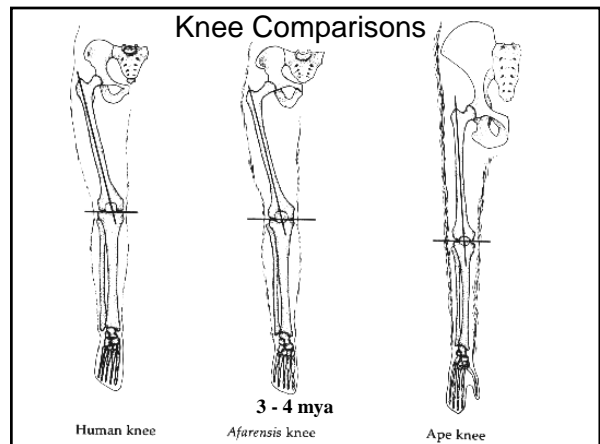
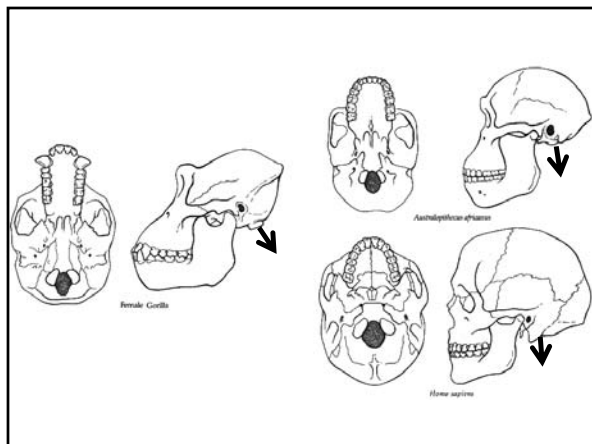
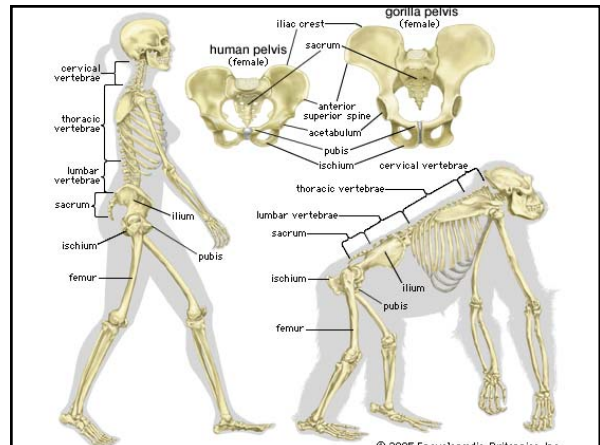
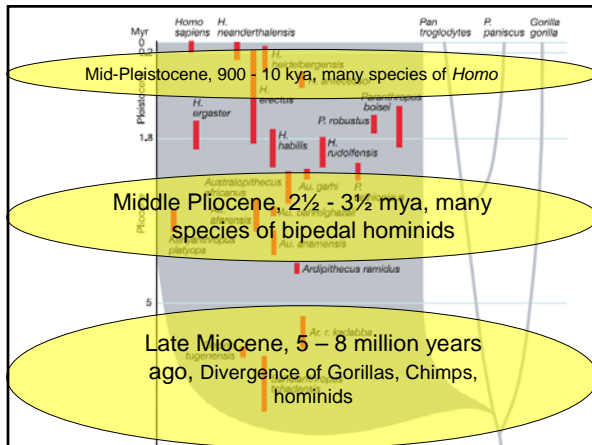


