

Human Evolution
Core course: ZOOL3014
B.Sc. (Hons'): VIth Semester

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Before Homo, Early evolution of Primates

Oligocene primates

Parapithecus was a primitive primate ancestral to man, apes and monkeys. It was very small squirrel-like earliest primitive monkey having tarsier-like appearance. The jaw was conical, the two halves converging at an angle of 33 degrees. These creatures were probably adapted for arboreal mode of life and had opposable thumb, forwardly directed eyes and reduced snout

Propliopithecus fossils were discovered from Fayum deposits in Egypt that comprised of a lower jaw with teeth. The jaw is smaller and more pointed than that of a gibbon, prognathous and deep. Canines were smaller and bunodont grinders had 5 bulbous cusps as in apes and man.

Limnopithecus first discovered by Hopwood in 1933 from Kenya is represented by several fragments of mandibles, teeth and limb bones. The dentition is gibbon-like but limb bones are unspecialized and a combination of monkeys and gibbons

Miocene apes

Pliopithecus is represented by several well preserved fossils from Egypt and Europe. It shows affinity with pongids but the mandibular symphysis is longer and more prosimian type. A shallow simian gap is present. Body is gibbon-like in the morphology of pelvis, vertebrae and sternum. Limb bones are surprisingly primitive, resembling those of prosimians while the general body proportions are like those of monkeys

Dryopithecus (=Sivapithecus) (=Proconsul) was ancestral to Orangutan, chimpanzee and gorilla and resembled gibbon in stature

Most of the fossils are represented by jaw fragments and teeth, with few exceptions such as a humerus and an ulna from France and a femur from Germany

The three genera, ***Dryopithecus***, ***Sivapithecus*** and ***Proconsul*** have been placed in the subfamily ***Dryopithecinae***

Arms and legs were of same length and posture was semi-erect. Skull lacked the well-developed crests and massive ridges characteristic of modern apes. Dental arch was parabolic and dentition more man-like but canines were larger and lower premolar is sectorial

It was a brachiator, swinging with arms on tree branches

Sivapithecus is believed to be the direct ancestor of Ramapithecus, whose fossils have been recovered from the same deposits in the Siwalik Hills and date from 17 to 8 million years old

Sugrivapithecus fossils were discovered from Siwalik Hill by Lewis in 1934 and are represented by fragments of jaw and teeth. The small size of teeth and canines and simplified molars suggest a transitional stage to hominid type of dentition

Gigantopithecus remains have been recovered from Siwalik Hills. Reduction of front teeth and canines shows hominid tendencies but the jaw was massive and premolars and molars were large. Jaw allowed grinding sideways motion. It was larger than gorilla, a terrestrial herbivore and lived in open grasslands

Lufengpithecus fossils recovered from China reveal a highly sexually dimorphic hominoid, having distinctly smaller females and considerably larger male of the size of a chimpanzee

Sahelanthropus tchadensis A cranium, jaw fragments and several teeth were discovered from Chad in Africa by Michel Brunet et al. (2002). The 6-7 million year old skull resembles that of a chimpanzee from the posterior side but on the front side is Australopithecine in character

Ramapithecus (=Kenyapithecus)(=Bramapithecus) fossils of fragments of an upper jaw and teeth were found in 1932 from Haritalaya Nagar in Himachal Pradesh in Siwalik Hills in India by G.Edward Lewis

In Kenya L.S.B. Leakey (1955) discovered a few teeth and jaw fragments of the same species. Canines were small and grinders had low cusps but coated with thick layer of enamel

Brahmapithecus is represented by lower jaw only

Face was short and jaw allowed sideway motion. Dentition was human and palate arched. Incisors and canines were small, permitting lateral chewing. Grinding teeth were large and broad with thick enamel coating, suggesting herbivore diet of grass, seeds, roots and perhaps raw meat

Ramapithecus fossils show advancement in morphology over ***Sivapithecus*** that brings it closer to ***Australopithecus***. They probably originated in Africa and later migrated to Eurasia

Pliocene Hominids

After *Ramapithecus* no fossils are available for almost 10 million years, which is a big gap in phylogeny of man

Oreopithecus fossils were discovered from lignite mines in Italy

One nearly complete skeleton of the abominable Coal Man was unearthed from Italy and later about 200 fossils were collected from Europe and East Africa

Dentition was human, canines were small and face short but premolars and molars were ape-like. Pelvic girdle was broad, indicating erect posture

It was an herbivore living in swampy areas

Australopithecus africanus, “the southern ape” is the most primitive of Australopithecines that existed between 5.5 and 2 million years ago

Fossil of a 5-year old boy (Taung baby) was discovered from South Africa by Prof. Raymond A. Dart in 1924

It was 5 feet tall and walked erect. Vertebral column had a lumbar curve and pelvis was broad. Foramen magnum was placed under the skull. Teeth human and dental arch smoothly rounded. Palate seems to be shallow anteriorly and deep posteriorly. Canines were small and simian gap absent. Premolars and molars greatly enlarged relative to incisors and canines

Cranial capacity was 450-700 cc. Face was prognathous with long palate but less prominent eyebrow ridges and without chin. Orbits were large and rounded. Nasal bones were flat, giving the short face a dish-shaped appearance.

