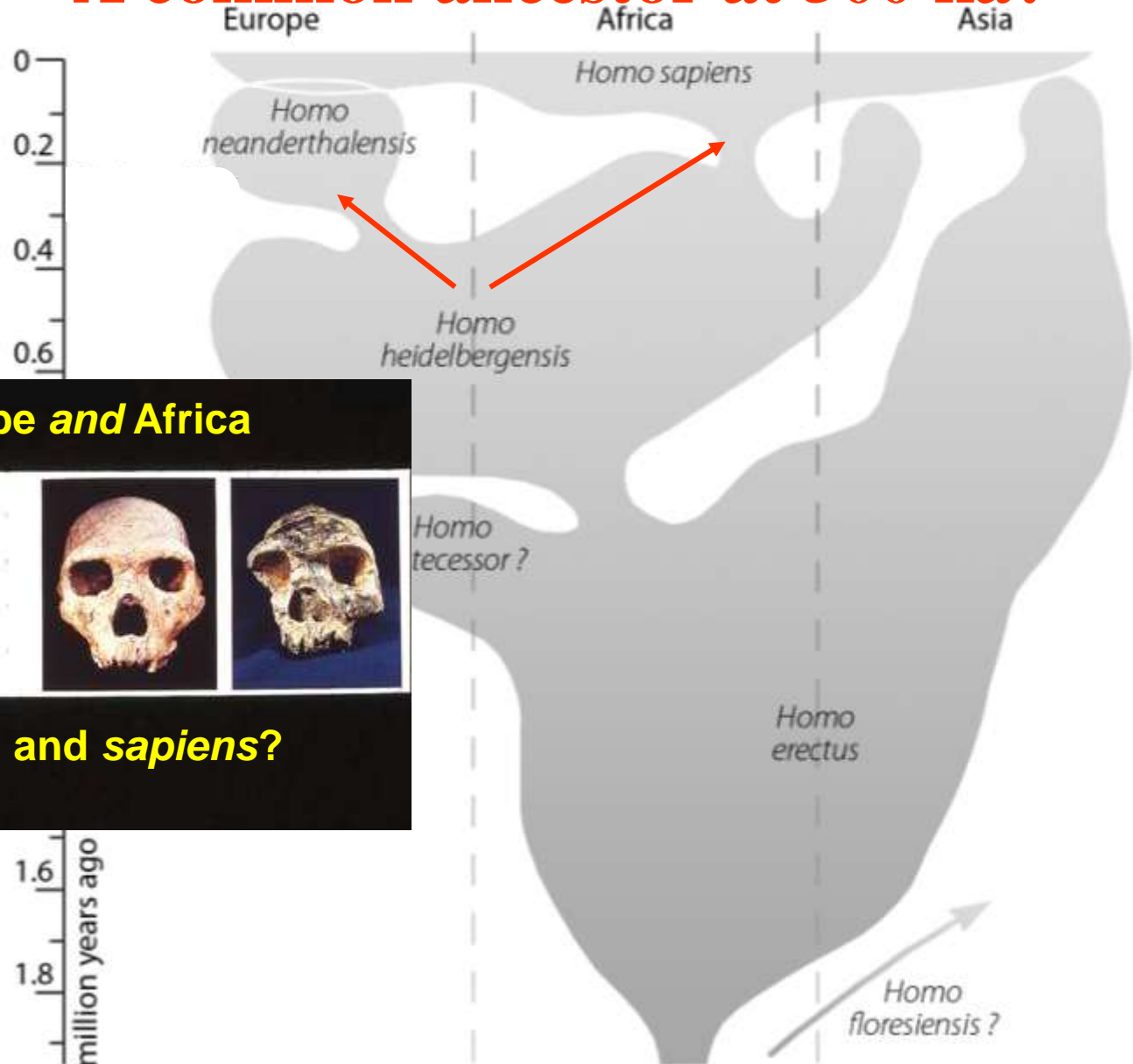


# A common ancestor at 500 ka?



## *H. heid.* in Europe and Africa

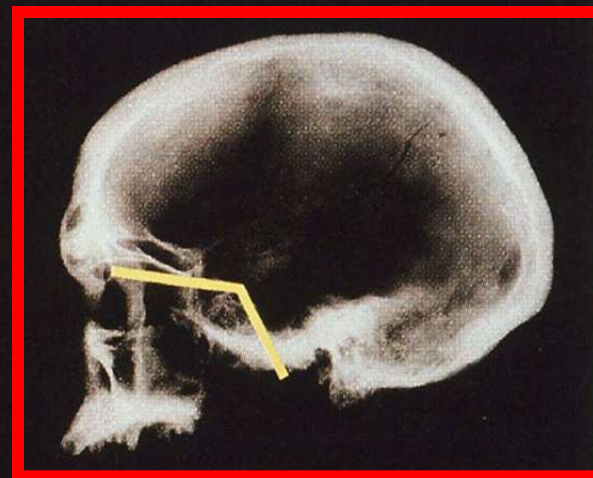
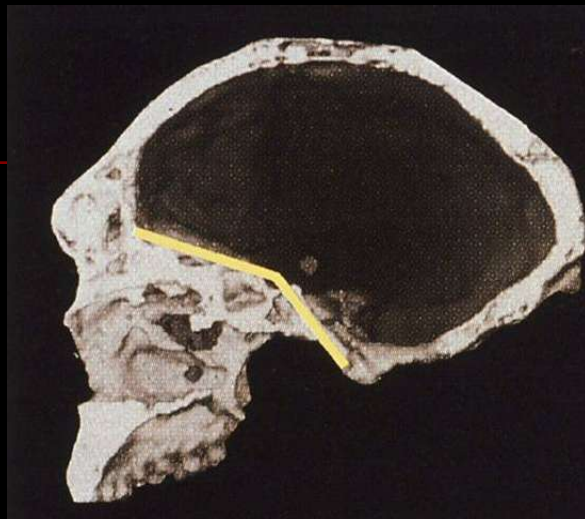


## LCA of Nea. and sapiens?

# The origin of *our* species (*H. sapiens*)

TWO origins to explain:

1. The shared  
(species) features



2. Non-shared  
(regional/racial)  
features

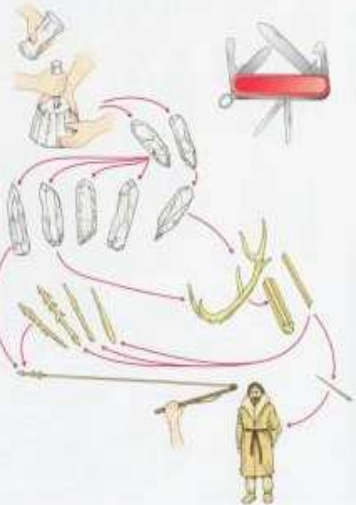


# Origins of modern human behaviour?

## Tools and Human Behaviour: the Upper Palaeolithic

### Complex technology

Blades that are 10-15 cm long, very thin and very sharp. They were used for cutting, scraping and spearing. The blades of stone were not used off directly, they had to be attached to a handle. These blades could then be modified to make a range of specialised tools for cutting, spearing or scraping. Some of them, in fact, were used to work materials such as wood, bone, or ivory to produce further specialised tools, or artwork.



**Blades** The use of flintknapping to produce blades was a major development in the Upper Palaeolithic. The blades were produced by a process known as the Levallois technique. This involved striking a piece of rock down to only one or two flakes, the new flaked almost many long thin flakes (blades) to be systematically produced from a single original block of stone. The blades were often knapped off by the use of a pointed 'baton' made of bone or antler. They were then worked further to turn them into 'knives', 'scrapers', 'blades', 'hoops' etc. The industries concerned are called 'Upper Palaeolithic' in Europe and western Asia, and 'Later Stone Age' in Africa.

**New tools and art** Alongside the predominance of blades, there was also a great increase in the working of bone, antler and ivory, and evidence of clay-working, ropes and even tannery. Composite tools made of several parts became more common, such as harpoons with detachable heads and spearthrowers were used to increase the range of primitive Personal



ornaments appear in the archaeological record, such as necklaces of shells in Australia, beads of cowrie shells in Africa, and pendants of ivory in Europe. There is also much greater evidence of the use of pigments, sometimes painted on objects, sometimes on cave walls, and sometimes in bodies of burial. This 'creative explosion' is seen by many archaeologists as marking the definite arrival of

**Blades and human behaviour: the Upper Palaeolithic**

Below left Modern hunters are distinguished for the use of spears and antlers, and this was certainly prevalent in the Upper Palaeolithic of Europe. The sites and where all such behaviour began? The site of Wonder Cave in South Africa was produced 20,000-year-old evidence of the use of antlers as a pigment, in the form of red ochre. It was produced into spears, probably to decorate the body, and has a piece of antler that has been experimentally inserted into a spearhead. When used, these spears would have been very striking - the colour of blood.

Below right Upper Palaeolithic and Later Stone Age sites have been identified but also been missed. The best that they represent the smallest part.

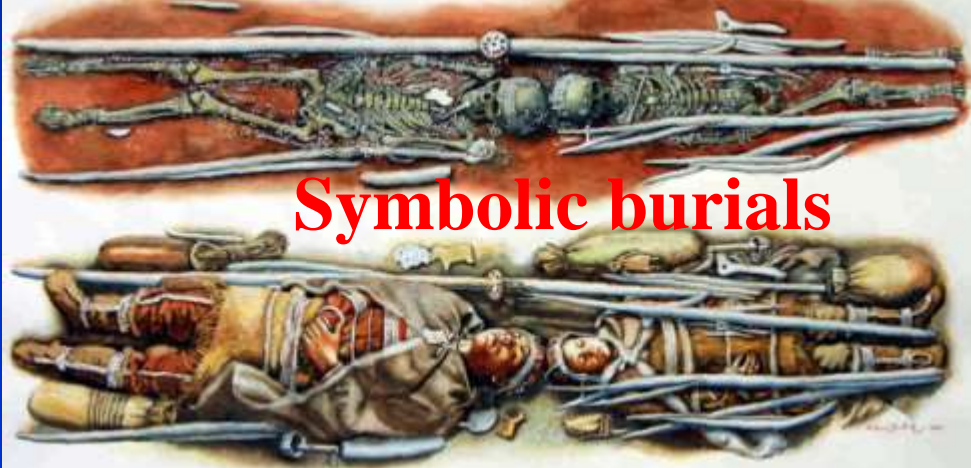


“Houses”