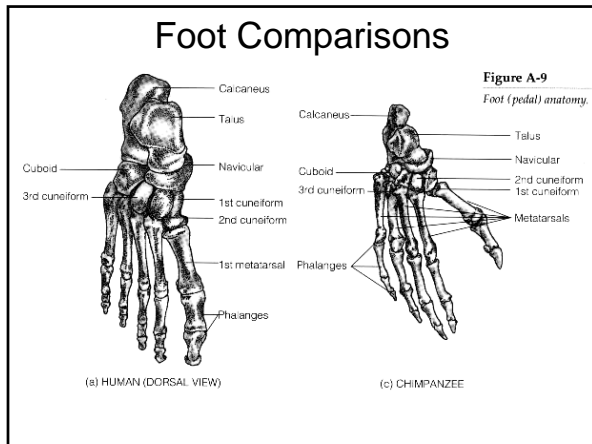
Diversity and Evolution

- When we use the term diversity today, we tend to think in terms of a handful of “races” within our species
- Anthropology takes a long term view that considers the many *species* within our evolutionary lineage over the past 8 million years

3 Periods of High Diversity

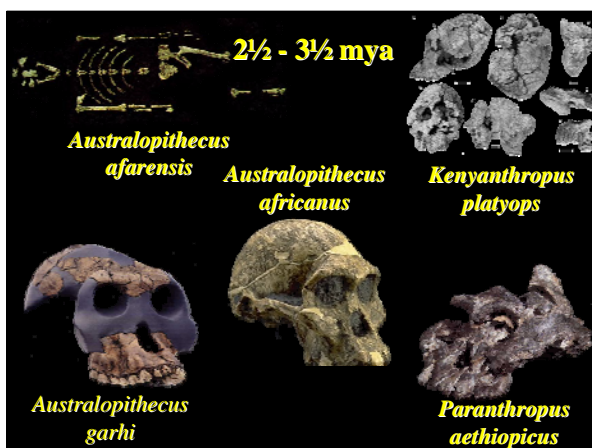
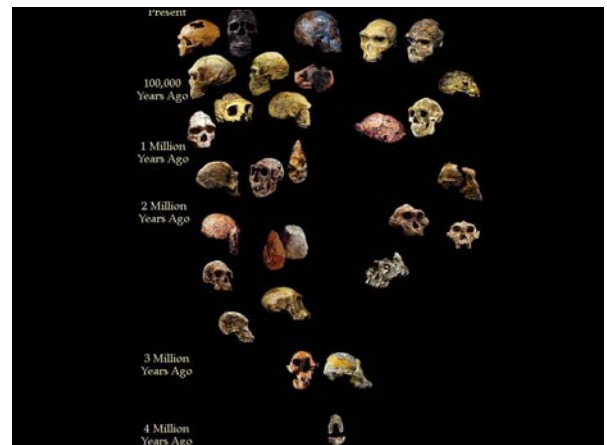
- Late Miocene, 5 – 8 million years ago
 - Divergence of Gorillas, Chimps, hominids, evolution of bipedalism
- Middle Pliocene, 2½ - 3½ million years ago
 - Many species of bipedal hominids
- Mid-late Pleistocene, 900 - 10 kya
 - Many species of *Homo*, encephalization





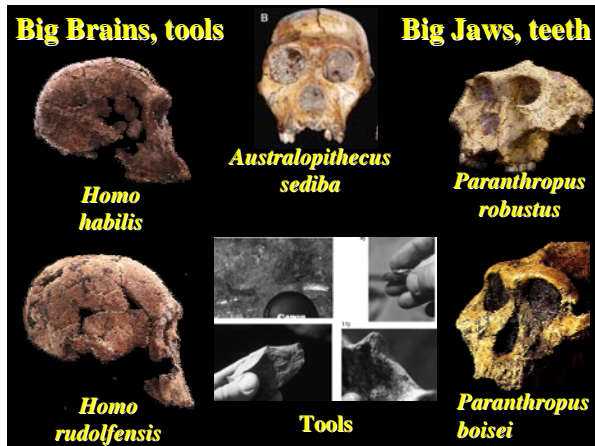
Result of high diversity?