Australopithecus occurred in two forms:

a **small gracile** and

a **larger robust form** spread in Tanzania, Kenya and Ethiopia and South Africa

Many scientists are now using the generic name ***Paranthropus***, which was originally given to the species ***robustus***, to refer to the robust forms of ***Australopithecus***, which includes:

robustus

boisei and

aethiopicus

Australopithecus afarensis was a gracile form and probably a descendant of ***A. africanus***

One almost complete skeleton of a female named “**Lucy**” was discovered from Afar (Ethiopia) by Donald Johanson in 1973

It was dated at 3.5 million years. It was about 5 feet tall and walked erect and had an arched foot to support the bipedal gait. Cranial capacity was 400-500 cc

Canines were small with thick layer of enamel and molars were designed to grind tough material



Australopithecus garhi. A fragmentary skull was excavated in 1997 by Asfaw and White from Bouri village in the middle Awash region in Ethiopia and dated at 2.5 million years

The fossil was found near antelope bones which were butchered by it using specialized stone tools that were carried with it from other places where the raw material for it was available

The stone hammers, axes and blades enabled this species to exploit a broader range of habitats and prey to obtain energy rich food that was necessary for the enlargement of energy consuming brain

Australopithecus anamensis fossils, discovered near Anam lake at Kanapoi and Allia Bay in Kenya by Meave G. Leakey, were dated to about 4 million years

Skull fragments and teeth were similar to those of earlier species but arms and leg bones were more advanced and indicative of bipedal gait

Ardipithecus ramidus is represented by 21 specimens found near Lake Turkana and from Aramis in the Awash Valley in 1995. Dated back to 4.4 million years, it perhaps walked erect. It is believed to be a sister species of *anamensis*

The following three species were robust forms of *Australopithecus*, sometimes identified by the separate generic name, *Paranthropus*, as they seem to have descended from a common ancestor-

Australopithecus robustus (=Paranthropus robustus)

Zinjanthropus boisei

Australopithecus aethiopicus

***Australopithecus robustus (=Paranthropus robustus)* was first discovered by Robert Broom in 1939 from South Africa and dated to 1.5-2.0 million years**

It is characterized by heavily built skull having rounded appearance, higher vertex and a bony keel on the top for the attachment of large jaw muscles

Forehead was slanting and eyebrow ridges massive. Foramen magnum and occipital condyles were anteriorly placed. Dental arch was rounded and massive without diastema and simian shelf. Incisors and canines were small and spatulate, while premolars and molars were very large

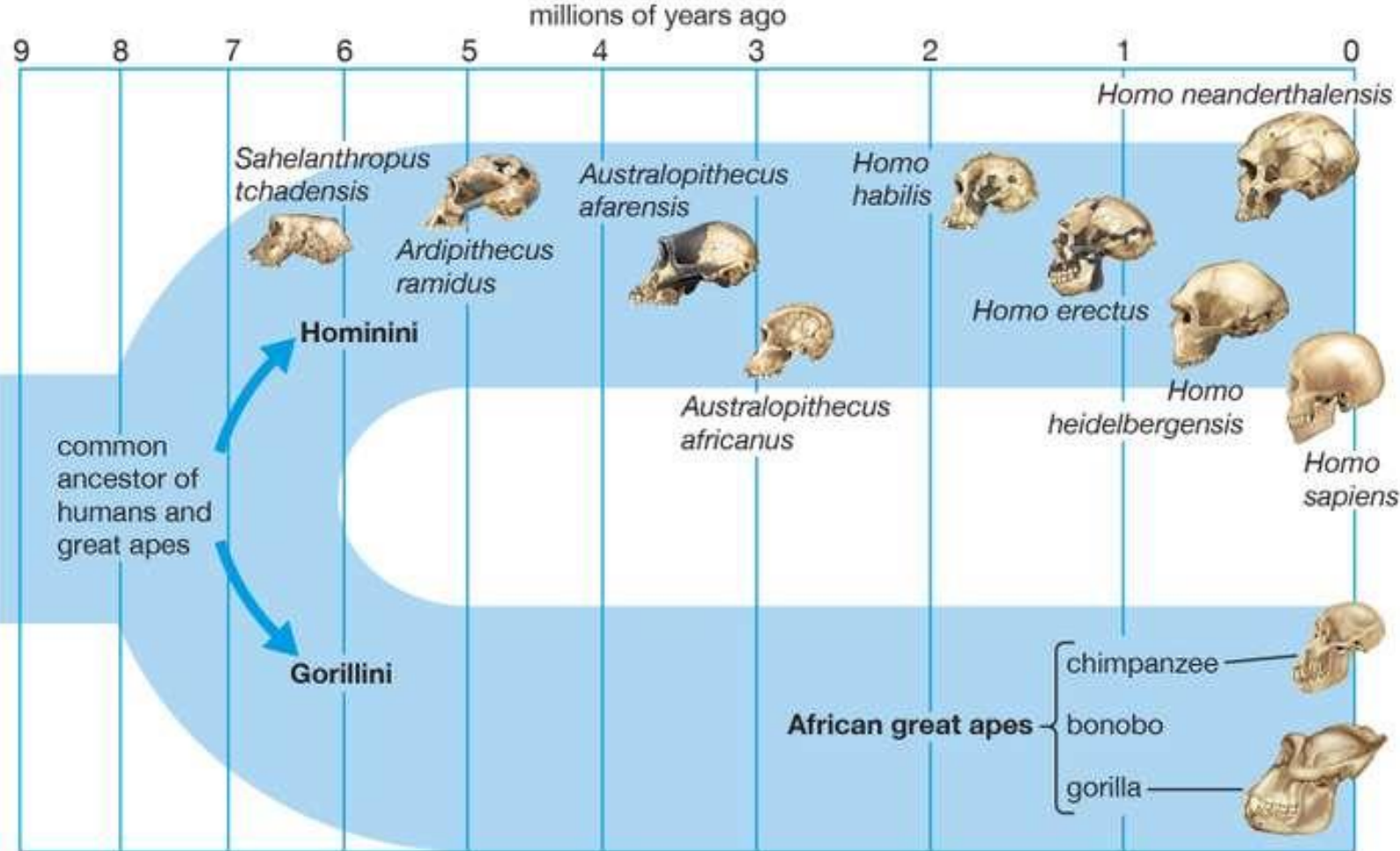
Zinjanthropus boisei, the “Nutcracker Man” was discovered by L.S.B. Leakey in 1959 from Tanganyika in East Africa and at Olduvai gorge in Tanzania, along with stone tools, and was dated to about 1.7 million years