### Networking



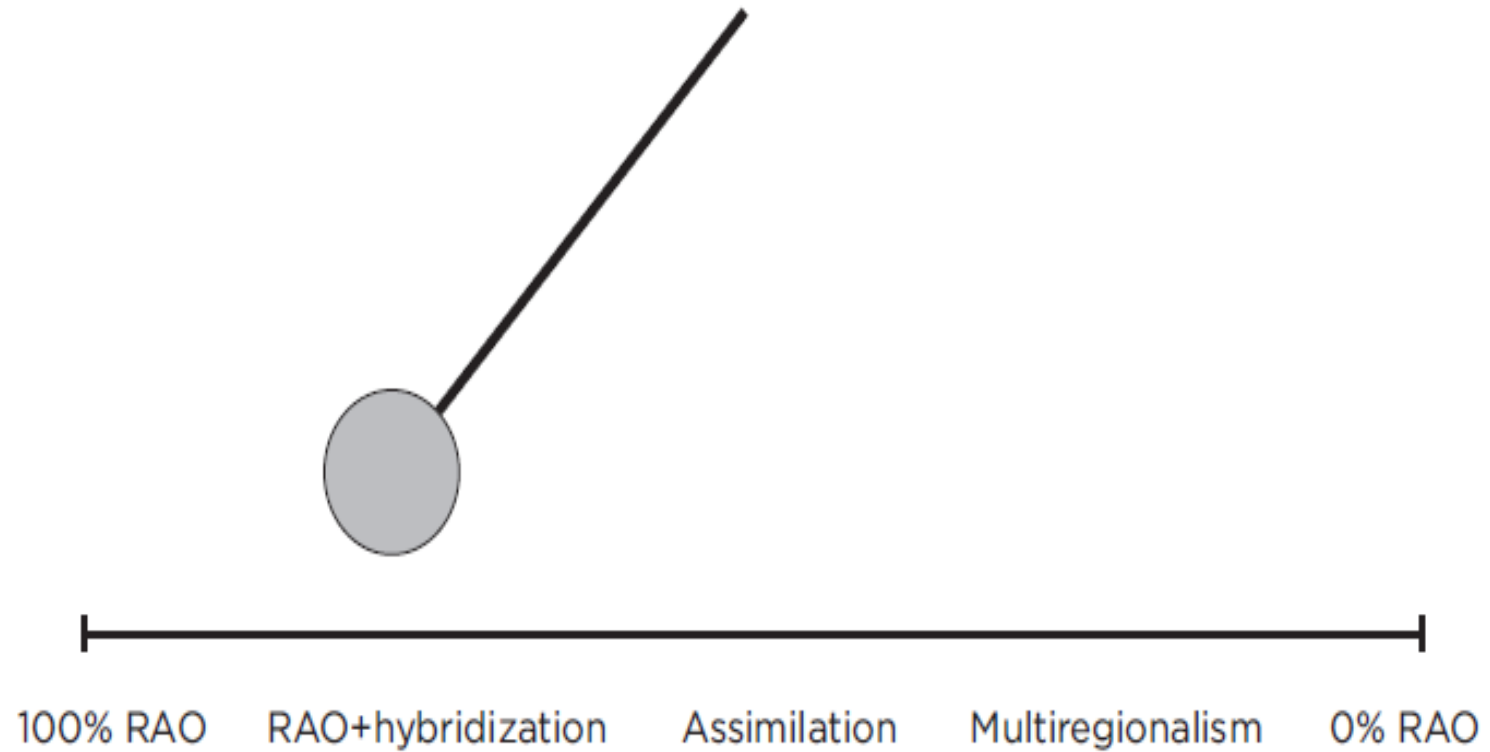
### Symbolic burials



Art

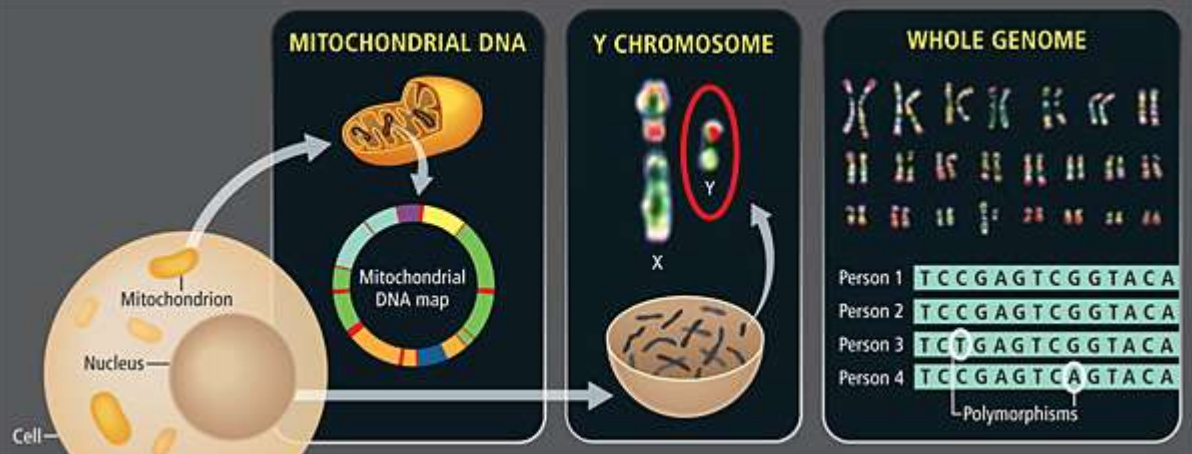


# Models of modern human origins



1984

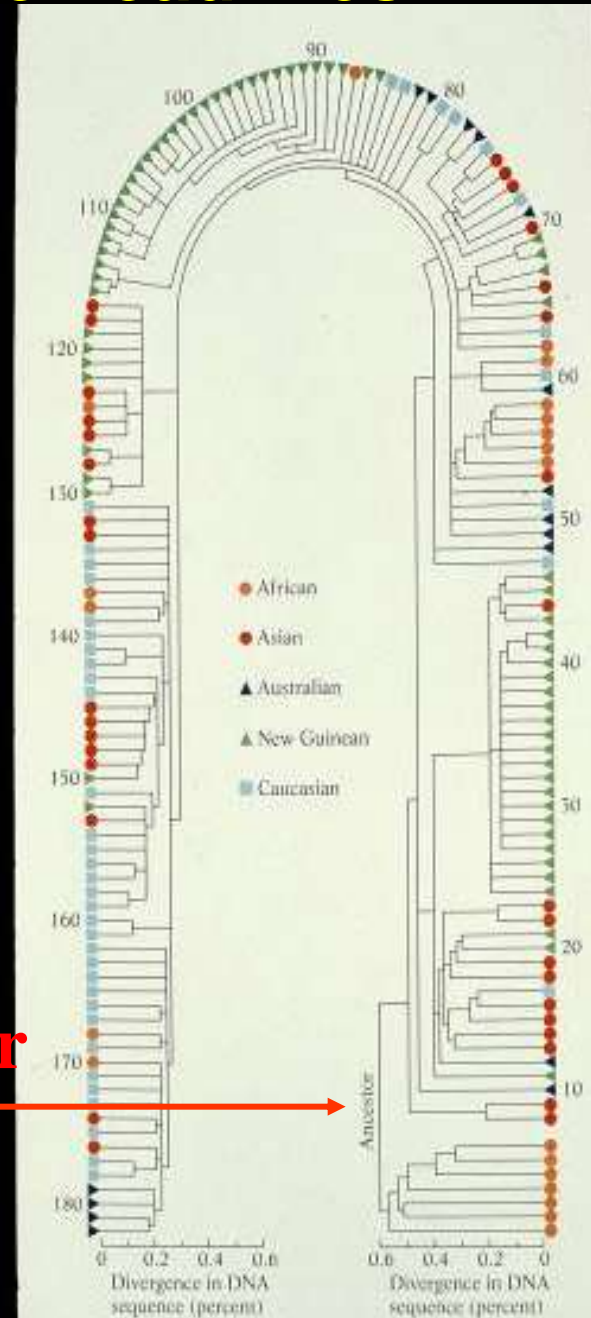
1970



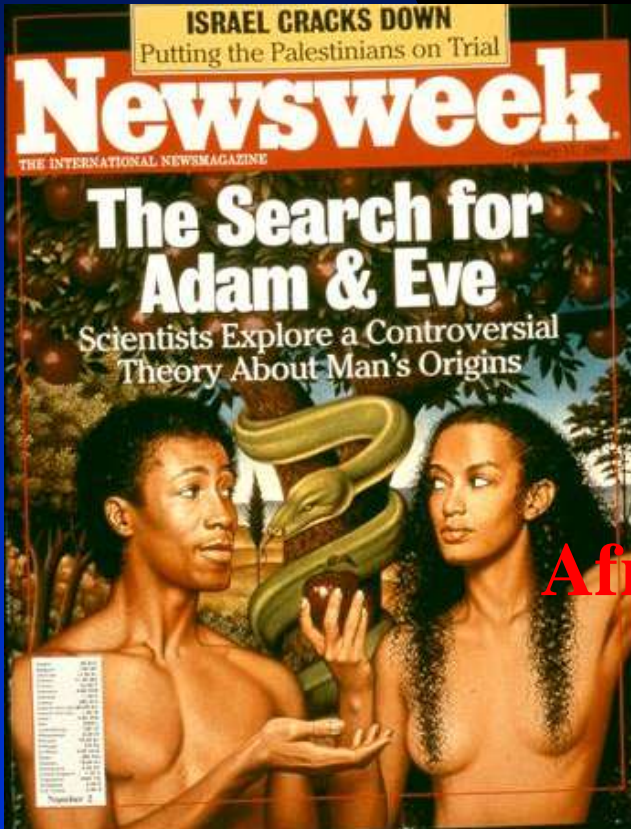
# 1987: Mitochondrial Eve hits the headlines!