- Evolution of three different lineages
 - Gorillas—first to split from common ancestor
 - Chimpanzees—last to share common ancestor with us
 - Bipedal hominids, several flavors

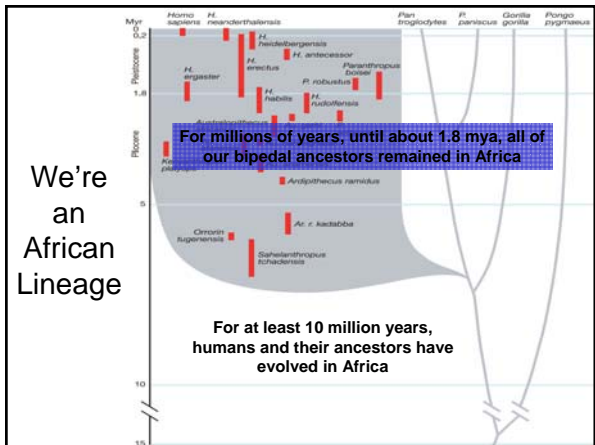
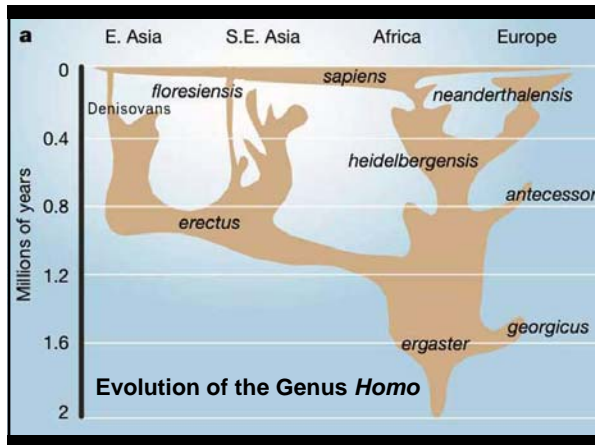


Result of high diversity?

- Hominids split during this period of extreme climatic change with tougher plant foods into several evolving lineages:
 1. A group of Australopithecines that continue until a little after 2 mya
 2. A group of very large jawed heavy chewers (*Paranthropus*)
 3. A group that retains slighter jaws but show cranial expansion (*Homo*)

