

Human Evolution: our primate ancestry

"Light will be thrown on the origin of
man and his history."

C. Darwin, 1859

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Human Culture.....

an evolutionary force



<http://www.nytimes.com/2010/03/02/science/02evo.html?pagewanted=1&em>

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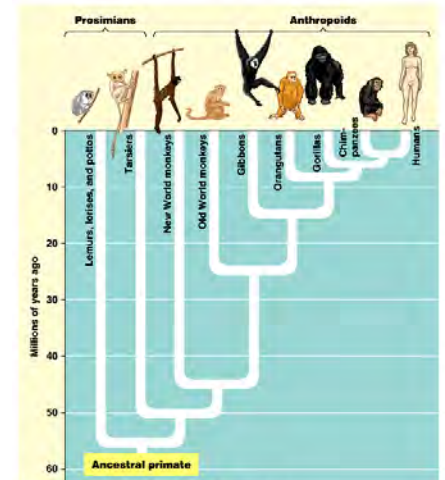


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Prosimians
early arboreal
primates



Myth #1

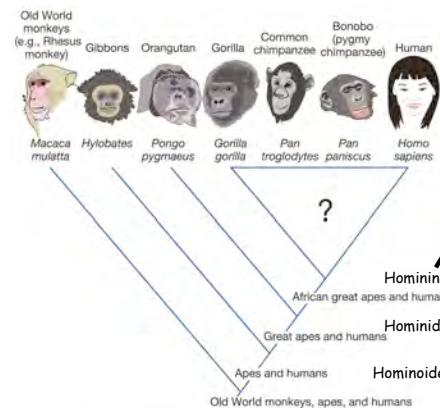


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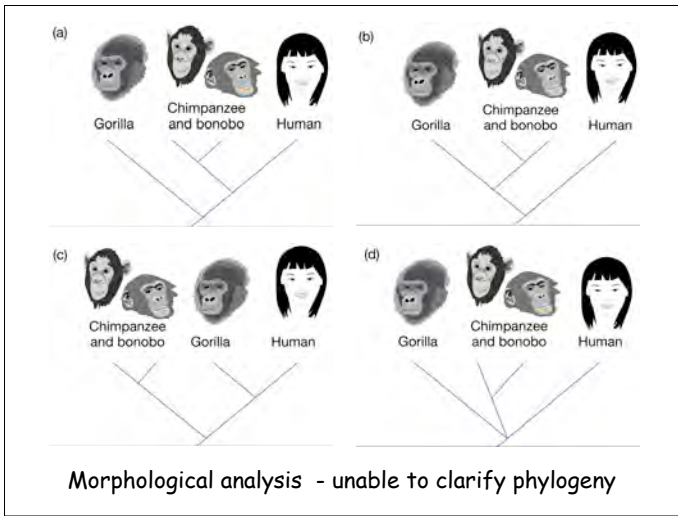
Humans are closely related to the African Great Apes



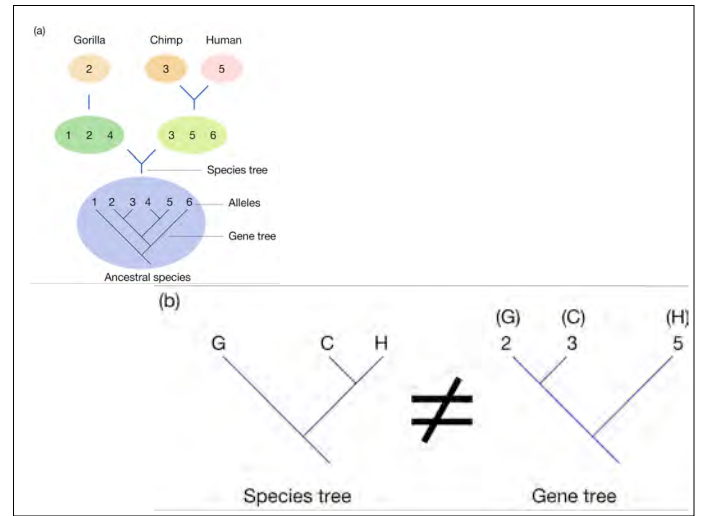
- elongated skull
- larger brow ridge
- short/stout canines
- enlarged mammarys
- reduced hair