It had massive jaws and teeth, with small incisors and large canines. There is cerebral enlargement with a cranial capacity of 600 cc. Face was protruding and forehead high, having prominent eyebrow ridges. Nasal spine was elevated

Australopithecus aethiopicus was discovered by Allan C. Walker from Lake Turkana in Kenya and is represented by a 2.5 million years old blackish skull

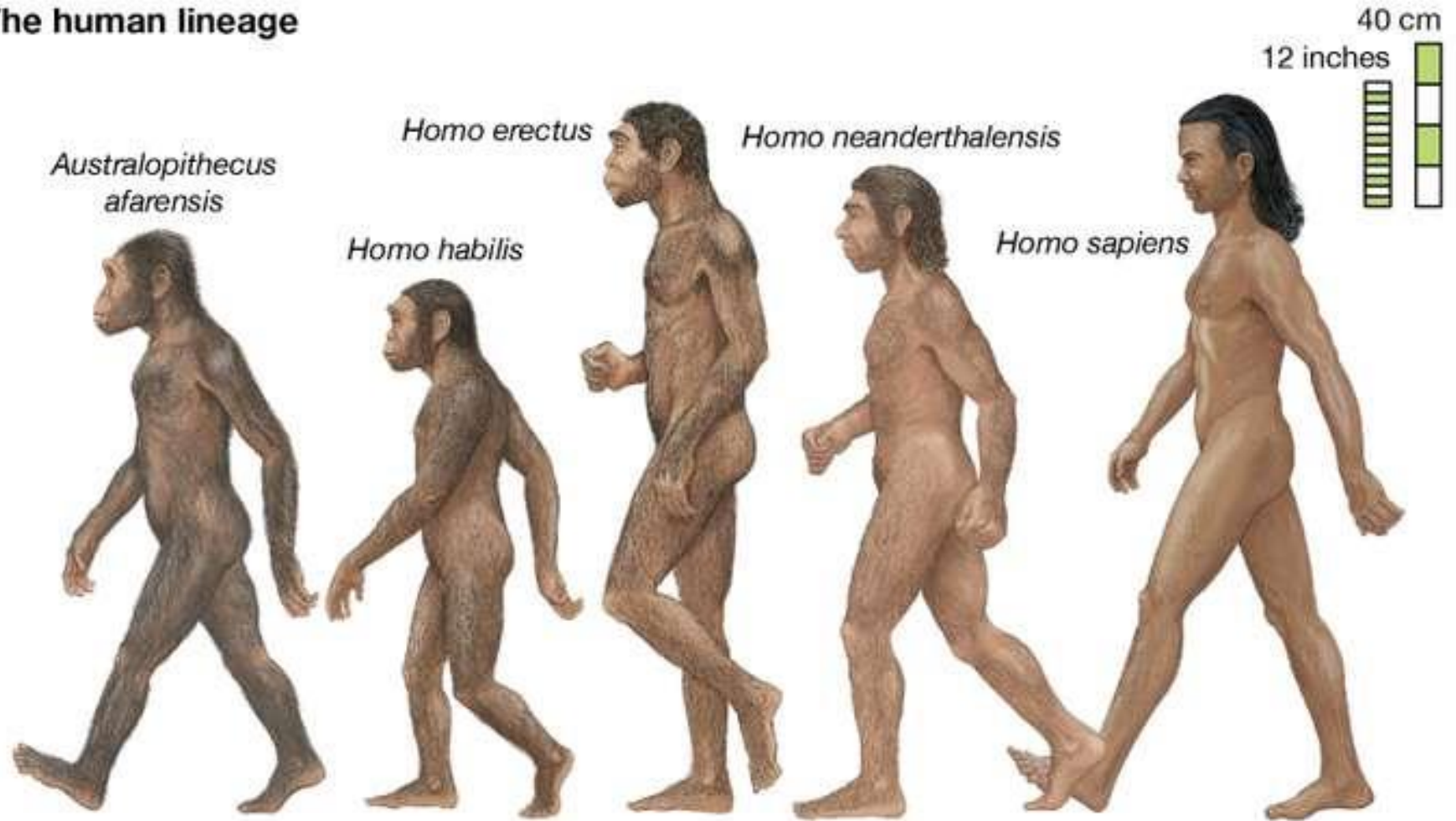
It is related to *A. robustus* and *boisei* and may be their ancestor