Mitochondrial DNA and human evolution *Nature* 325, 31-36

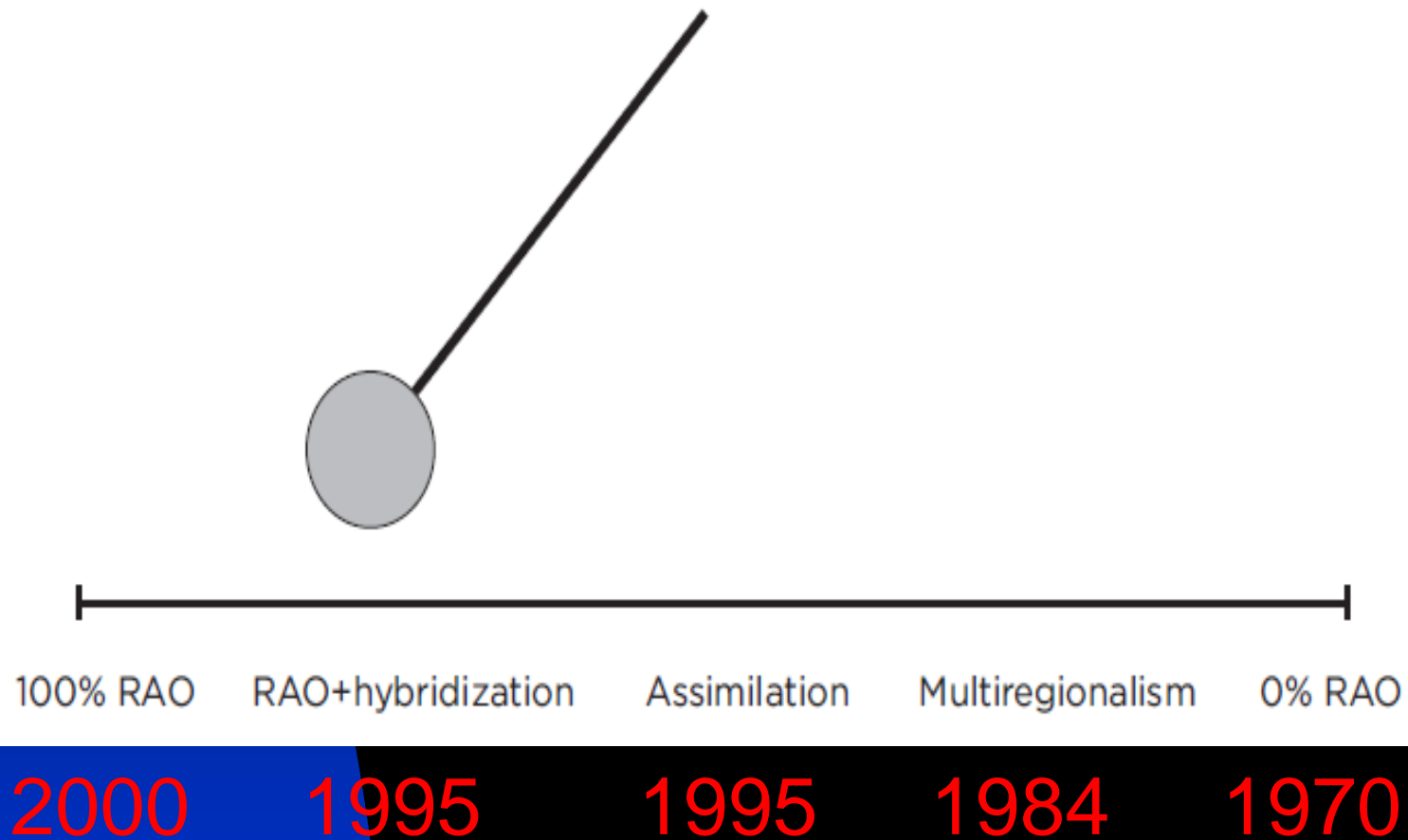
Rebecca L. Cann, Mark Stoneking & Allan C. Wilson (1987)



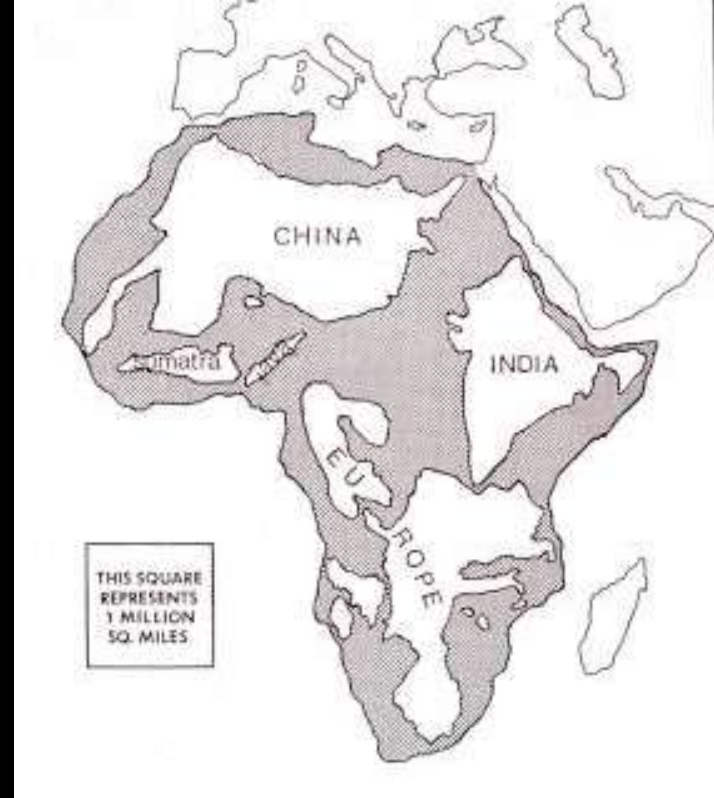
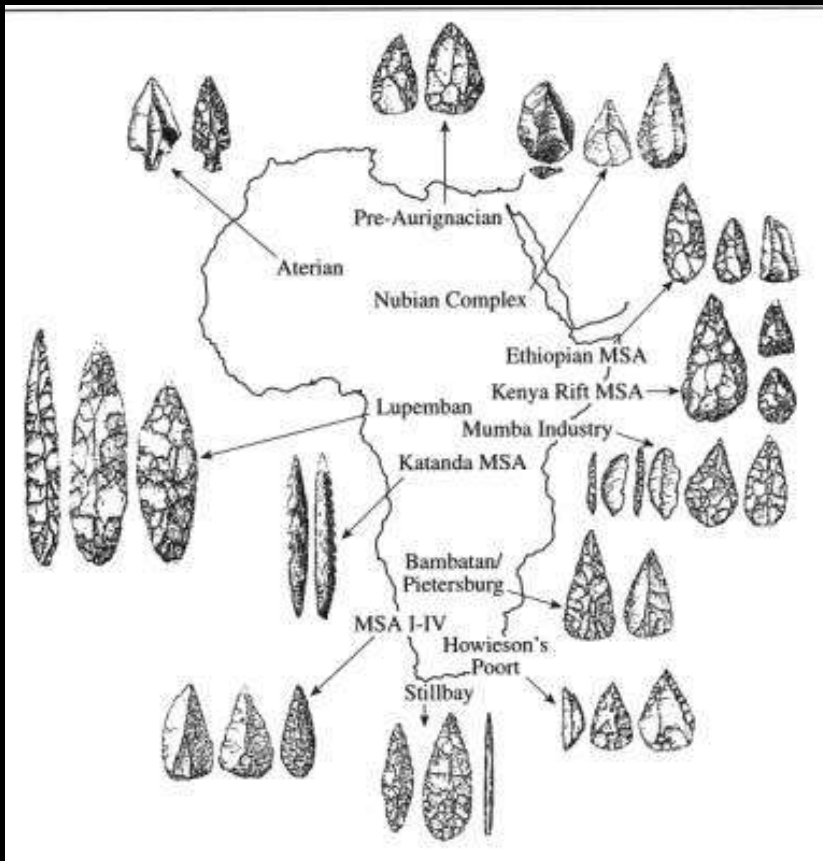
**African female ancestor  
~200ka**



# The pendulum starts swinging!

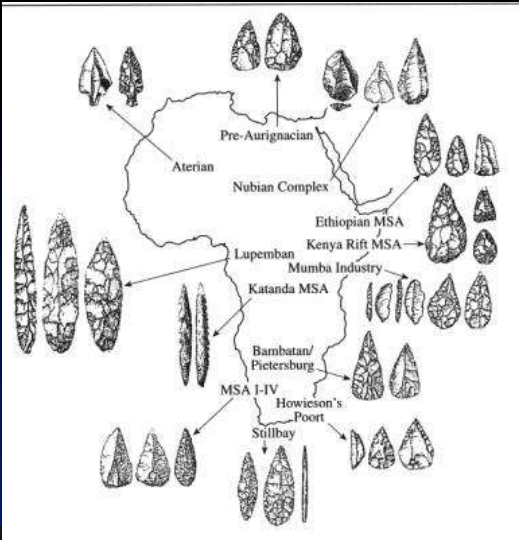


# The African record





# *H. sapiens*: fossils suggest an African origin for the modern pattern ~ 150-200ka?



Age ka ~260    ~150?    ~160?    ~195?    >130



Tim White



Lieberman

Microliths



Twin Rivers



Pinnacle Point



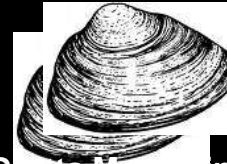
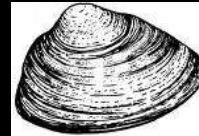
Mumba



Enakpune ya Muto

Howiesonspoort

Shellfishing



Grotta Moscerini

Klasies

Ochre



Kaphurin



Twin Rivers



Klasies Qafzeh



Blombos

300 ka

200

150

100

Taforalt

50

0

Shell beads



Skhul



Blombos



Enakpune ya Muto

Early *H. sapiens* fossils



Omo Kibish



Herto

**“Modern” anatomy and behaviour have deep roots in Africa...**

# ~60 ka: Modern Humans start to leave Africa...

## Ancient history in the DNA

By comparing mutations in the DNA of people who live in different parts of the world, geneticists are developing new theories about how humans populated Earth. The evidence points to a common African origin about 150,000 years ago. Much of the work has been based on maternal lines.

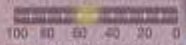
**Venus of Lespugue**  
 Found: Lespugue, France  
 Dated: 20,000 years ago



**Horse pendant**  
 Found: Sange, Russia  
 Dated: 25,000 years ago



### Roots in Central Asia



All Asians derived from two common roots, with some lineages more frequent in southern Asia (Vietnamese, Malays, New Guineans) and others more prevalent in the north (Tibetans, Koreans, Siberians).

### The first Europeans



Migrants arrived from the Near East as early as 50,000 years ago. The population shrank drastically during the last Ice Age 20,000 years ago, then rebounded. About 9,000 years ago, migrants from the Middle East moved north along with the spread of agriculture.

EUROPE

ASIA

### The Australian enigma



Modern humans traveled to Australia by boat 40,000 to 60,000 years ago. One theory suggests that they followed the southern Asian coast, mastering boat building along the way.

### Many paths through the Middle East



Humans journeyed from Africa into the Middle East about 75,000 years ago. Over thousands of years, in multiple migrations, they spread east into Asia and northwest into Europe.

OCEANIA

AUSTRALIA

### Early Homo sapiens skull

Found: Omo River, Ethiopia  
 Dated: 125,000 years ago



### Red ochre burial

Found: Mungo National Park, Australia  
 Dated: about 60,000 years ago



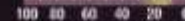
### Stone tools

Found: Cactus Hill, Virginia  
 Dated: 15,000 to 10,000 years ago



Land bridge between continents

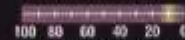
### A bridge to the New World



The first inhabitants of the New World migrated from central Siberia 20,000 to 30,000 years ago along the Bering land bridge. They may have been joined by a second migration 15,000 years ago that skirted the coast. Na-Dene people, who include the Athabascans, Apaches, and Navajos, are genetically distinct from the first American Indians, and came from northern Siberia about 9,000 years ago. Eskimos and Aleuts arrived 4,000 to 6,000 years later.