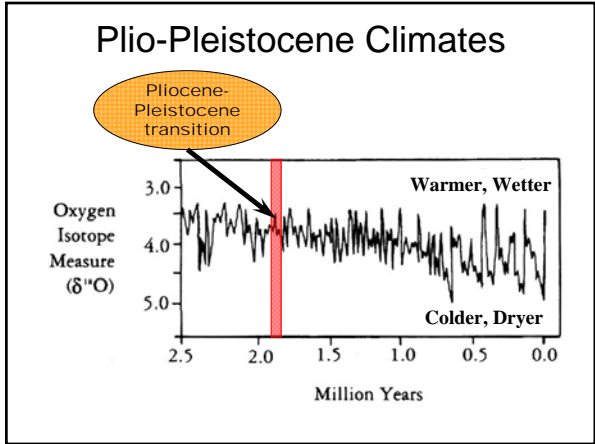


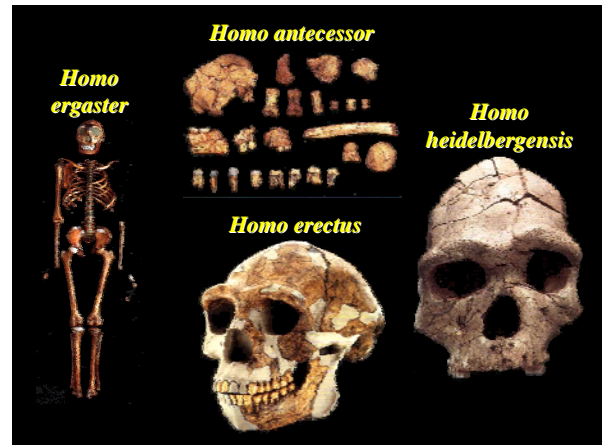
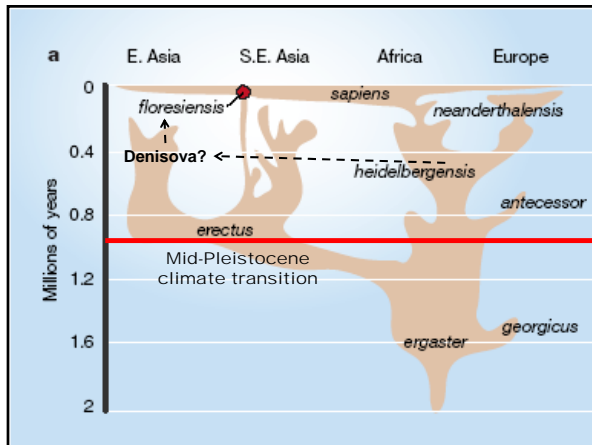
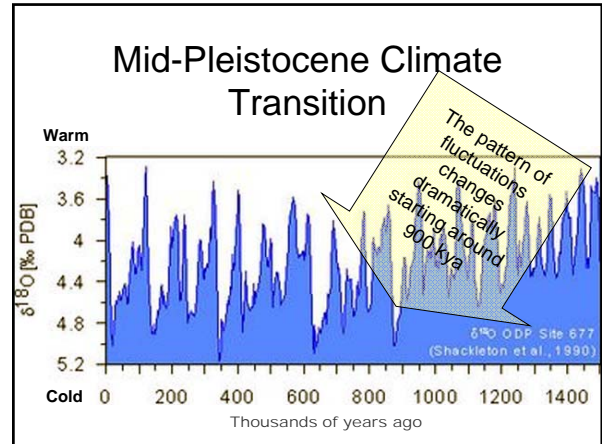
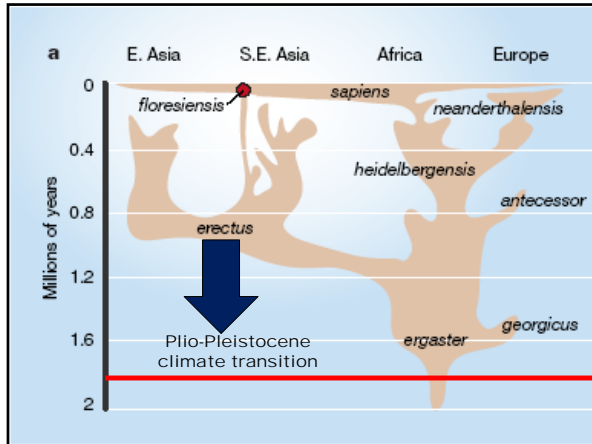
WHICH LED TO



Then we began leaving


- Over and over and over again our bipedal ancestors walked out of Africa
 - First, at the climatic upheaval that marked the Pliocene/Pleistocene boundary
 - Next at the mid-Pleistocene Climate transition
 - Finally, 60-70 kya our species left