- large brains
- no tail
- erect posture
- < joint flexibility

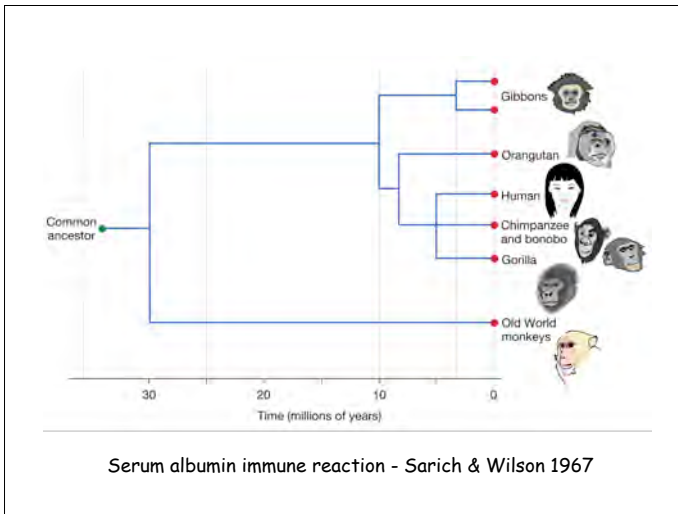
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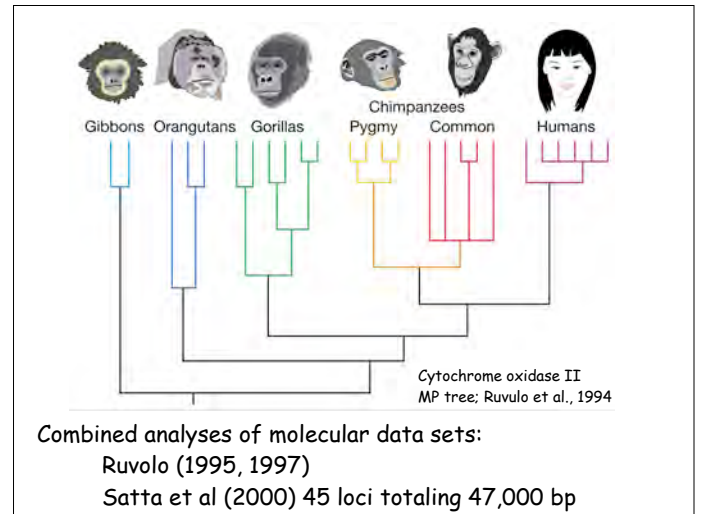
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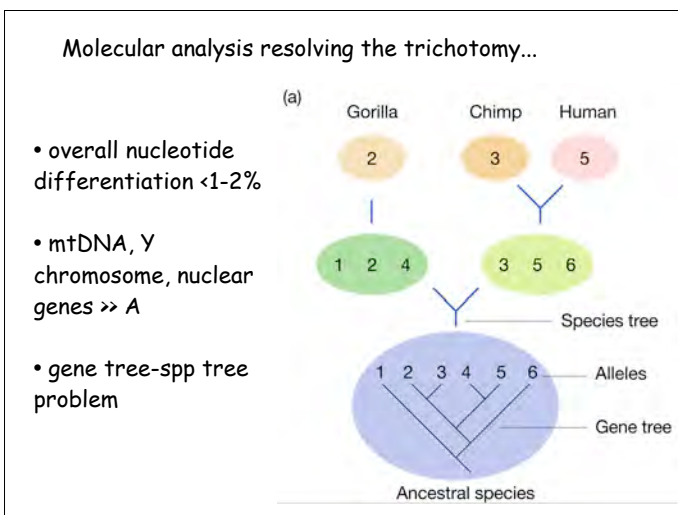
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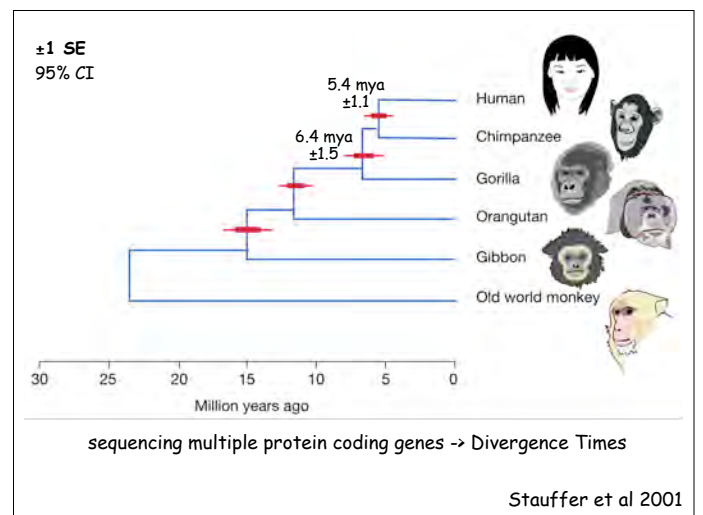
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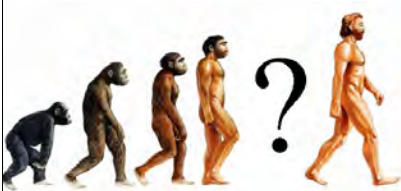
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Ardipithecus ramidus