NORTH AMERICA

### Along the Andes to Tierra del Fuego



The earliest migration swept from Siberia to Tierra del Fuego, traveling along the Andes. Another route curved farther east, to present-day Brazil.

SOUTH AMERICA

### The X factor

A small group of Indians near the Great Lakes has a lineage (haplogroup "X" unlike those of other American Indians, but related to a European strain. Some archaeologists think that the colonists came from Iberia about 15,000 years ago, crossing the North Atlantic ice pack to Greenland. Others believe the X factor is the remnant of a vanished Asian lineage.

For most of the past 65,000 years, sea levels have been lower than today. During the last Ice Age 20,000 years ago, sea levels were about 400 feet lower.



### Throwing stone

Found: Monte Verde, Chile  
 Dated: 14,800 years ago

**Key**  
 Dotted arrows show hypothetical routes.  
 Colored arrows represent separate genetic lineages.

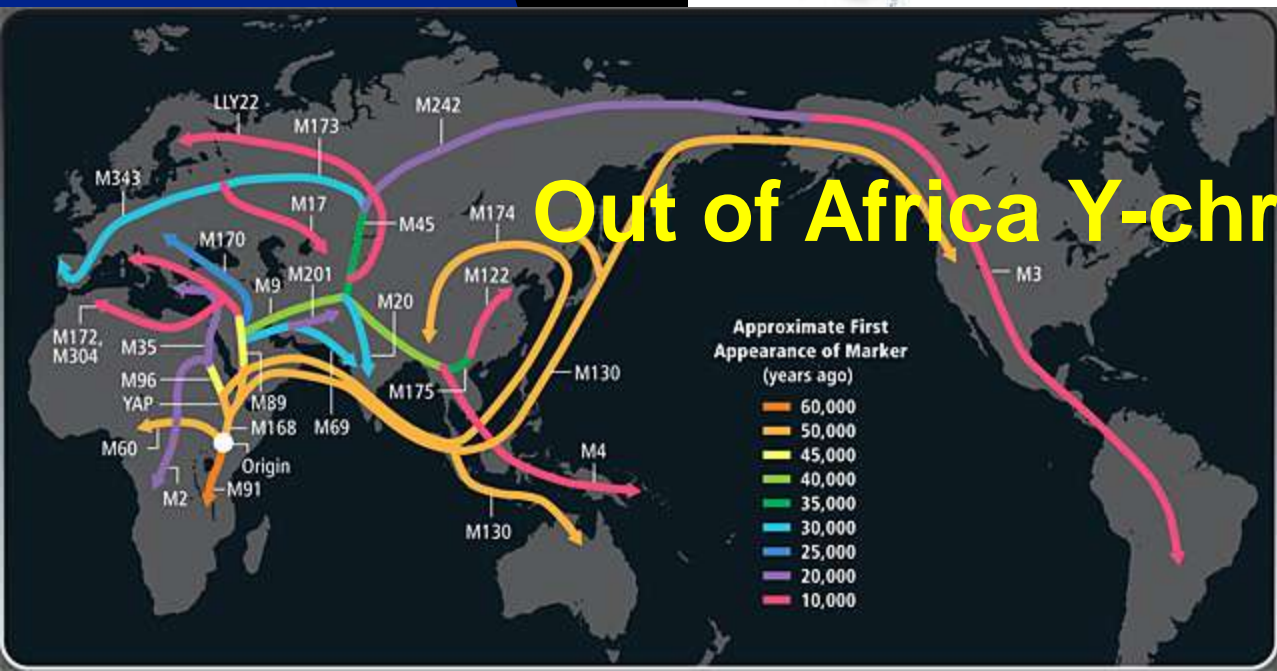
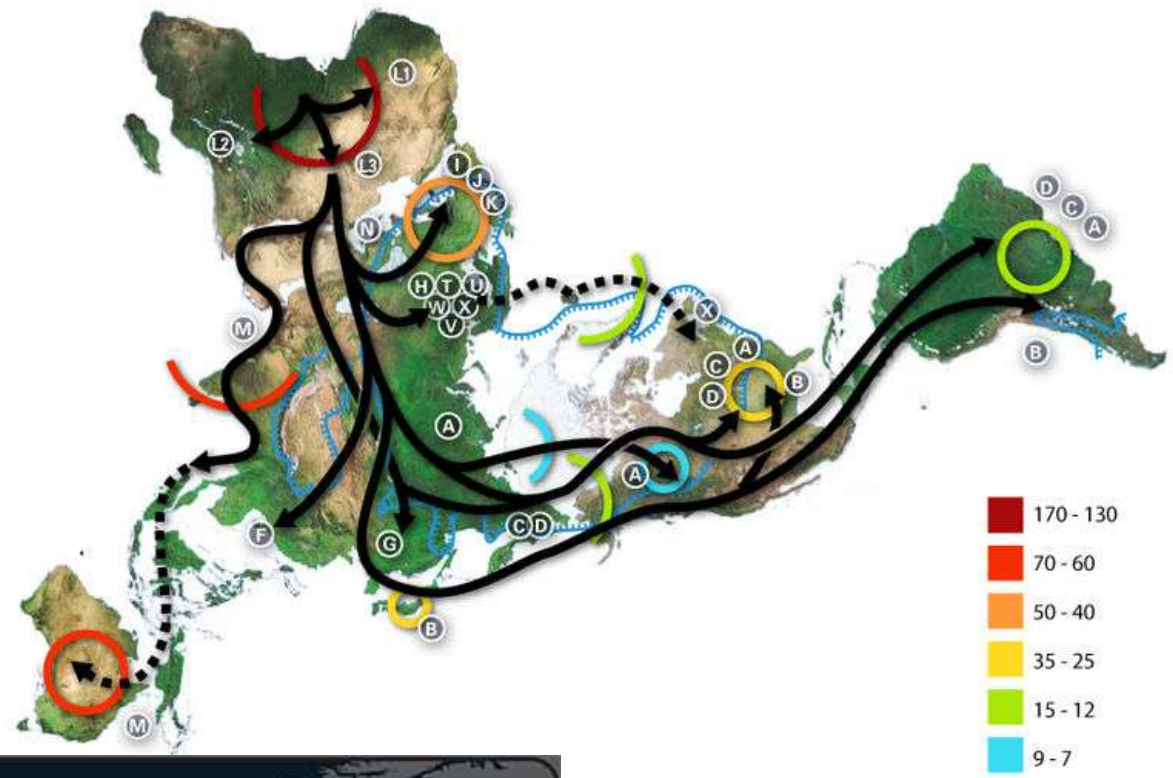
Scale: Major migrations in thousands of years before present.

Ancient coastlines

The DNA of present-day Africans is more diverse than that of people on other continents, indicating that humans have lived there longest. Traces of ancient African genes can be found in everyone living today.

Sources: Douglas Wallace, Michael Hammer, and Marie Perle, Emory University; David Bradley, Paula Durkin, NCMA, Theoretical School, Georgetown University for Biomedical Research; The Human Genome

# Out of Africa Mitochondrial DNA



# Out of Africa Y-chromosome DNA

# The evolution of regionality ("race")

MRCA

EA1  
EA2  
EA3  
EA4

Eurasia  
+  
ROW

A5  
A6  
A7  
A8  
A9  
A10

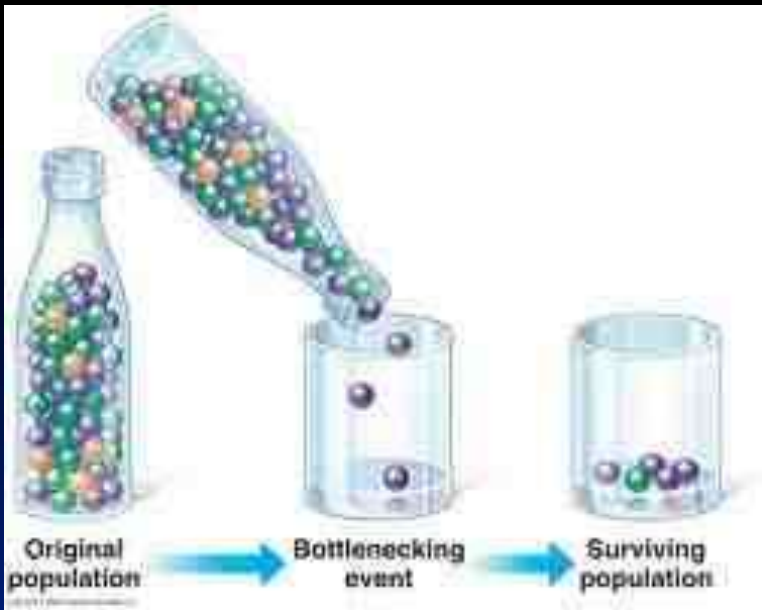
Africa



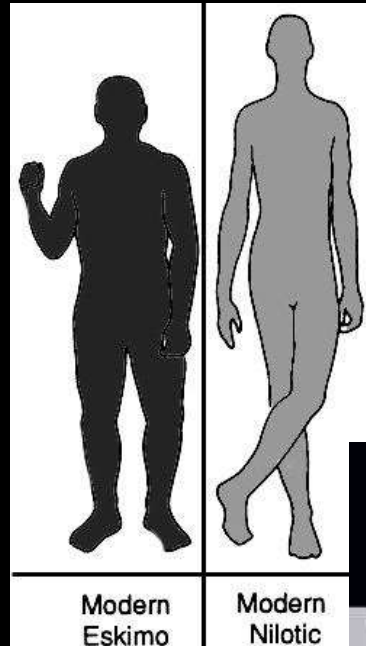
DNA

benetton





## Natural selection



## Bottlenecks + Founder Effects

## Sexual/cultural selection



**We are all the same (species), but we all look different (individuals, ♀/♂, regions, “races”).**

## Species

*(Homo sapiens)*

large brain  
high round skull  
small face  
chin  
small browridges  
lightly-built skeltn