Homo soloensis

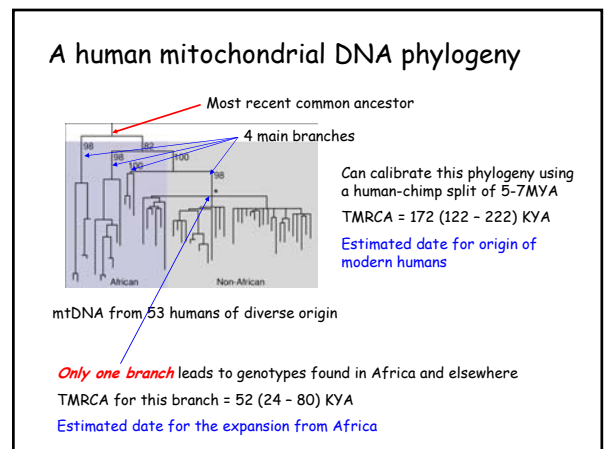
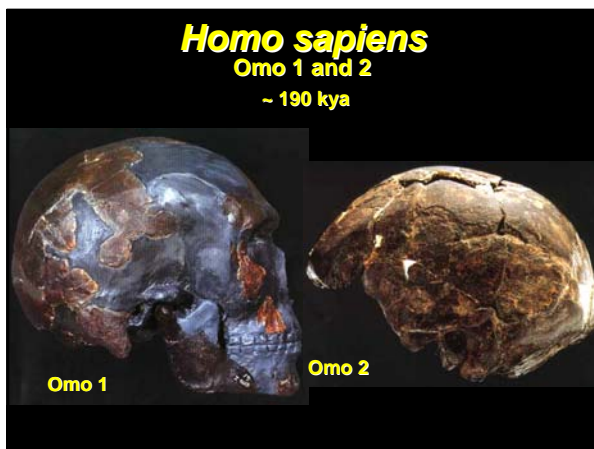
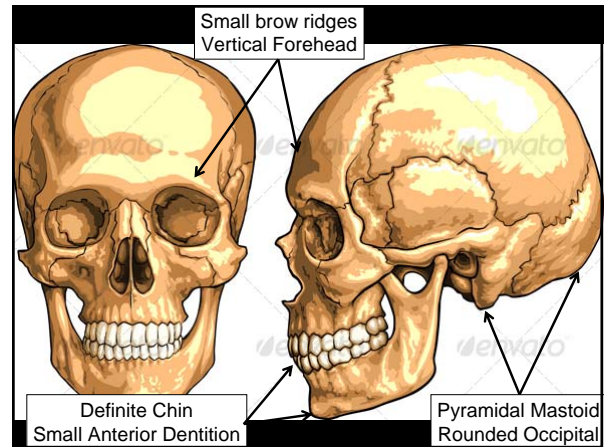
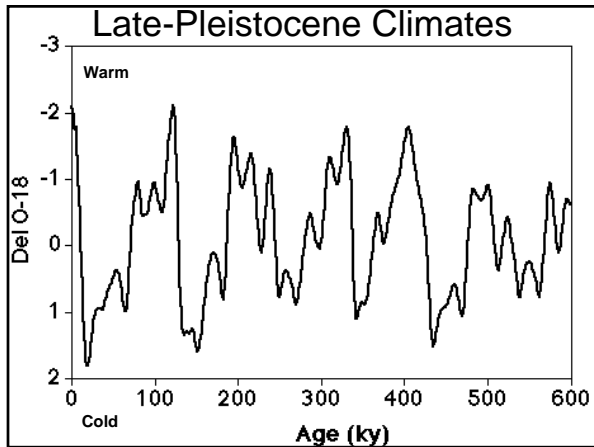
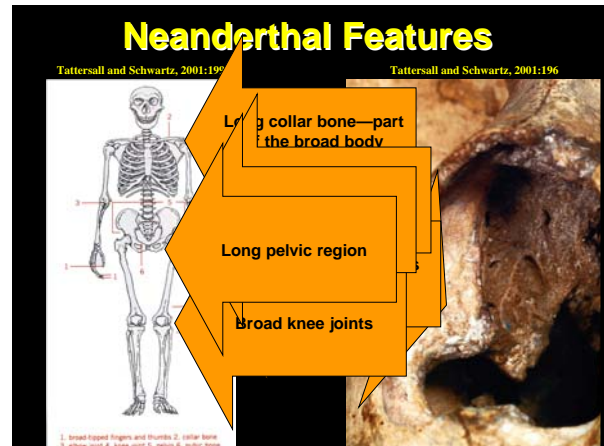
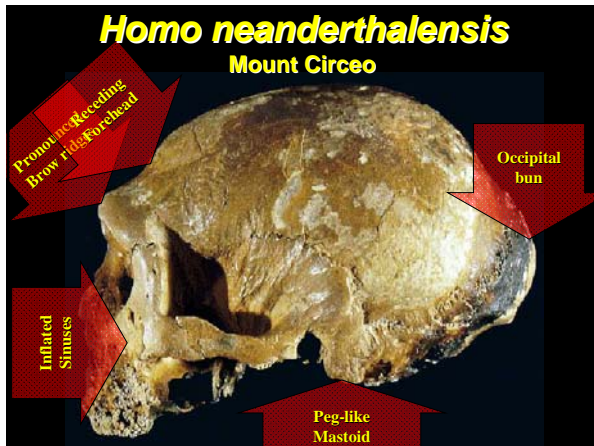
- Late surviving *Homo erectus* in east Asia?
- Dates as recent as 30 kya
- Solo 6 skull cap shown