Australopithecus anamensis

Australopithecus afarensis

Australopithecus africanus

Australopithecus garhi

Australopithecus aethiopicus

Australopithecus robustus

Australopithecus boisei

Homo habilis

Homo erectus

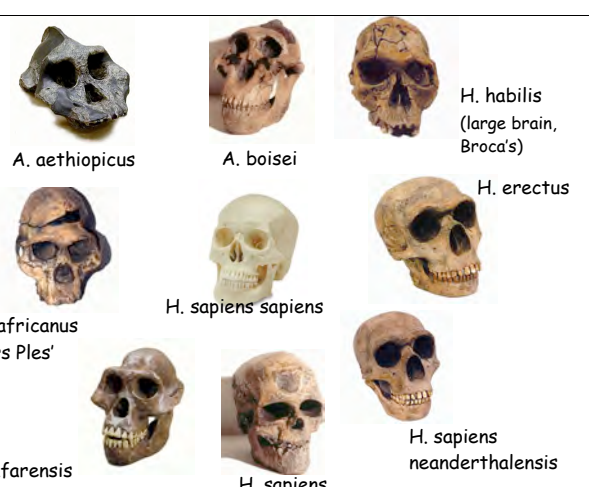
Homo ergaster

Homo sapiens heidelbergensis

Homo sapiens neanderthalensis

Homo sapiens sapiens

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A. aethiopicus

A. boisei

H. habilis (large brain, Broca's)

H. erectus

A. africanus 'Mrs Ples'

H. sapiens sapiens

A. afarensis 'Lucy'

H. sapiens CroMagnon

H. sapiens neanderthalensis

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Australopithecus aethiopicus (2.5 Ma)

Australopithecus garhi

- Cranial
- Post-cranial
- Dental

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Australopithecus africanus



'Taung child' (small brain, human teeth)

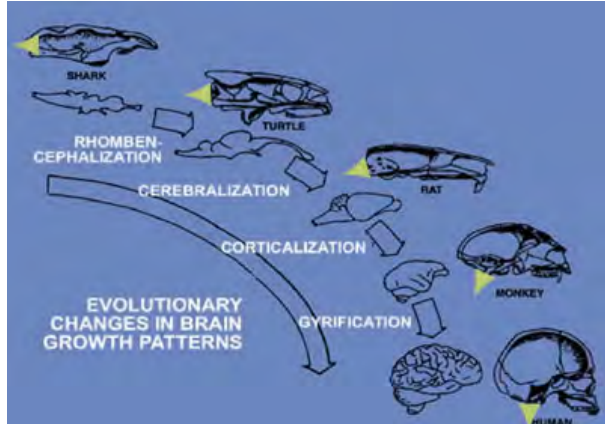
1924 Raymond Dart

'Mrs Ples' (1m, 30kg, upright)