**Natural Selection**

**Sexual Selection**

**Founder Effect**

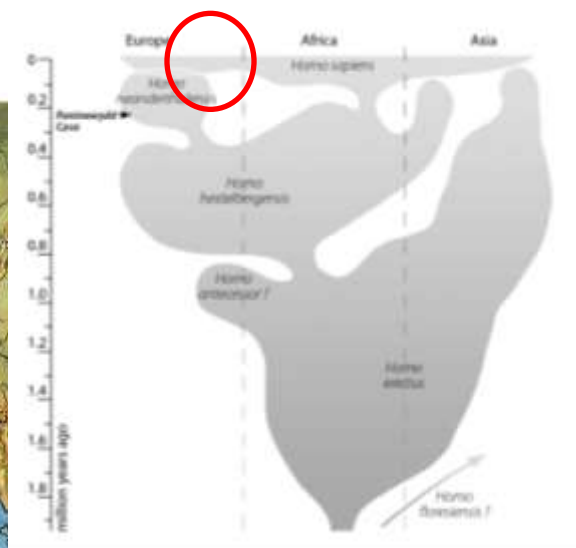
**Drift**



## Individuals

body shape  
skin colour  
hair  
nose  
eyes  
lips etc

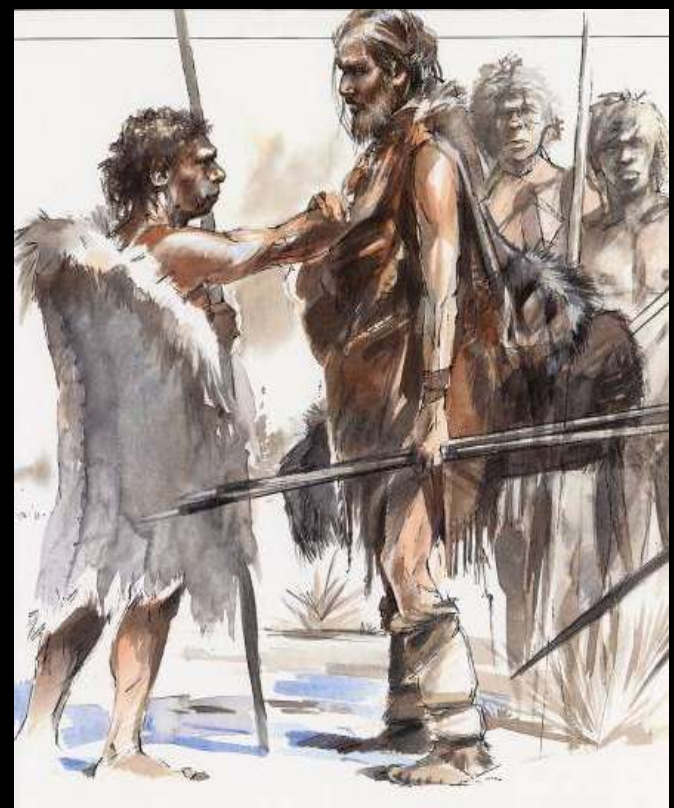
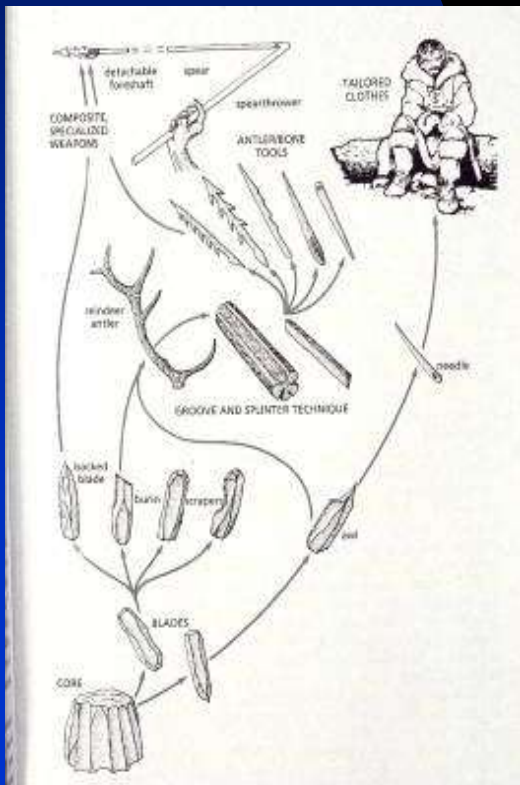
- Neanderthal / Mousterian
- Modern / Upper Paleolithic



Chauvet ~35ka



# 40-60 ka: Neanderthals and moderns meet?



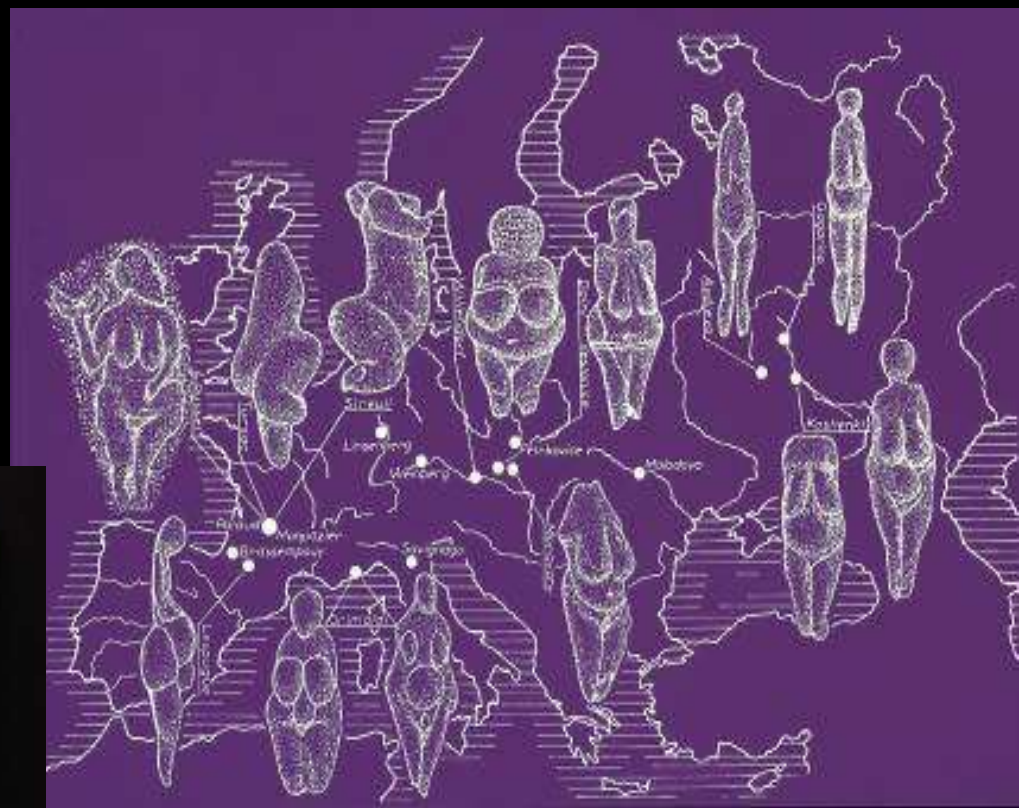


# Art and music 30-40 ka

Animals and flutes: Hohle Fels & Vogelherd ~ 40ka



Female figurines Europe and Asia



# What happened to the Neanderthals?

## Continuity?

~~Evolved into the Cro-Magnons~~

Genetically absorbed

## Extinction?

Interpopulation conflict

Demographic disadvantage

Competitive exclusion

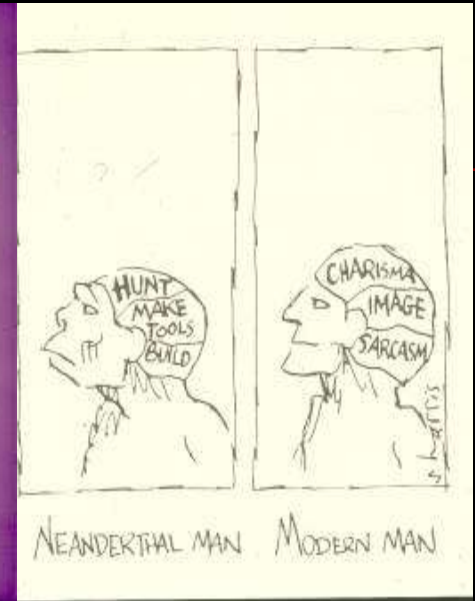
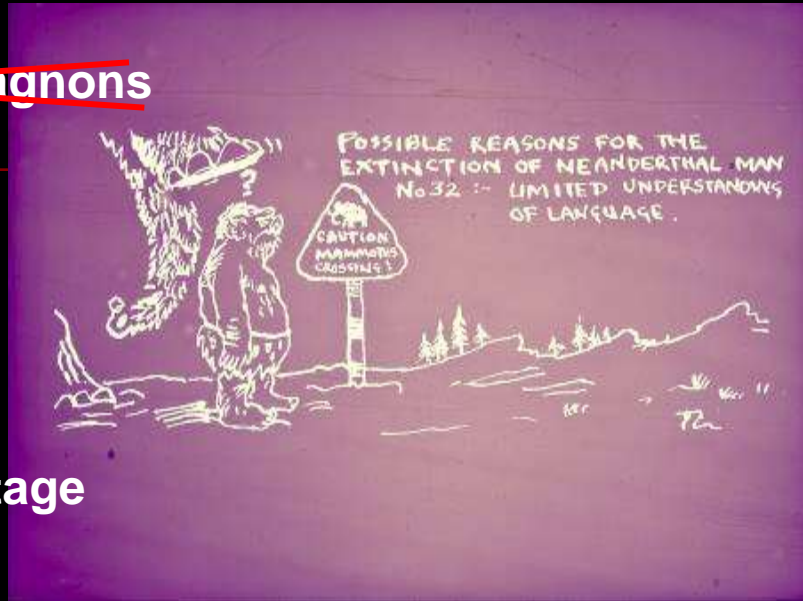
Infectious diseases

