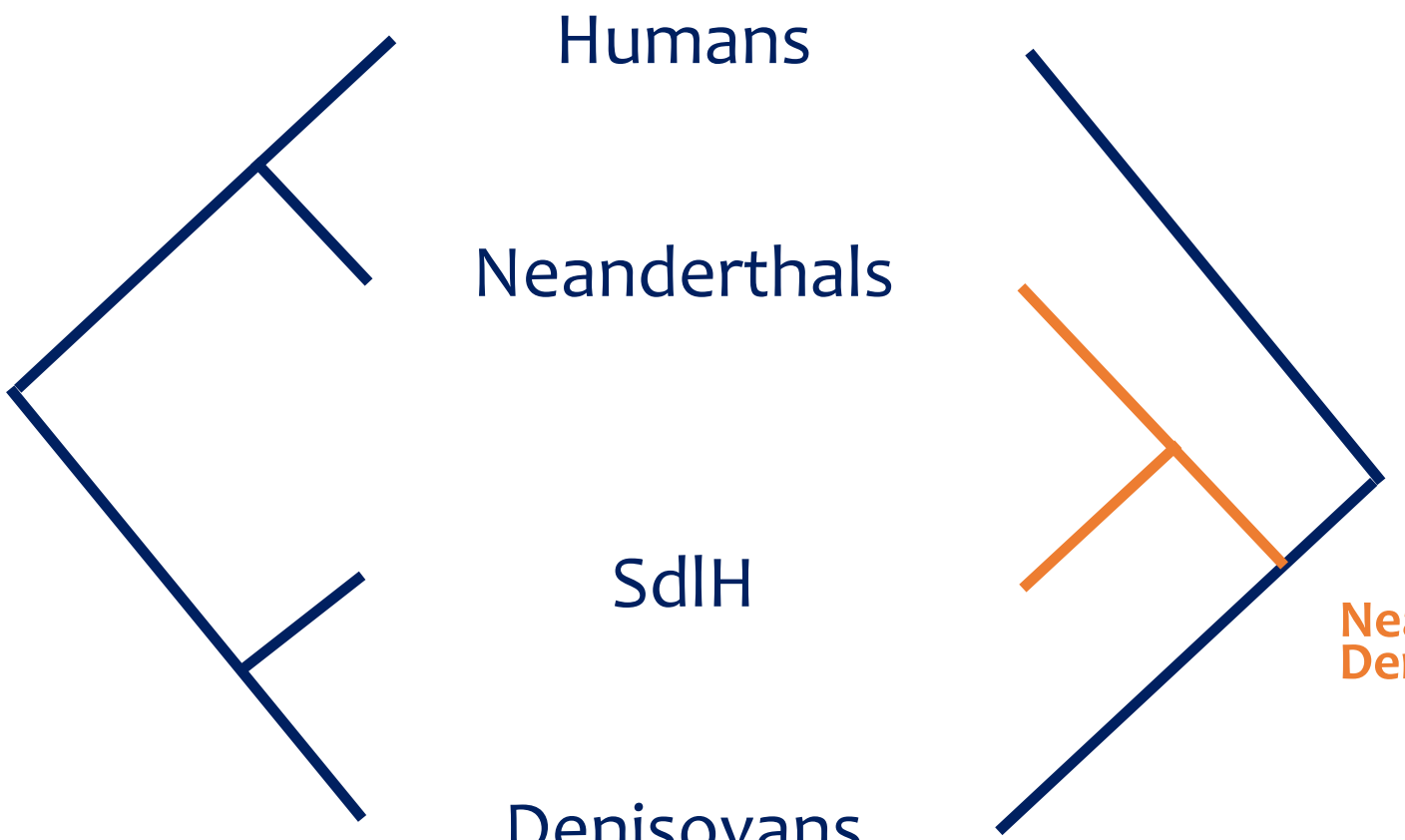


mtDNA

Mitochondrial replacement by ancient hominin?