The divergence of humans and great apes from a common ancestor



Human Evolution

The human lineage



Pleistocene hominids

Homo habilis, called the “Able Man” lived 1.85-2.6 million years ago and walked erect

Fossils were discovered by Louis Leakey in 1959 from Olduvai Gorge in Tanzania, where later several teeth, jaw and skull fragments were discovered. Its premolars and molars were smaller and anterior teeth larger

It was 140 cm tall, with cranial capacity of 700 cc and human teeth

It was a habitual biped and probably ancestral to all *Homo*

It hunted small animals and was a scavenger of large carcasses

Face was less prognathous and nasal bones convex

It was closely related to *A. africanus* but was more advanced in features and occupied similar ecological niche

Homo habilis



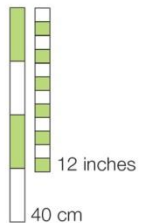
Homo erectus fossil remains dating from 1.9 million years to about 250,000 years discovered from Java, China and later Europe and Africa are collectively known as **Homo erectus**, the archaic man that had larger brain and used stone hand axes

Supraorbital ridges are prominent, with an indented area behind them

It had massive face that projected below and heavily built mandibles, without a chin that were moved by strong masseter muscles

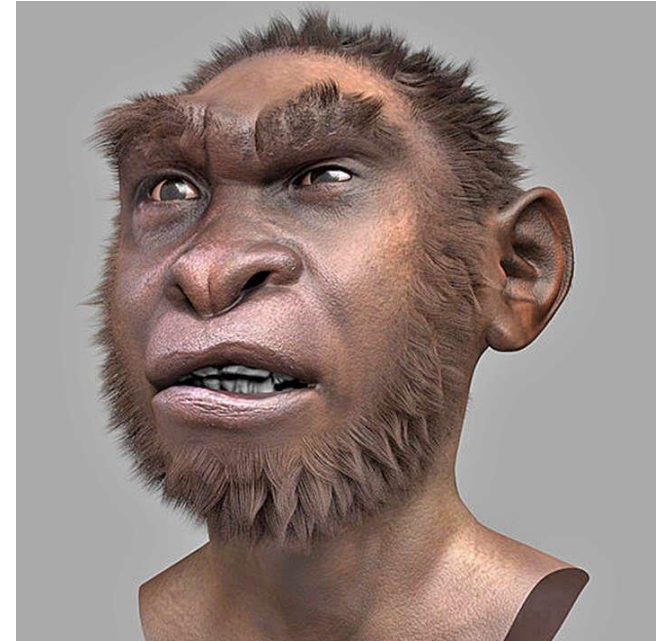
Teeth are similar to ours but incisors are slightly larger and shovel-shaped having enlarged pulp cavity, an adaptation for hard chewing

Homo erectus



They knew the controlled use of fire to cook food and keep them warm. The use of fire was perhaps necessary to occupy caves that were inhabited by large carnivores

The mean cranial capacity was 1020 cc, which was approximately twice the size of australopithecines but only three-fourth of *Homo sapiens*



Homo ergaster*, considered the African counterpart of *Homo erectus*, was discovered from Koobi Fora in Kenya and dated to 1.6 million years. In 1954 hominid remains from Algeria and Morocco showed affinities with the Chinese form of *Homo erectus

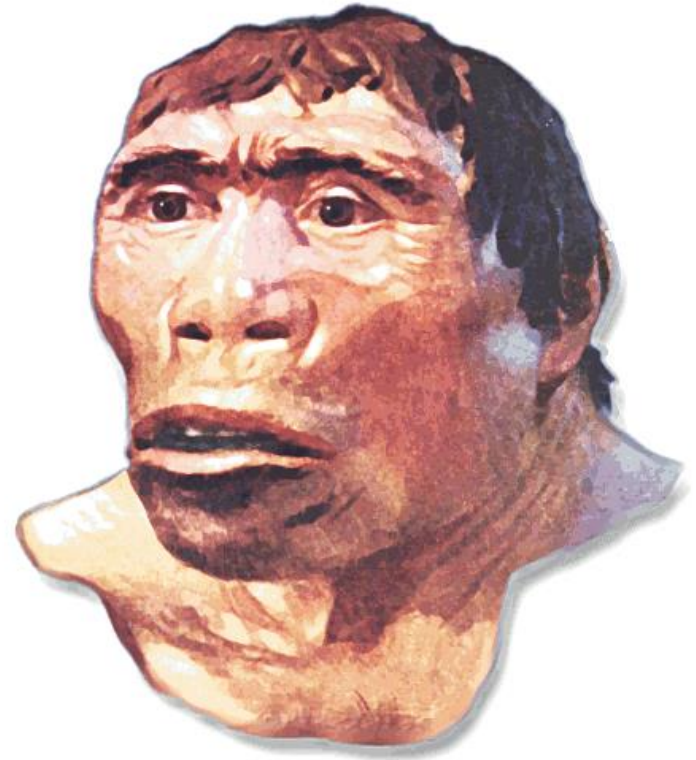
After 1970, Richard Leakey unearthed fossils from the eastern shores of Lake Turkana and one complete skull from Koobi Fora that is believed to be the earliest *Homo erectus* fossil in Africa

Pithecanthropus erectus (Java Man) was discovered by a Dutch army officer, Eugene Dubois in 1891

Skull cap, few teeth and a femur are known. Forehead was low and supraorbital ridge. Cranial capacity was 775-900 cc.