1947 Robert Broom

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Endocasts



SHARK

TURTLE

RAT

MONKEY

HUMAN

RHOMBEN-CEPHALIZATION

CEREBRALIZATION

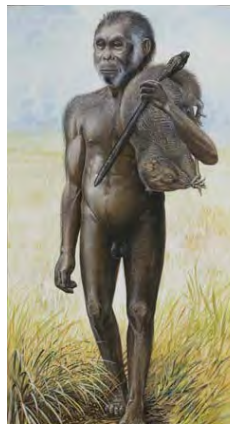
CORTICALIZATION

GYRIFICATION

EVOLUTIONARY CHANGES IN BRAIN GROWTH PATTERNS

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The Hobbits....



Scientists uncover possible new species of human

Dwarf skeleton is 18,000 years old (2004)



Homo floresiensis type specimen Flores, Indonesia

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How would a human-chimp hybrid or the discovery of a living Homo erectus change the way we see the world? (Dawkins 2009)

..... predictive hypotheses

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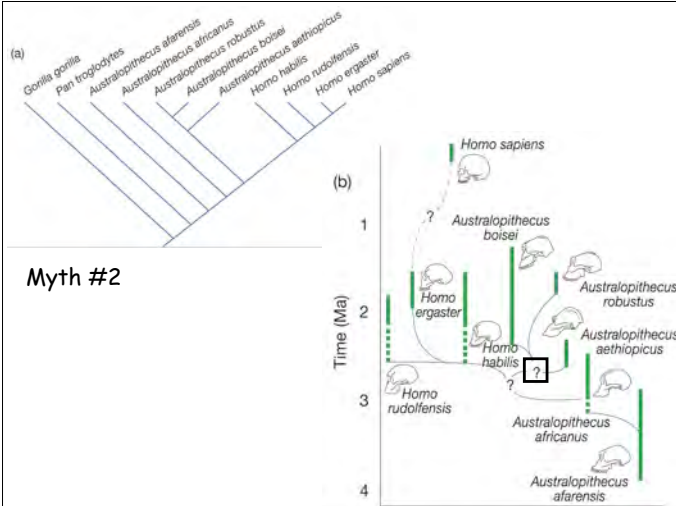
Australopithecus sediba



1.8 million years ago

Dirks et al, 2010

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Australopithecus sediba

- closer to Homo than any fossil ever found before?



H- nose A- brain

A- arms

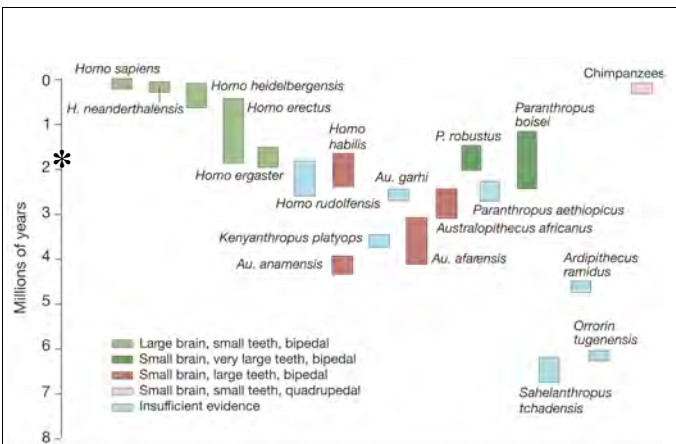
H- hands

H- legs

A- ankle bones

Berger et al, 2010

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Myth #3

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Where rather than Who?