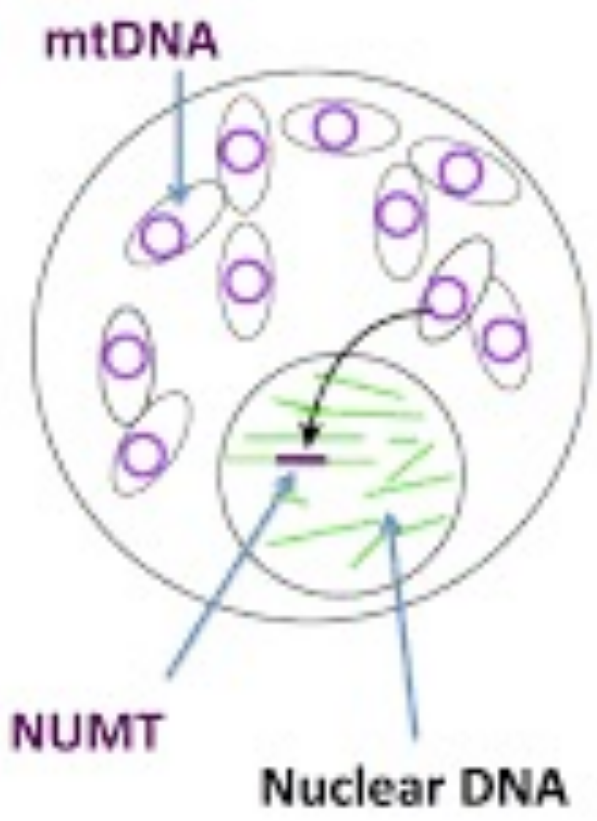


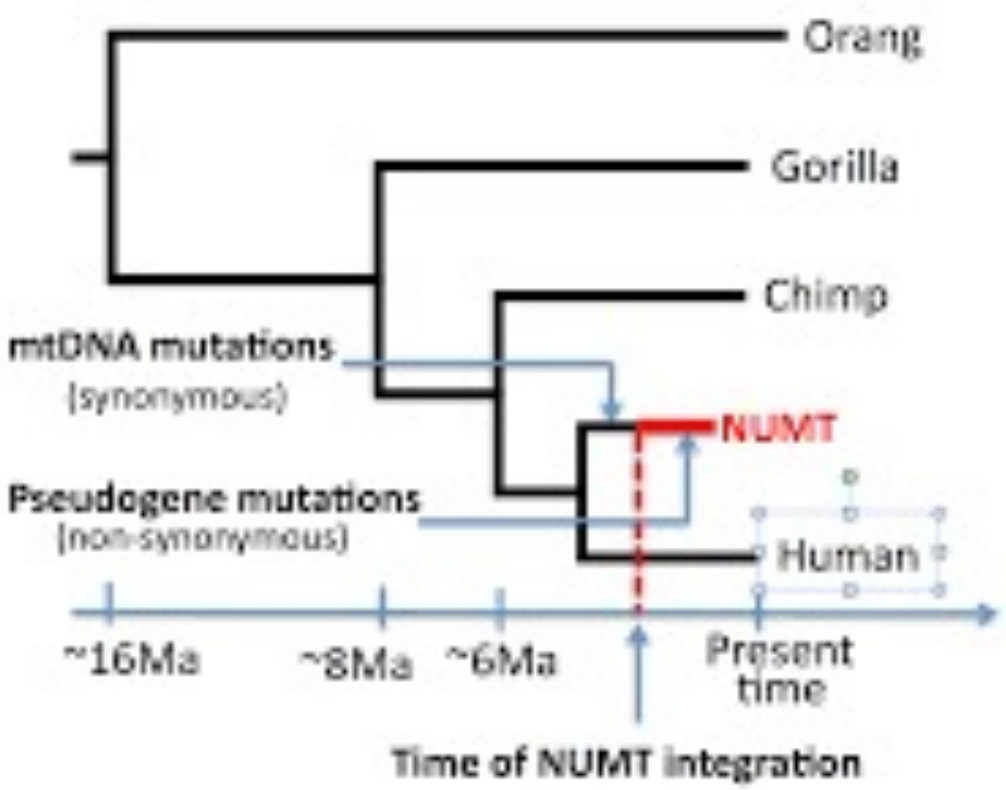
mtDNA

nucDNA

Neanderthals group with Denisovans in nuclear DNA

Numts are “genomic fossils” recording the mtDNA across time





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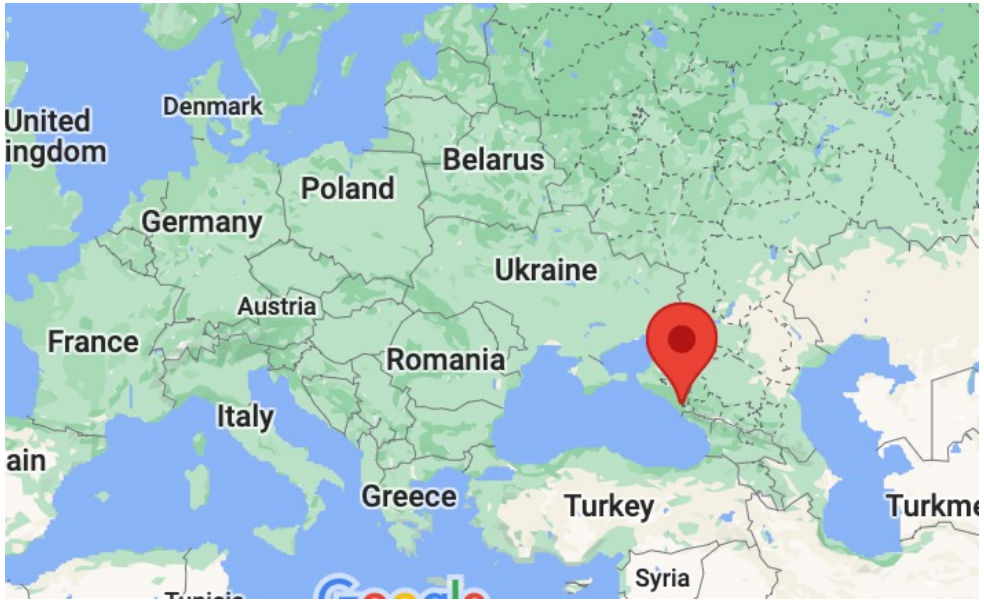