Height was about 5 feet and it walked erect efficiently. Bones of the skull were extraordinarily thick.

Face was prognathous, chinless and skull flat on the top and projected behind



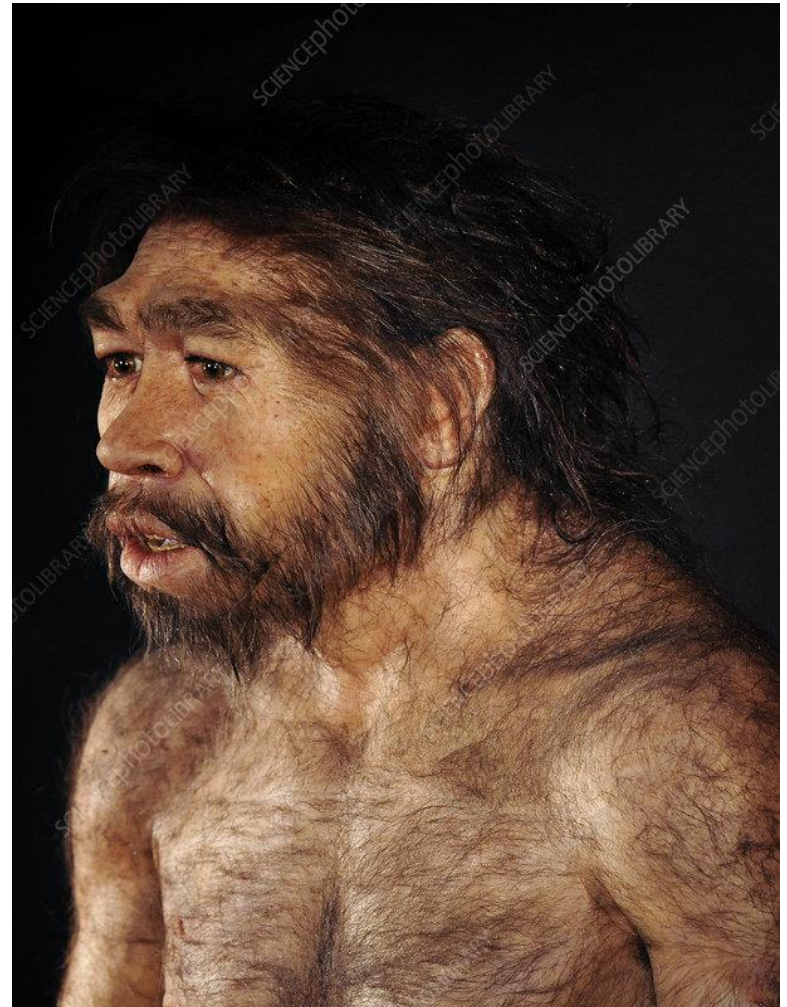
Sinanthropus pekinensis (Peking Man)

First reported by a Canadian Professor, Davidson Black in 1927, who found only one skull

It was similar to Java man but skulls were small and cranial capacity 850-1200 cc

Eyebrow ridges were stout.

Stone tools of varied designs were also found along with bones of large animals and pieces of charred wood and bones. It walked erect



Homo heidelbergensis

Represented by a single jaw recovered from a sandpit near Heidelberg in Germany in 1907

Lower jaw was massive and chinless but teeth were stout and human

The anatomical features were more advanced than those of the African and Asian forms of *Homo erectus*

They were low-browed hominids having thick bones and robust skeletons and perhaps represented earlier stage of *Homo sapiens*



Steinham Man is represented by a complete skull found in 1933 from a gravel pit at Steinham site in Germany

Its age is estimated to be same as for Swanscombe man, from the second interglacial period

Cranial capacity was 1070 to 1175 cc. Fore head was high but eyebrow ridges were heavy and the nasal opening broad as in Neanderthals

Ehringsdorf Man is also known from Germany with a cranial capacity of 1350 cc

It lived up to 120,000 years ago. Forehead was well developed, eyebrow ridges heavy and chin reduced

Swanscombe Man is known by two pieces of the skull roof consisting of one occipital and two parietal bones that are unusually thick

Skull is broad at the back but the occipital region is not projected behind as in Neanderthals. Cranial capacity was 1300 cc

Some stone tools were also discovered from the same site

Fontechivade Man fossils are from France

Skull bones were thick and cranial capacity about 1400 cc. Supraorbital ridges were not prominent

Solo Man is known by partial skull and 2 femur bones discovered from Solo river in Java in 1933

Forehead was low and eyebrow ridges heavy.
Cranial capacity was 1300 cc

Rhodesian man was discovered in Rhodesia (= Zimbabwe) in 1921

Cranial capacity was 1300 cc

Eyebrow ridges were heavy and jaw was projecting forward, although the dental arch was parabolic

The Rhodesian man was about 6 feet tall, neanderthaloid in appearance and is now regarded as a subspecies of *Homo sapiens*



Neanderthal Man (*Homo neanderthalensis*) is known originally from Neander Valley in Germany

Later, fossils of about 200 individuals were unearthed from 70 sites in Austria, China, France, England, Germany, Greece, Italy, Iraq, Israel, Java, Russia and Yugoslavia