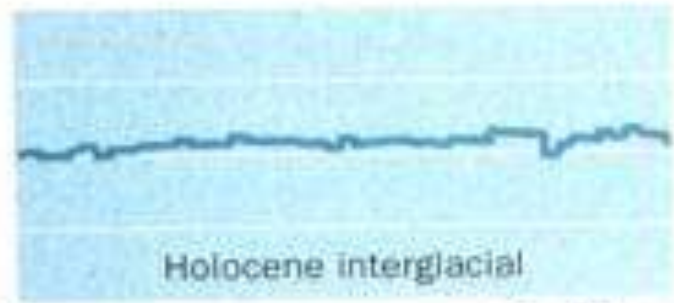
Distinct physiologies/diets

Competition/fluctuating climates

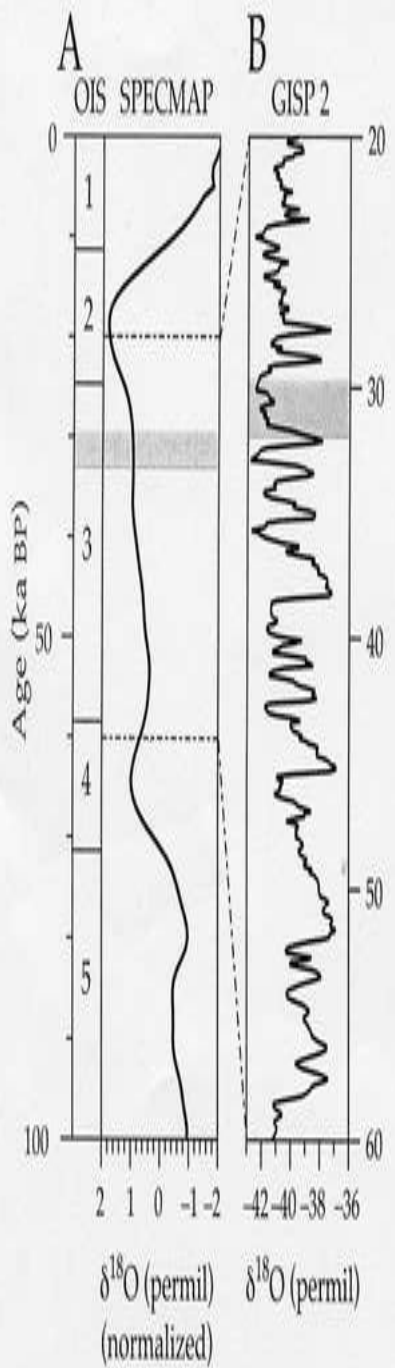
Climate change

Part of megafaunal extinctions



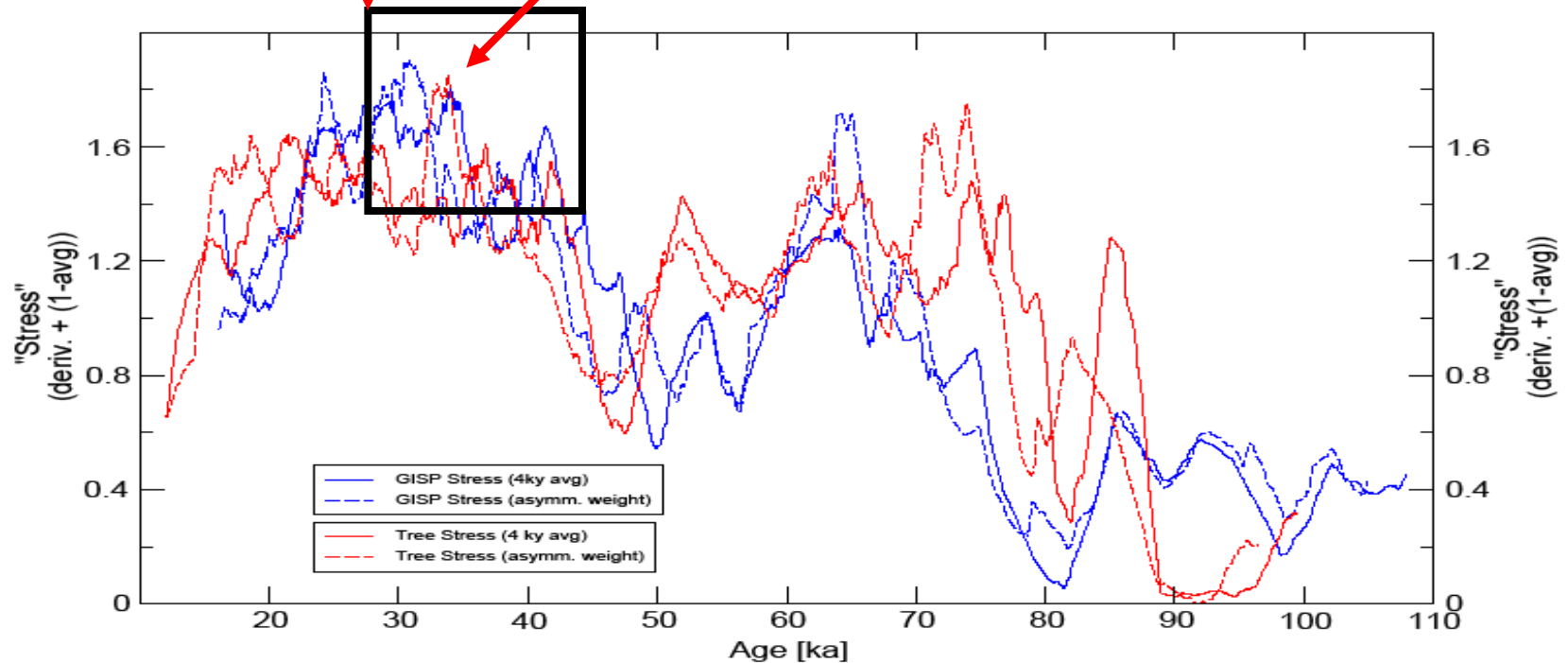


Modern 10,000 yr BP 20,000 yr BP 40,000 yr BP



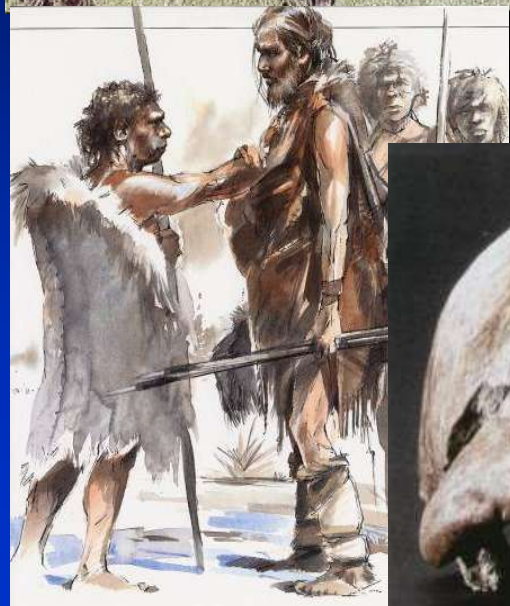
# Modelling using Greenland Ice Core and European Pollen data: did a combination of low temperatures, rapid oscillations AND new competitors cause the final extinction of the Neanderthals in Europe?

Nea extinction  
Period of high climatic stress AND Nea-mod overlap



Tue Oct 2 11:51:00 2001

# Interbreeding?



Neanderthals Were Not Our Ancestors

## I'm a Neanderthal man

Despite what the scientists say, it explains why men have been behaving badly for the past 100,000 years

**S**o now it's official. Neanderthal man is extinct. According to some research in the *American Journal of Human Genetics*, modern Europeans share no trace whatever of any Neanderthal genes.

Scientists led by Dr. Svante Pääbo at the Institute of Molecular Biology at Uppsala examined samples of DNA from across Europe and discovered that everyone from Asia to India to Hawaii is descended from the same subset of hunter-gatherers who first arrived here some 60,000 years ago.

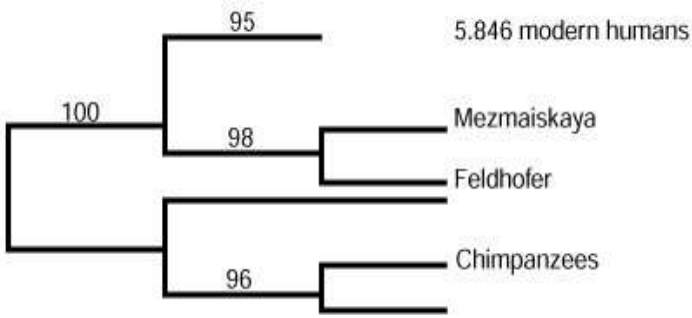
The Neanderthals had already been living in Europe for 100,000 years. They were bigger, stronger and faster than the men involved but didn't have larger brains, one out of the several, single-sex sex lines.

Incidentally, Neanderthals are a perfect example of the way animals — far from becoming adapted through natural selection — will often regress to their



EVOLUTION'S SURVIVORS: A young Boyan and Arak

**MISSING LINK:** Neanderthals and their cousins, the Denisovans, were close — could one be using the



## Ancient DNA



## THE Sun NEANDERTHALS DEAD OFFICIAL

This species is no more.. it has ceased to be.. this is an EX species



# Close Encounters Of the Prehistoric Kind

As a result, many people living outside Africa have inherited a small but significant amount of DNA from these extinct humans.

The long-awaited sequence of the Neandertal genome suggests that modern humans and Neandertals interbred tens of thousands of years ago, perhaps in the Middle East



## SEPARATING THEM FROM US

Some genes that differ between modern humans and Neandertals

Gene	Significance
<i>RPTN</i>	Encodes the protein repertin, expressed in skin, sweat glands, hair roots, and tongue papillae
<i>TRPM1</i>	Encodes melastatin, a protein that helps maintain skin pigmentation
<i>TNMD4</i>	Associated with type 2 diabetes in humans; evolutionary changes may have affected energy metabolism
<i>DIK1A</i>	Found in an area critical for causing Down syndrome
<i>NRG3</i>	Mutations associated with schizophrenia
<i>CADPS2/AUTS2</i>	Mutations implicated in autism
<i>RUNX2 (CBRA1)</i>	Causes oosteorarthritis, characterized by delayed closure of cranial sutures, malformed clavicles, bell-shaped rib cage, and dental abnormalities
<i>SPAG11</i>	Protein important for the beating of the sperm flagellum

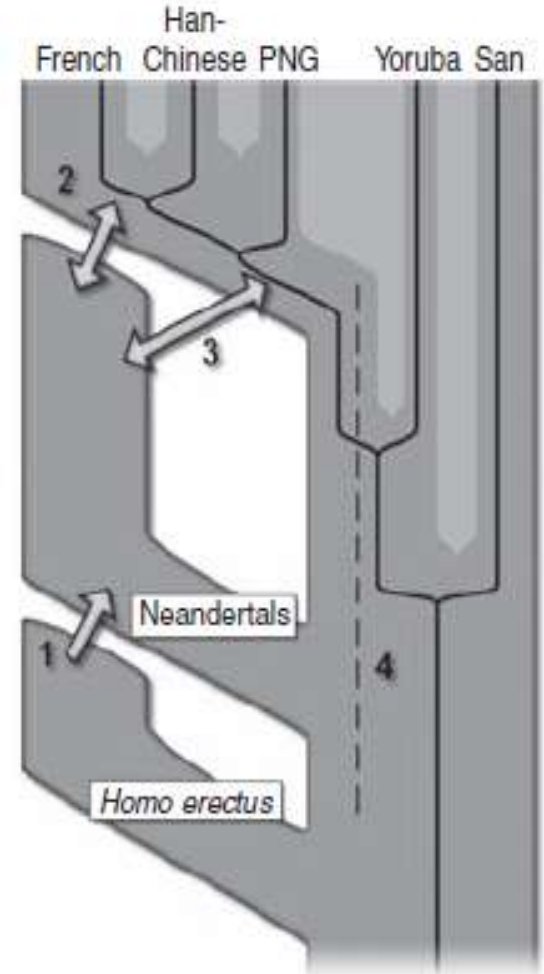


Fig. 6. Four possible scenarios of genetic mixture

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



# Denisova Admixture and the First Modern Human Dispersals into Southeast Asia and Oceania

David Reich,<sup>1,2,\*</sup> Nick Patterson,<sup>2</sup> Martin Kircher,<sup>3</sup> Frederick Delfin,<sup>3</sup> Madhusudan R. Nandineni,<sup>3,4</sup> Irina Pugach,<sup>3</sup> Albert Min-Shan Ko,<sup>3</sup> Ying-Chin Ko,<sup>5</sup> Timothy A. Jinam,<sup>6</sup> Maude E. Phipps,<sup>7</sup> Naruya Saitou,<sup>6</sup> Andreas Wollstein,<sup>8,9</sup> Manfred Kayser,<sup>9</sup> Svante Pääbo,<sup>3,\*</sup> and Mark Stoneking<sup>3,\*</sup>