Fossils older than 1.5my all E & S Africa



H. habilis (tools, large brain, Broca's)



A. afarensis



A. aethiopicus



A. boisei



H. erectus (fire, stone tools)



Australopithecus africanus 'Mrs Ples'



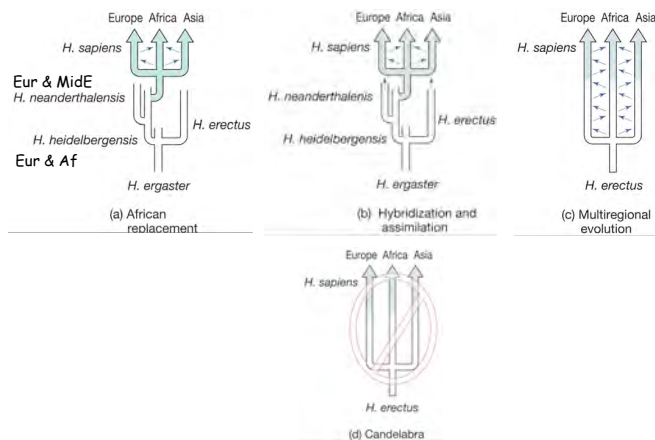
H. sapiens CroMagnon



H. sapiens neanderthalensis (burial, culture)

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2. Recent ancestry of humans? ...migration & diversification

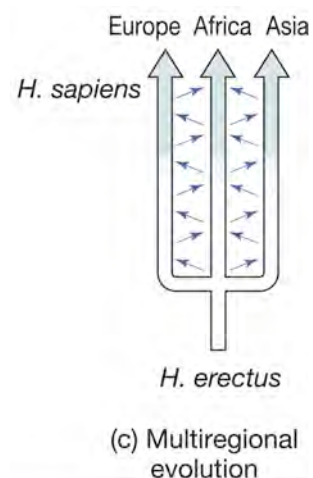


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Templeton's challenge

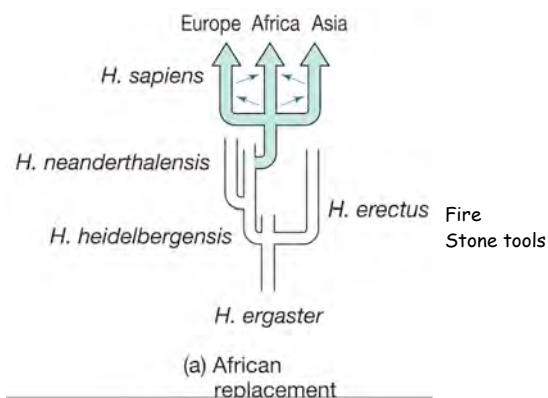
Templeton tree - more parsimonious, with v diff topology

- no strictly deep-rooted African lineages
- Homo evolved in either Africa or Asia
- much gene exchange



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Who was Mitochondrial Eve?



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Many subsequent studies with similar results...

Vigilant et al. (1991):

partial mtDNA sequence from 189 persons 166,000-249,000 YA

Ruvulo et al. (1993):

partial mtDNA sequence 129,000-536,000 YA

Horai et al. (1995):

entire mtDNA sequence 125,000-161,000 YA

Goldstein et al. (1995):

30 microsatellite loci 75,000-287,000 YA

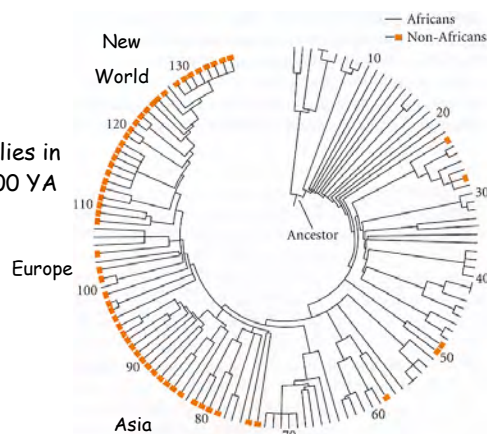
Tishkoff et al. (1996): tandem repeat on c12 from >1600 people

.... Y chromosome, MHC etc 102,000-450,000 YA

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mtDNA RFLP
147 individuals

⇒root of tree lies in
Africa ~200,000 YA



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Osborne et al. 2008 A humid corridor across the Sahara for the migration of early modern humans out of Africa 120,000 years ago. PNAS 105(43): 16444-16447

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Resolution from genetics of interbreeding populations...