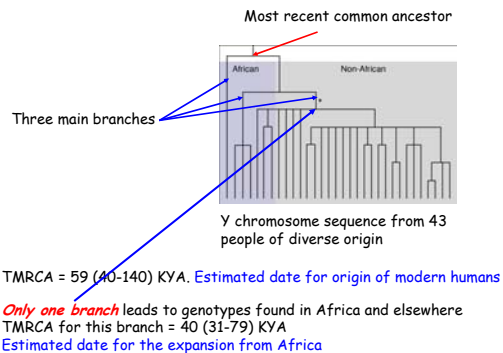
Denisova hominid

- Siberian remains, 40-60 kya
- Hand bone, teeth
- DNA very divergent from modern





A human Y chromosome phylogeny



What phylogenies tell us

TMRCA	MtDNA	Y chromosome
Whole Species	122-222 KYA	40-140 KYA
Out of Africa	24-80 KYA	31-79 KYA

Combined data suggest:

Humans emerged in Africa ~ 120-140 KYA

Humans spread from Africa ~ 30-80 KYA

Could Humans have interbred with other hominids?

- While our ancestors evolved up to 200 kya, other hominids were extant as recently as 12 kya
 - Denisova ~30 kya
 - *Homo soloensis* ~30 kya
 - Neanderthals ~25 kya
 - *Homo floresiensis* "hobbit" ~12 kya

How can we Tell?

- *Homo soloensis* and *Homo floresiensis* are morphologically so different from moderns that successful interbreeding is unlikely
- No genetic testing is available on these recent hominids yet

The Genetic Tests

- mtDNA has been sequenced for both the Denisova hominid and several Neanderthal fossils
- This sequence data shows that both of these ancient hominids are distinct species from modern humans
 - Neanderthals mtDNA shows common ancestor with humans ~500 kya
 - Denisova common ancestor ~1 mya

The Genetic Tests

- The Denisova hominid has only **contamination levels** of Y chromosome sequences
 - Researchers suggest finger bone is from a female
- Neanderthal Y chromosome sequence information is even more unique than mtDNA suggesting even more divergence from modern humans
- **mtDNA and Y chromosome are the ancestrally informative DNAs!**

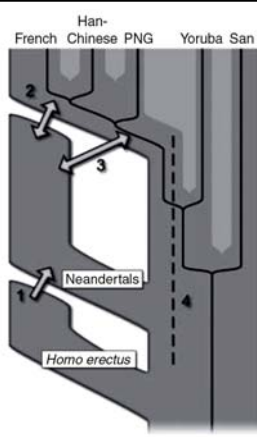
Nuclear DNA

- Analyses of nuclear DNA (other than Y chromosome) from Croatian Neanderthals dated about 40 kya and from the Denisova female suggests interbreeding with modern humans
- Neanderthal DNA is most similar to non-African moderns
 - Researchers suggest 1-4% DNA from Neanderthals
- Denisova is most like Melanesians
 - 4-5% DNA from Denisovans

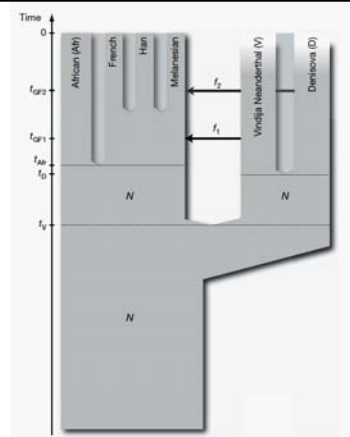
What does this mean?

- Ancestrally informative DNA shows no interbreeding
 - mtDNA, Y chromosome
- Nuclear DNA shows odd patterns with non-African DNA related to Neanderthals and Denisovans
 - Neanderthal interbreeding is dated at between 50 – 80 kya
 - Denisova interbreeding dated to ~30 kya -- with Melanesians?