Neanderthal Pos.	Mez-1 Neanderthal Allele	Mez-1 Denisovan Allele	No. Supporting Reads
3,478	A	G	66
8,463	T	C	16
9,525	T	C	7
9,711	T	C	13
11,618	T	C	15
	mtDNA	**numt**	

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Neanderthal **numts** resemble Denisovan mitochondrial DNA

Thus, ancient, human-like mitochondrial DNA invaded (**via hybridization**) and eventually **replaced** ancestral Neanderthal mitochondrial genomes

Implies a novel Out-of-Africa event, prior to the evolution of humans

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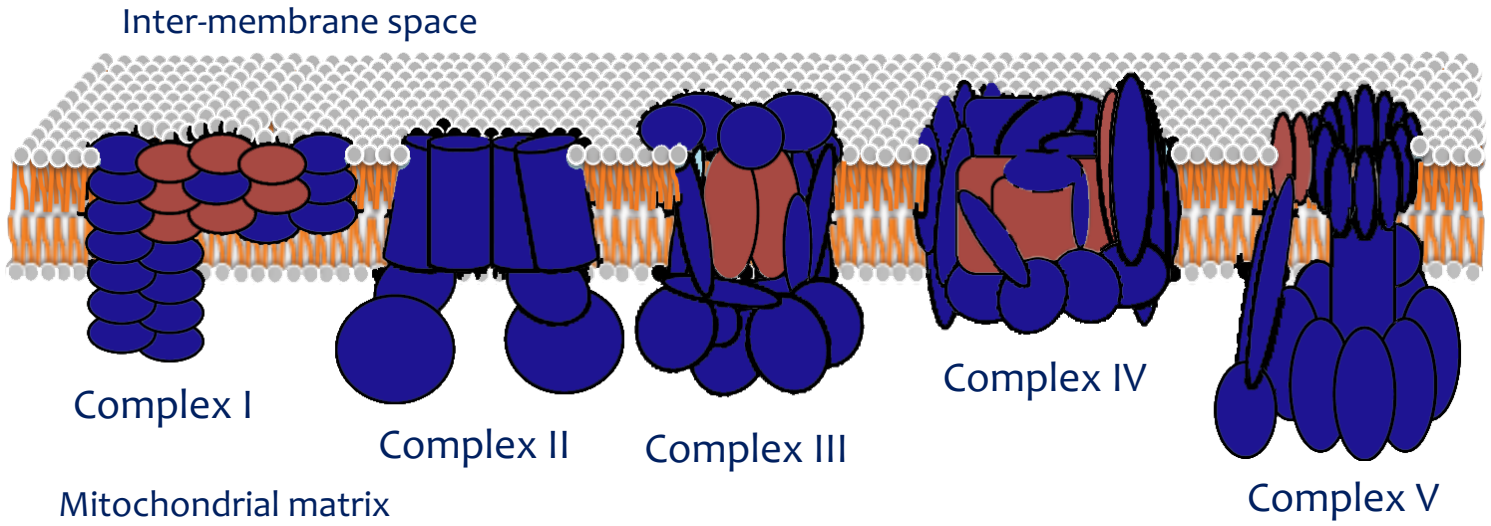
Did nuclear-encoded mitochondria-targeted genes move along with them?

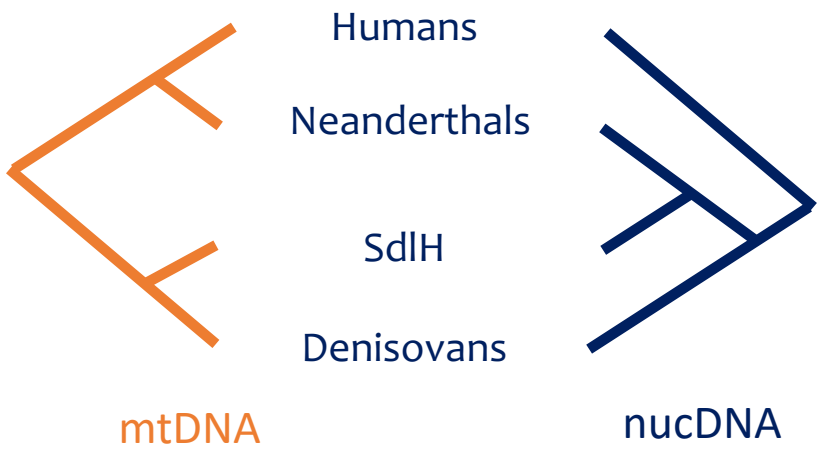
Oxidative Phosphorylation – "OXPHOS"



mt-encoded subunit

nuclear-encoded subunit

Rand et al 2004. *TREE*



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