The American Journal of Human Genetics (2011), doi:10.1016/j.ajhg.2011.09.005

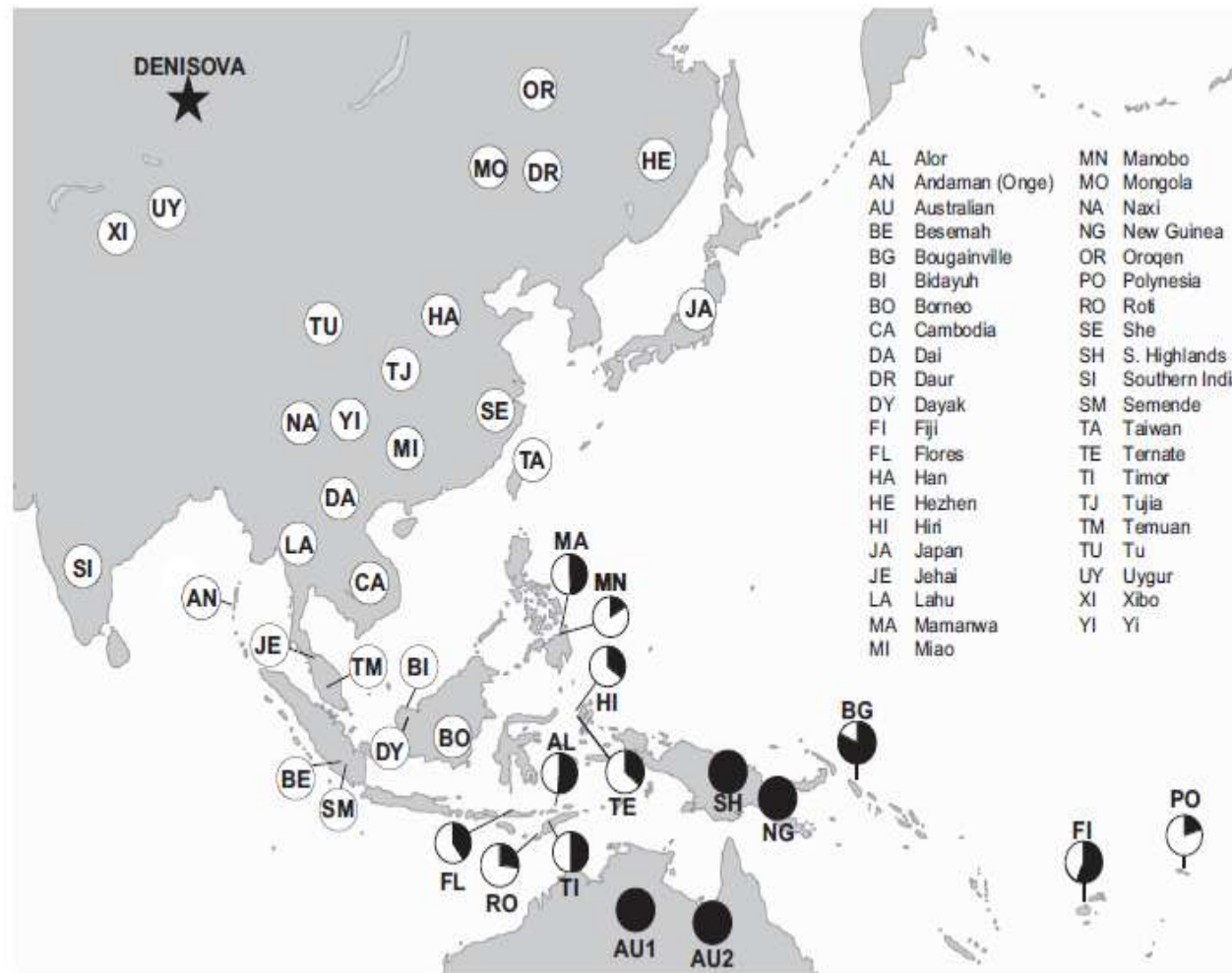


Figure 1. Denisovan Genetic Material as a Fraction of that in New Guineans



# COMMENT

**BIRDING HISTORY** Edward Lear's forgotten work on ornithology p.20

**EARTH SCIENCE** How rocks and life evolved together on our planet p.30

**MUSIC** Philip Glass on Einstein and the unpredictability of opera composition p.40

**EMPLOYMENT** The skills gained in PhD training make it worth the money p.48



## What makes a modern human

We probably all carry genes from archaic species such as Neanderthals. Chris Stringer explains why the DNA we have in common is more important than any differences.

3 MAY 2012 | VOL 485 | NATURE

### PATCHWORK PLANET

Most people's genomes contain remnants of archaic DNA from ancient interbreeding<sup>3-6</sup>.



Sub-Saharan Africa



Eurasia and Americas



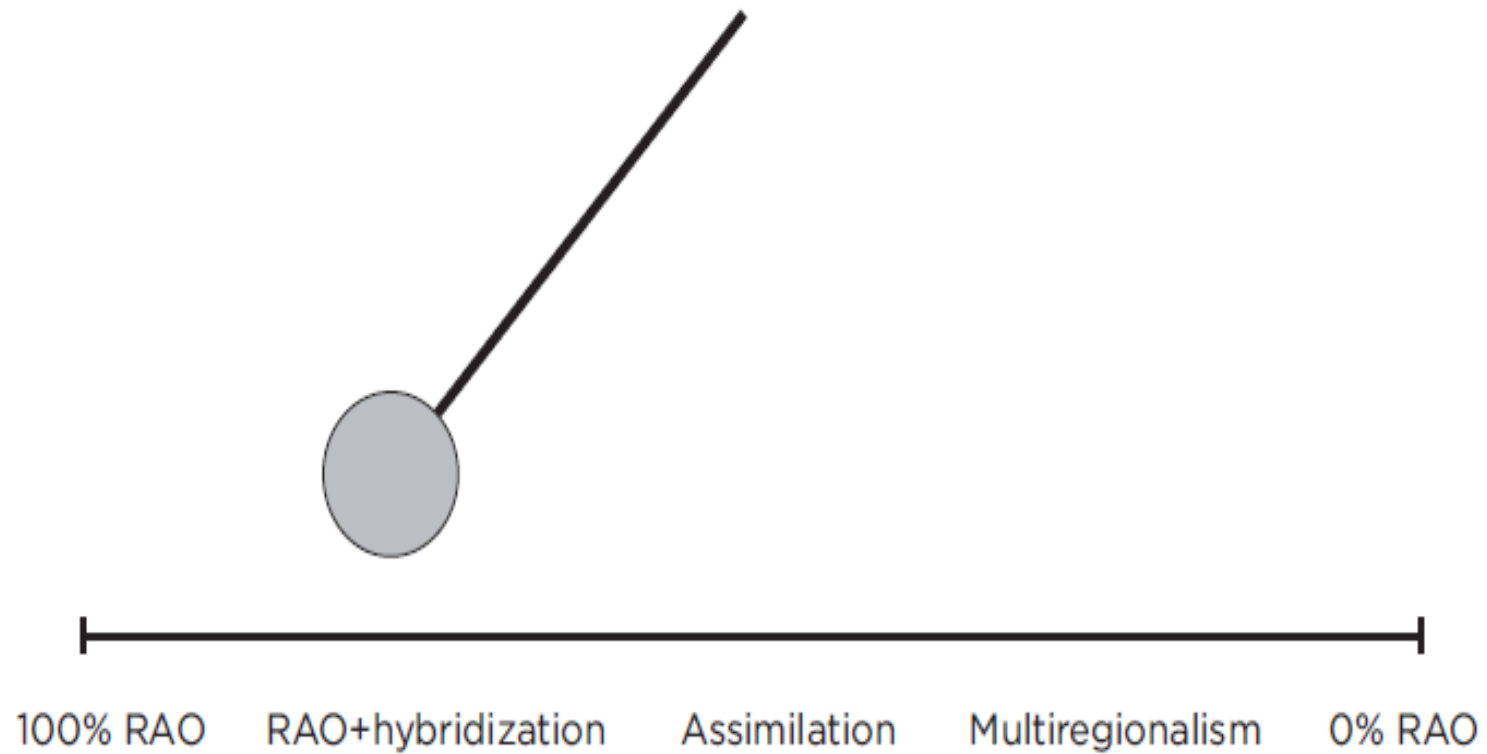
Australia and New Guinea

#### Genes\*

- African
- Unknown archaic African source
- Neanderthal
- Denisovan

\*Figures are approximate, and for Africa, based on limited data<sup>6</sup>.