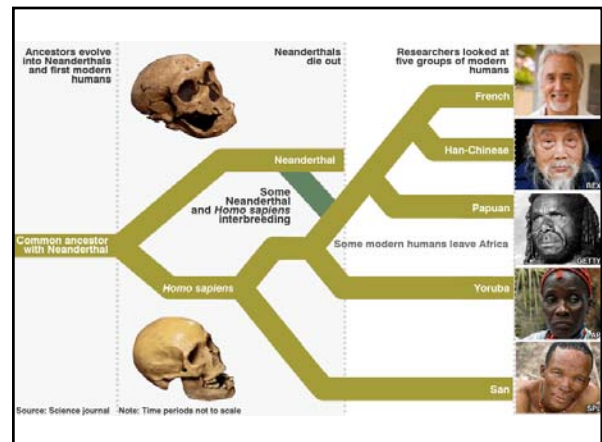
- Gene flow into Neanderthal from *Homo erectus*
 - This would make the Neanderthal genome show high divergence from modern humans
- Gene flow between late Neanderthals and humans in Europe and/or western Asia
 - There is no evidence of this because Neanderthals are equally distantly related to all non-Africans
- Gene flow between Neanderthals and the ancestors of all non-Africans
 - Most parsimonious explanation of our observation
- Old substructure in Africa that persisted from the origin of Neanderthals until the ancestors of non-Africans left Africa
 - Also compatible with the current data



Genetic comparisons of Denisova hominid, Vindija Neanderthal and modern humans



HOW DID THIS PLAY IN THE LAY PRESS?



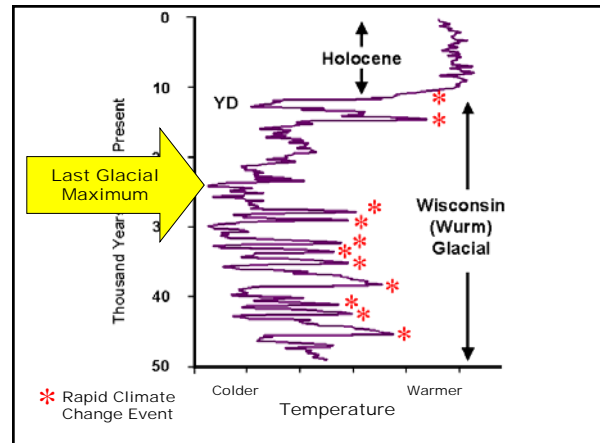
Popular Perception

- Press jumped on interbreeding because it is “sexy”
- Problems?
 - Researchers suggest that Neanderthals interbreeding only at some point between 50,000 and 80,000 years ago
 - But humans and Neanderthals coexisted for ~20,000 years in Europe starting about 45,000 years ago
 - If humans and Neanderthals interbred during that later time, the evidence should be in the genomes of Europeans today
 - The fact that there is no evidence of this later interbreeding suggests that there is something unusual about the interaction of the two species during the earlier period

Neanderthal Admixture

- Fourth model also consistent with the results
- Before humans and Neanderthals diverged in Africa if those ancestral Africans were segmented into population groups (subspecies)
 - Some kind of barrier keeping some gene variants in one part of Africa and other variants in another part
 - Ancestors of Neanderthals leave Africa, and then much later the ancestors of Europeans and Asians leave Africa.
 - If both sets of immigrants came from the same part of Africa, they might have both taken some gene variants with them that did not exist in other parts of Africa
 - This scenario could lead to Europeans and Asians (and some Africans) with Neanderthal-like pieces of DNA **without a single hybrid baby ever being born**

WHAT HAPPENED TO THE OTHER HOMINIDS?



Recent variation in *Homo*

- Throughout most of our 6 million year history there have been multiple species of hominids alive simultaneously
- As recently as 25 kya there were as many as four hominid species alive
- We are living in an extremely atypical time based on our evolutionary lineage