Neanderthals

- Europe and Middle East
- Large boned
- Large face
- Large brow ridge
- Large molars
- Large nasal cavity
- Occipital bun
- Mousterian tool tradition

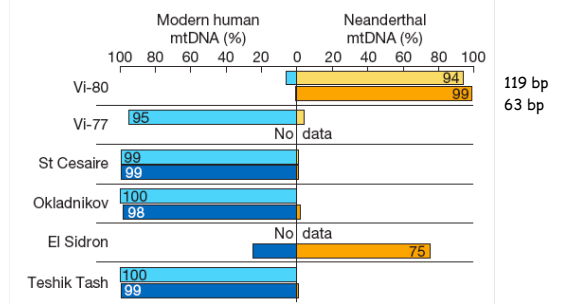


Homo neanderthalensis diverged ~200,000 YA in Europe

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Update...

Analysis of one million base pairs of Neanderthal DNA (Green et al 2006)



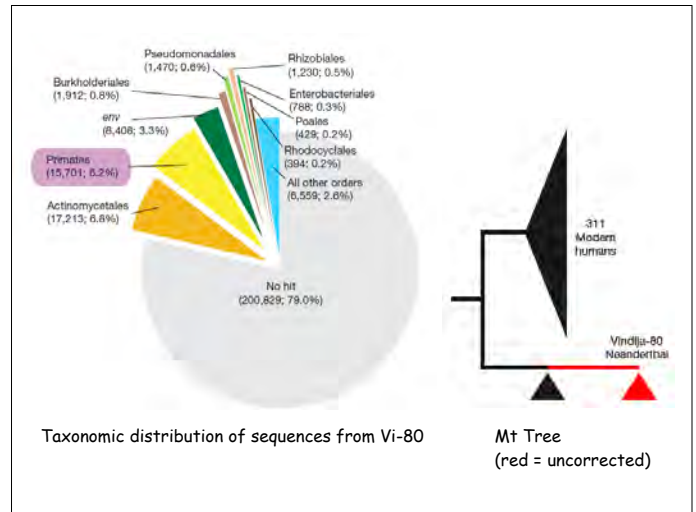
Vindija cave, Croatia (38,000 yr)
454 sequencing

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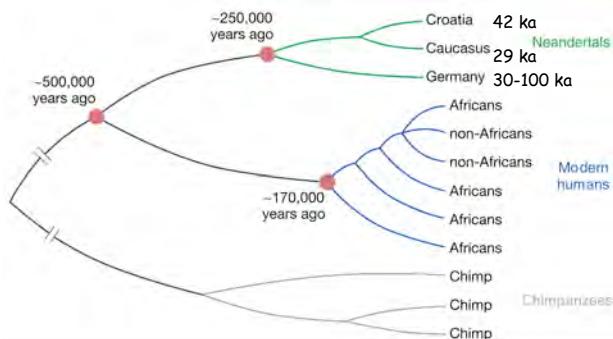
Krings et al. (1997): 379 bp sequence
994 modern humans & 16 chimps
Among Humans (x=8; 1-24)
Neanderthal vs human (x=27; 22-36)

Krings et al. (1999): 340bp
663 moderns, 7 chimp, 2 bonobo
Humans (x=10.9; 1-35)
N-human (x=35.3; 29-43)
N-chimp (ca. 94)