The species lived between 200,000 and 30,000 years ago. The average cranial capacity was 1450 cc, which is greater than in modern man, but the brain was large posteriorly and ventrally

They were stout and powerfully built people, weighing over 80 kg and having an average height of 5'6"

Long bones were thick, slightly curved and had large areas for muscle attachment

Forehead was low and slanting, eyebrow ridges were heavy and cheek bones were large. Nose was broad and chin was absent

Stature was robust and completely upright

Teeth were large

They were cave dwellers living in the most adverse environmental conditions and used fire, made stone tools and crude carvings and practiced burial

There is strong evidence of ritualistic practices, religious beliefs and ceremonious burials

The classic Neanderthals come from fourth interglacial period in Europe and had stocky and rugged stature, broad nose, stout mandible, projecting occipital region and no chin



Causes of extinction of Neanderthals

The most plausible explanation is that a more advanced species, Cro-Magnon man evolved in Africa and migrated to Europe about 40,000 year ago and exterminated the Neanderthals

However, recent findings indicate that extinction of Neanderthals was not so fast and that it coexisted with Cro-Magnon for about 10,000 years and perhaps produced viable hybrids

That leads to another possibility that they must have interbred with the new and more advanced populations immigrating from Africa, producing the modern man

But a study of mitochondrial DNA sequences recovered from the skeleton of a Neanderthal suggests that modern humans are closely related to each other than to Neanderthals

Cro-Magnon Man (*Homo sapiens fossilis*) was a contemporary of Neanderthal man and lived in Europe during the upper Paleolithic period (about 40,000-10,000 years ago)

Large number of fossils was found from a cave in Cro-Magnon in France

Male was 6 feet and female 5 feet 6 inches tall

Skull was like modern man, with a distinct chin, flat eyebrow ridges and orthognathous face. Teeth and jaw were distinctly like modern man

Cranial capacity was about 1500 cc., same as that of modern man

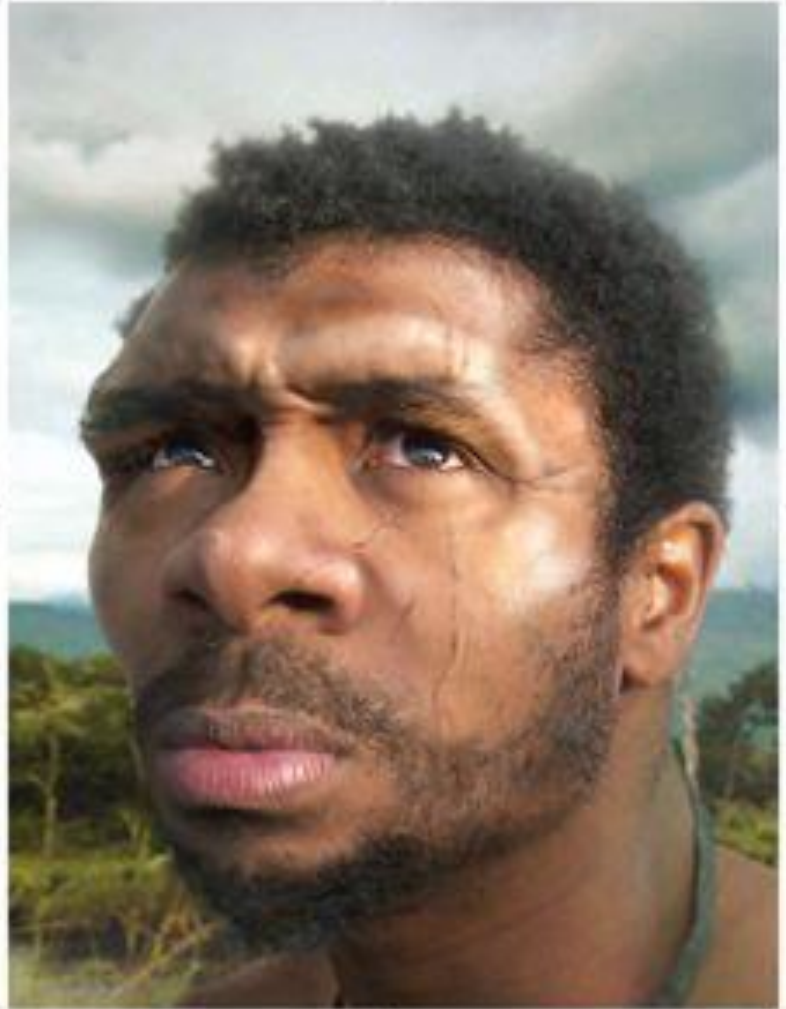
They showed technological advancement in using bones, antlers, stones etc. to make tools and spears and also specialized tools such as needles, harpoons, engraving tools, blades, soft hammers and heat-treated flints

They used ornaments for the first time and performed rituals. Coloured pictures of animals in the deepest parts of the caves and also carvings of wood, ivory and stones point to their advanced skills

They apparently knew the use of fire but did not practice agriculture or domestication of animals. They also buried their dead with some rituals