# The pendulum swings back a bit!

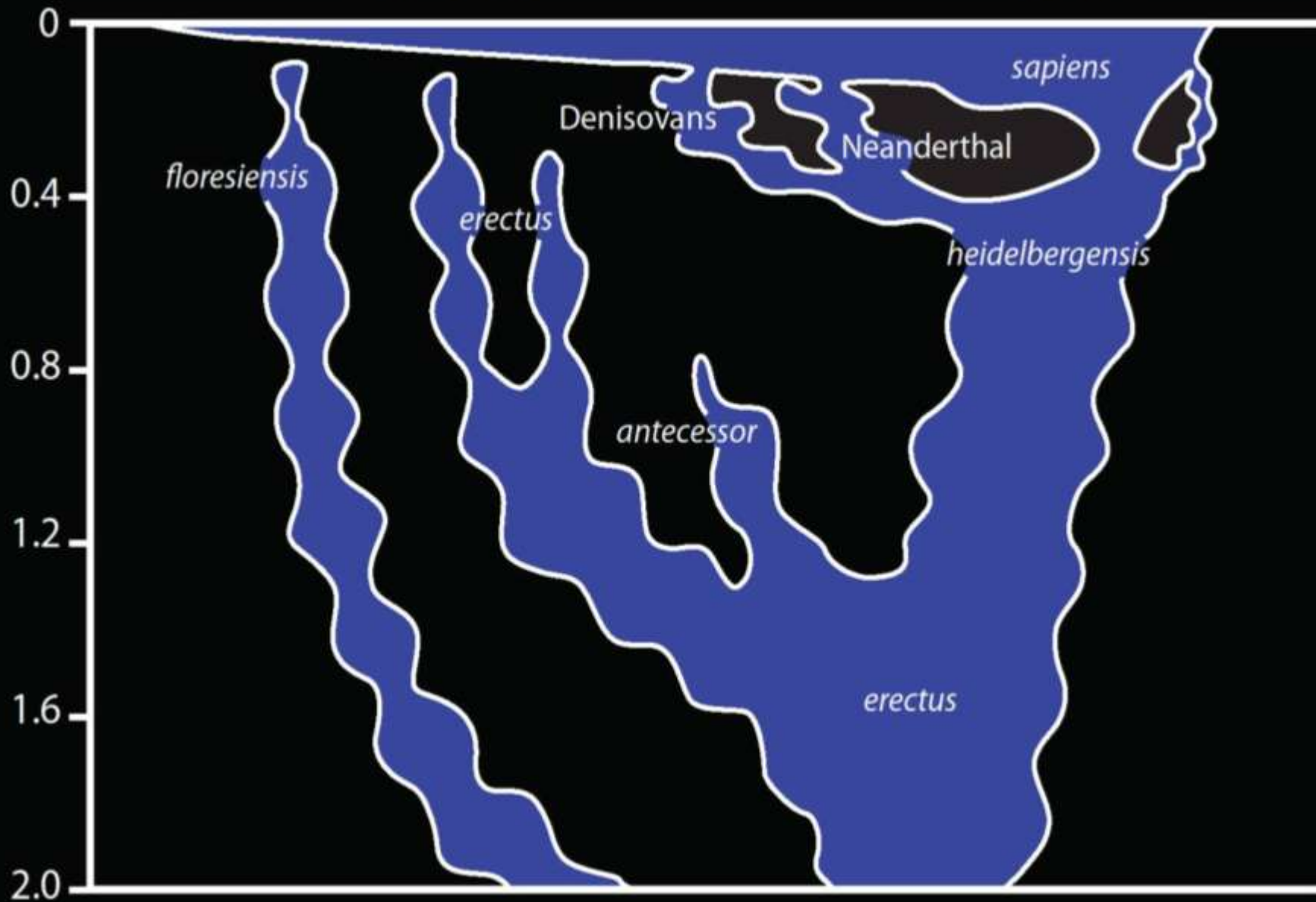


**2012**

**“Mostly Out of Africa”**

Eurasia

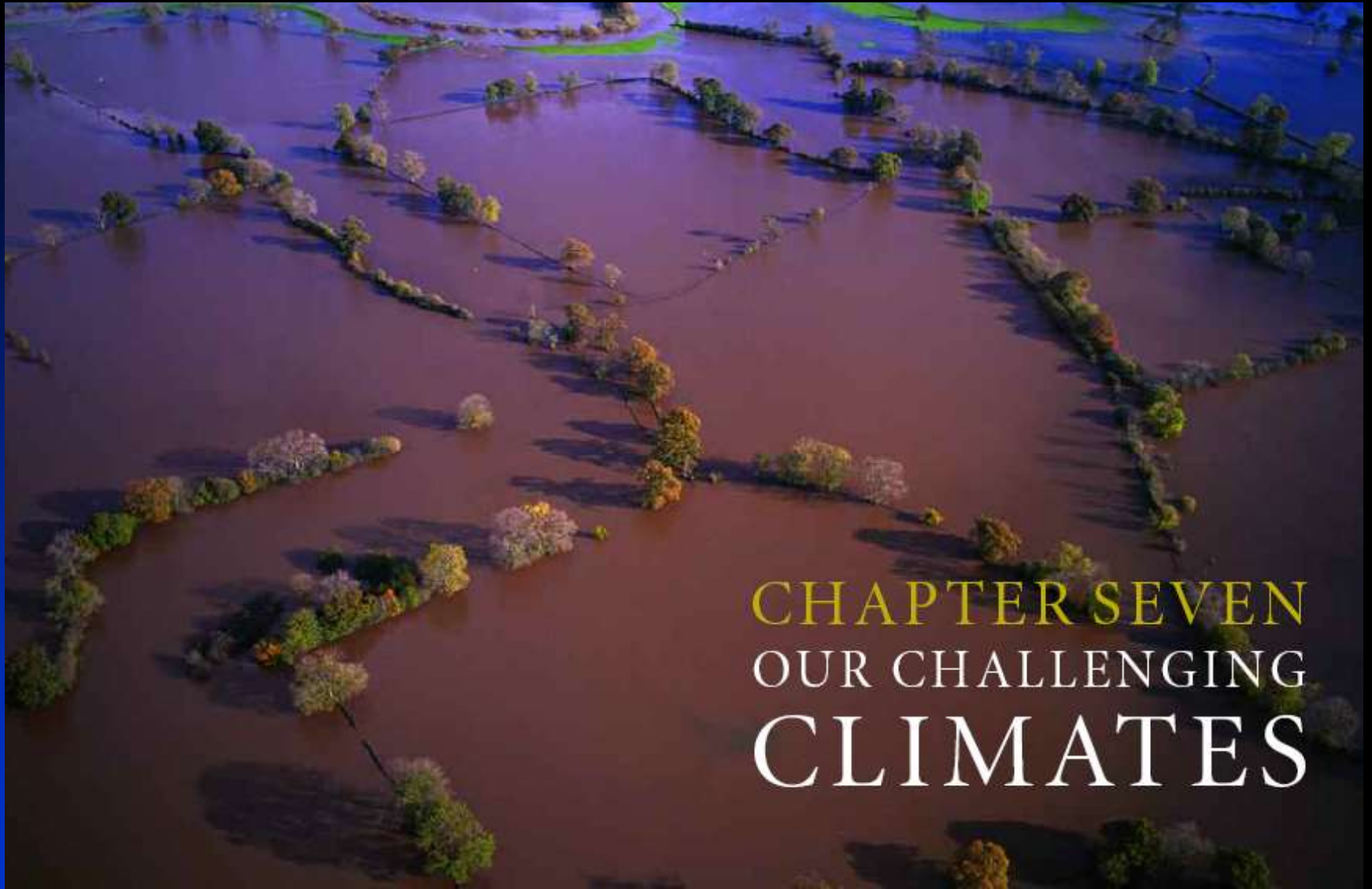
Africa



# The future?

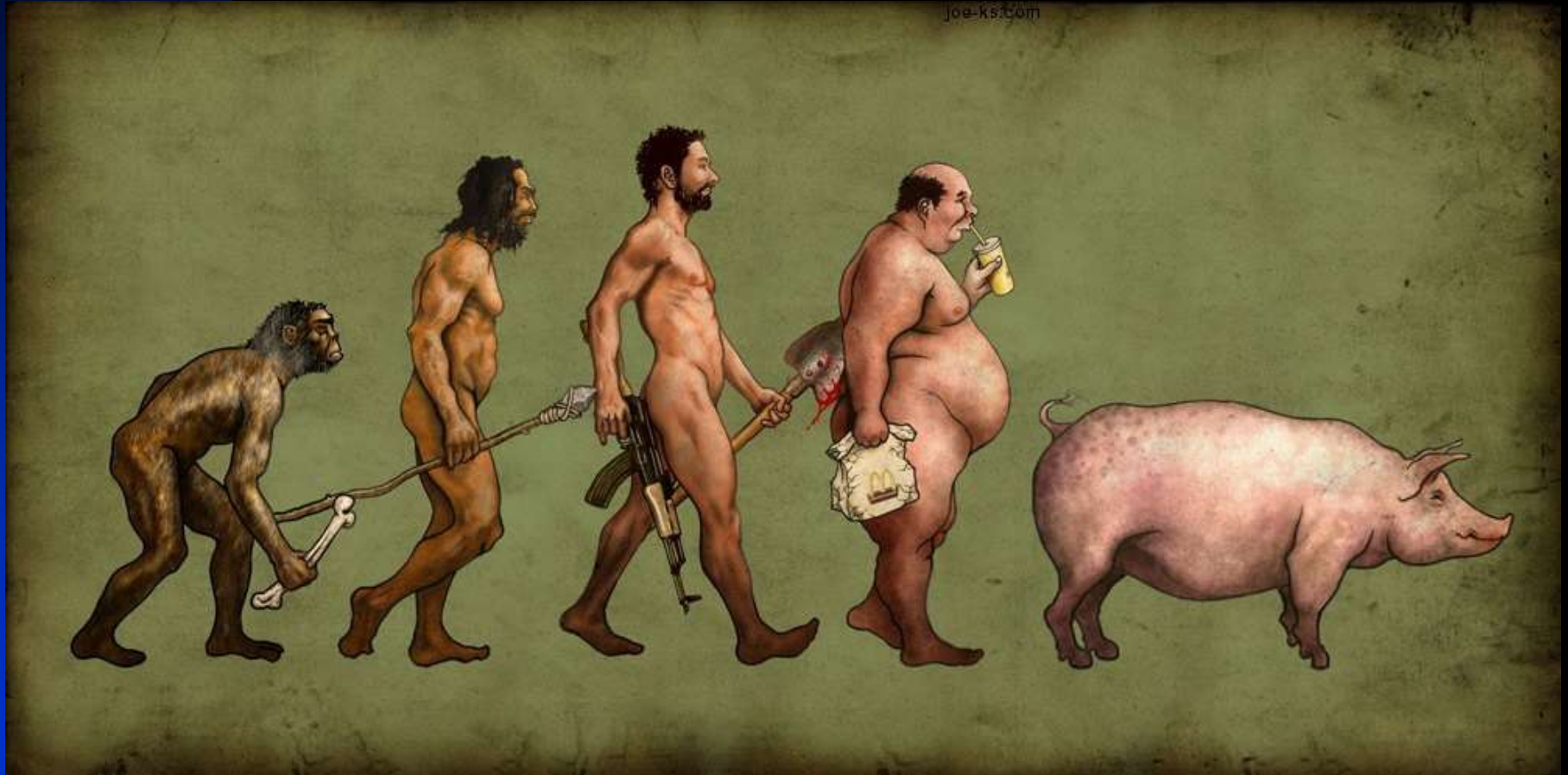


# The future?



## CHAPTER SEVEN OUR CHALLENGING CLIMATES

Our future is *partly* up to us....



Thanks to you all for listening, and to...  
The Natural History Museum London  
and all my sources of data and illustrations..



HUMAN  
ORIGINS  
RESEARCH  
GROUP