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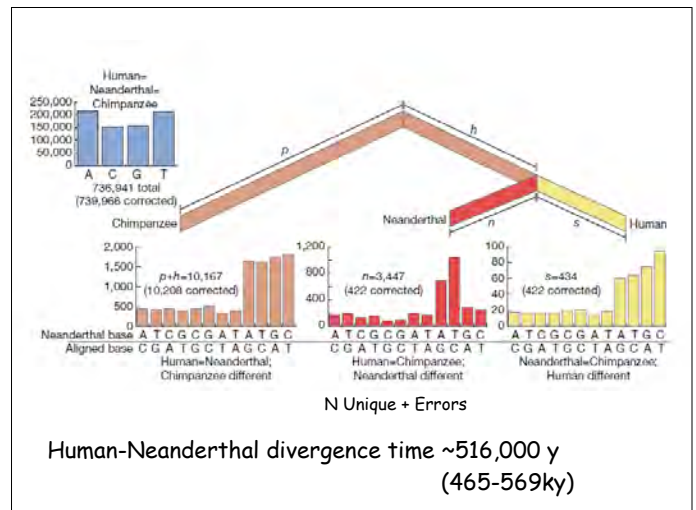


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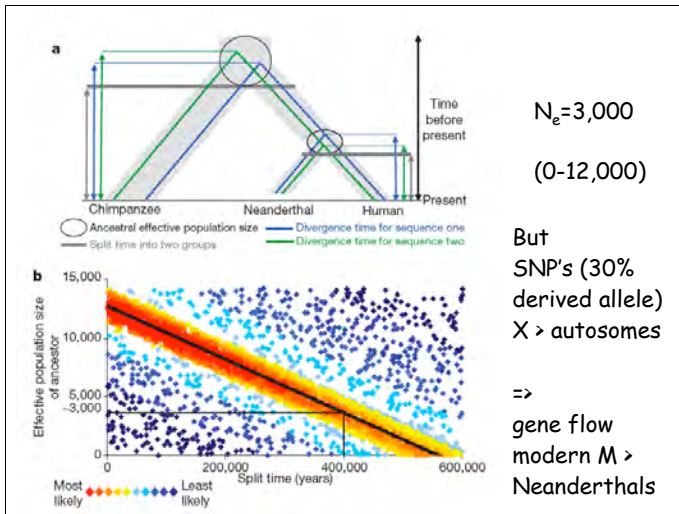


- baby differs from Feldhofer by 12 bp (mtDNA)
- distance => unlikely an interbreeding pop
- theoretical models 0.1-25% contribution
- morpho change, overlaps, cultural exchange
- nuclear genes? Pääbo, Krings etc

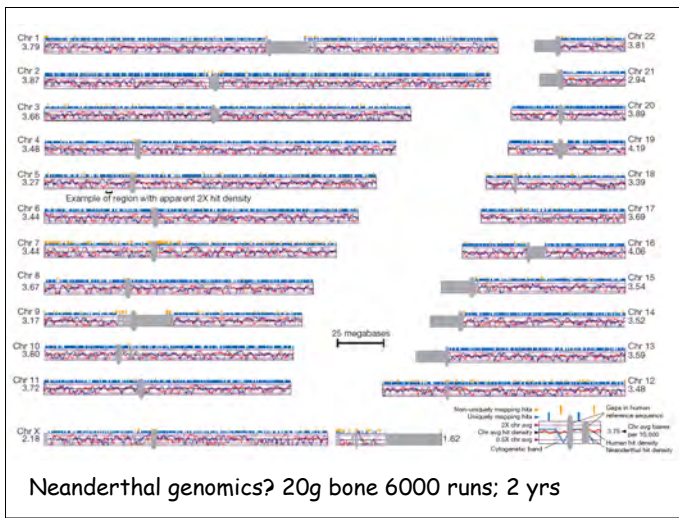
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Evans et al., (2006) Evidence that the adaptive allele of the brain size gene microencephalin introgressed in Homo sapiens from an archaic Homo lineage. PNAS 103: 18178-18183



Neanderthal Genome
"First Draft" Unveiled
February 12th 2009



- 99.5% similar
- Lactose intolerant
- ?language capabilities

Reconstructing the Neanderthal genome