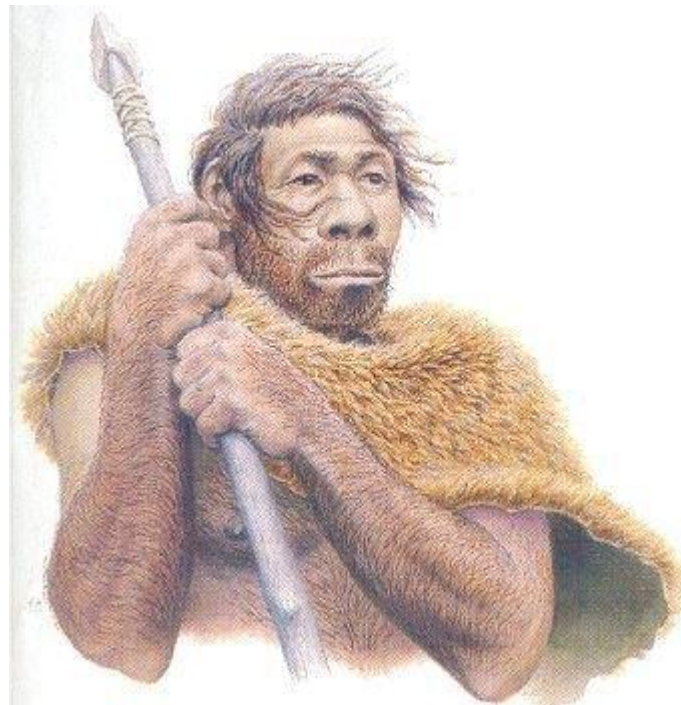
Both Cro-Magnon and Neanderthal man lived during the glacial period, when their main occupation was hunting wild animals for food, which they cooked on fire in caves

Cro-Magnon had better intelligence and advanced tools and arms and hence perhaps exterminated Neanderthal



Towards the end of glaciations, they probably migrated to warmer parts of the world and settled down in colonies along the rivers to practice agriculture and domestication of animals, which gave them sure and constant supply of food

Evolution of man after that was very fast as compared to the earlier slow pace of evolution during Pleistocene epoch



Homo floresiensis. Also named as ***Homo hobbit***, the discovery of the little man from limestone cave at Liang Bua on the Indonesian island of Flores by the Australian archaeologists surprised everyone

The 18,000 year old fossils were only a meter tall and had cranial capacity of only 380 cc



These tiny people lived in isolation in the far-flung Indonesian island where giant rats, tiny elephants, Komodo dragons and other large lizards were abundant

The isolation forced the species to remain small-sized and live in holes in the ground to escape giant predatory lizards and hunt giant rats for food

There is an ongoing debate over whether *H. floresiensis* is indeed a separate species

***H. floresiensis* shares a common ancestor with modern humans, but split from the modern human lineage and followed a distinct evolutionary path**

Some scientists hold that *H. floresiensis* was a modern *H. sapiens* with pathological dwarfism

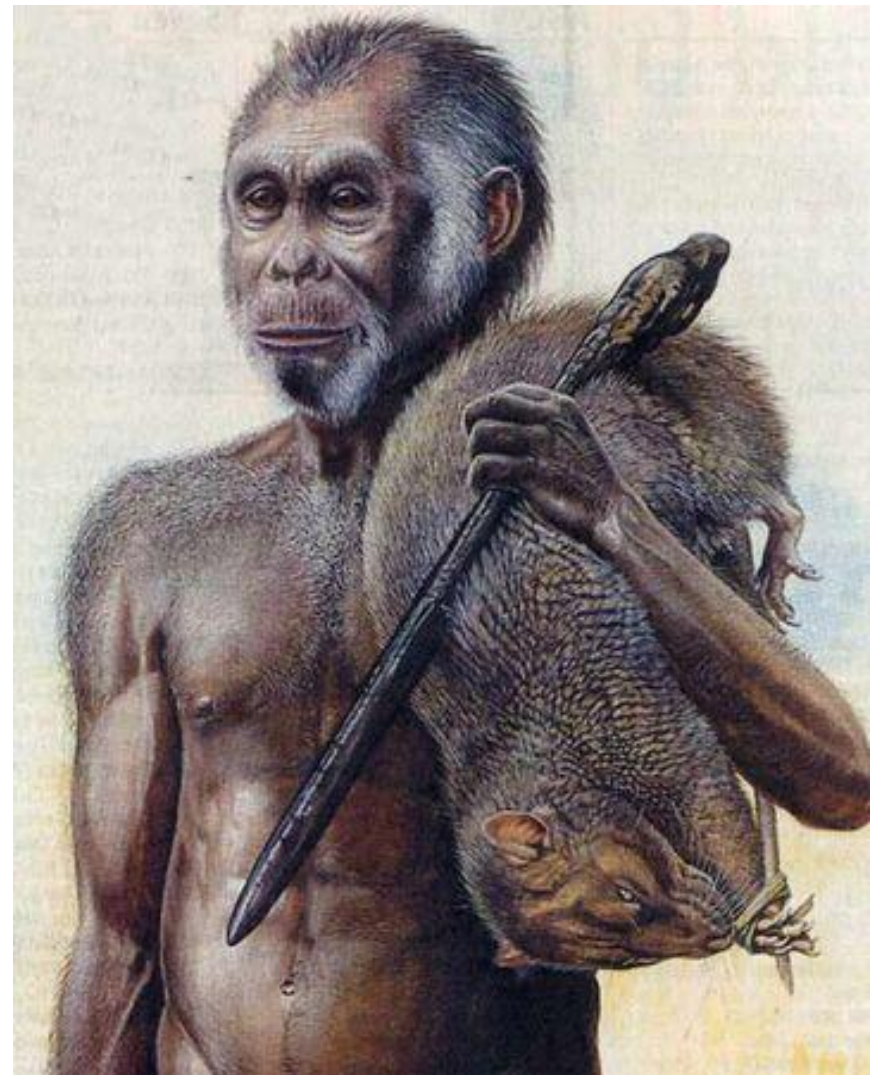
This hypothesis is supported in part, because some modern humans who live on [Flores](#), the island where the skeleton was found, are [pygmies](#)

This, coupled with pathological dwarfism, could possibly create a hobbit-like human. The other major attack on *H. floresiensis* is that it was found with tools only associated with *H. sapiens*

The hypothesis of pathological dwarfism, however, fails to explain additional anatomical features that are unlike those of modern humans (diseased or not) but much like those of ancient members of our genus

Aside from cranial features, these features include the form of bones in the wrist, forearm, shoulder, knees, and feet

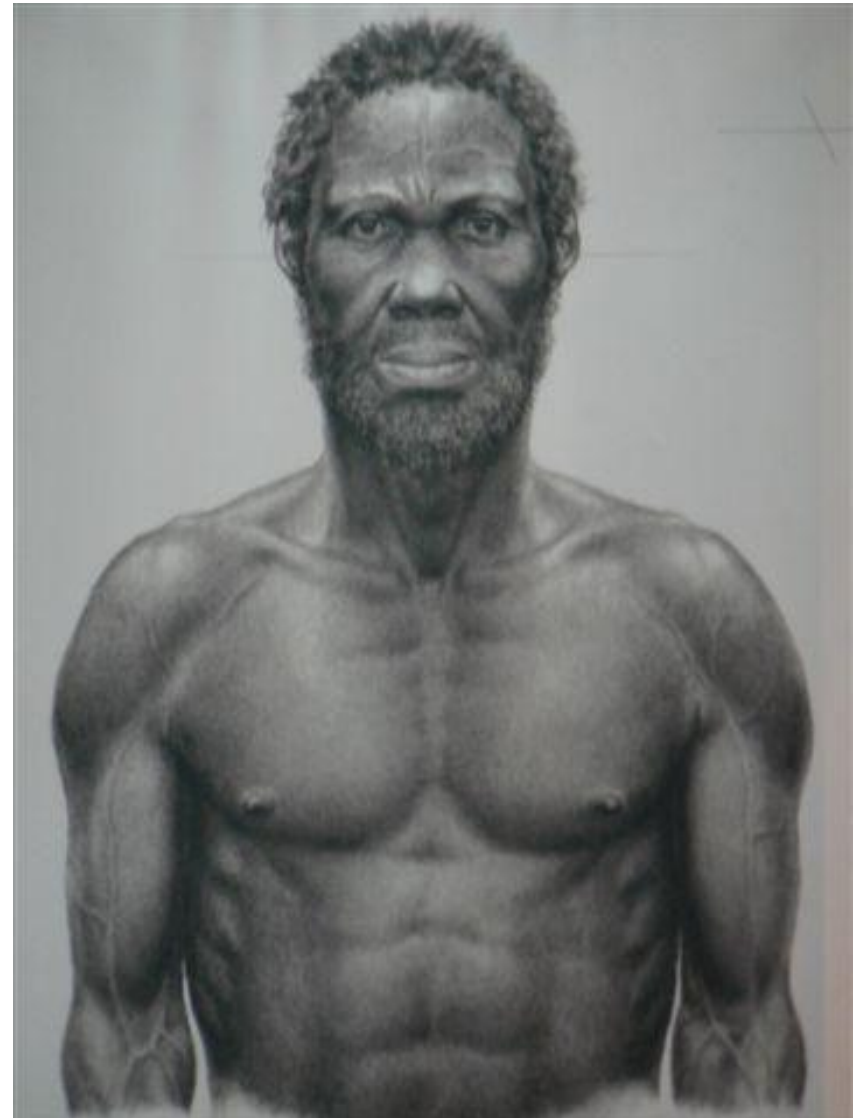
Additionally, this hypothesis fails to explain the find of multiple examples of individuals with these same characteristics, indicating they were common to a large population, and not limited to one individual



H. Sapiens

H. sapiens (the adjective **sapiens** is Latin for "wise" or "intelligent") have lived from about 250,000 years ago to the present

Between 400,000 years ago and the second interglacial period in the Middle **Pleistocene**, around 250,000 years ago, the trend in **skull expansion** and the elaboration of stone tool technologies developed, providing evidence for a transition from *H. erectus* to *H. sapiens*



The direct evidence suggests there was a migration of *H. erectus* out of Africa, then a further speciation of *H. sapiens* from *H. erectus* in Africa

A subsequent migration within and out of Africa eventually replaced the earlier dispersed *H. erectus*

This migration and origin theory is usually referred to as the *recent single origin* or Out of Africa theory

Current evidence does not preclude some multiregional evolution or some admixture of the migrant *H. sapiens* with existing *Homo* populations

Current research has established that humans are genetically highly homogenous, i.e. the DNA of individuals is more alike than usual for most species, which may have resulted from their relatively recent evolution or the possibility of a population bottleneck resulting from cataclysmic natural events such as the Toba catastrophe

Distinctive genetic characteristics have arisen, however, primarily as the result of small groups of people moving into new environmental circumstances

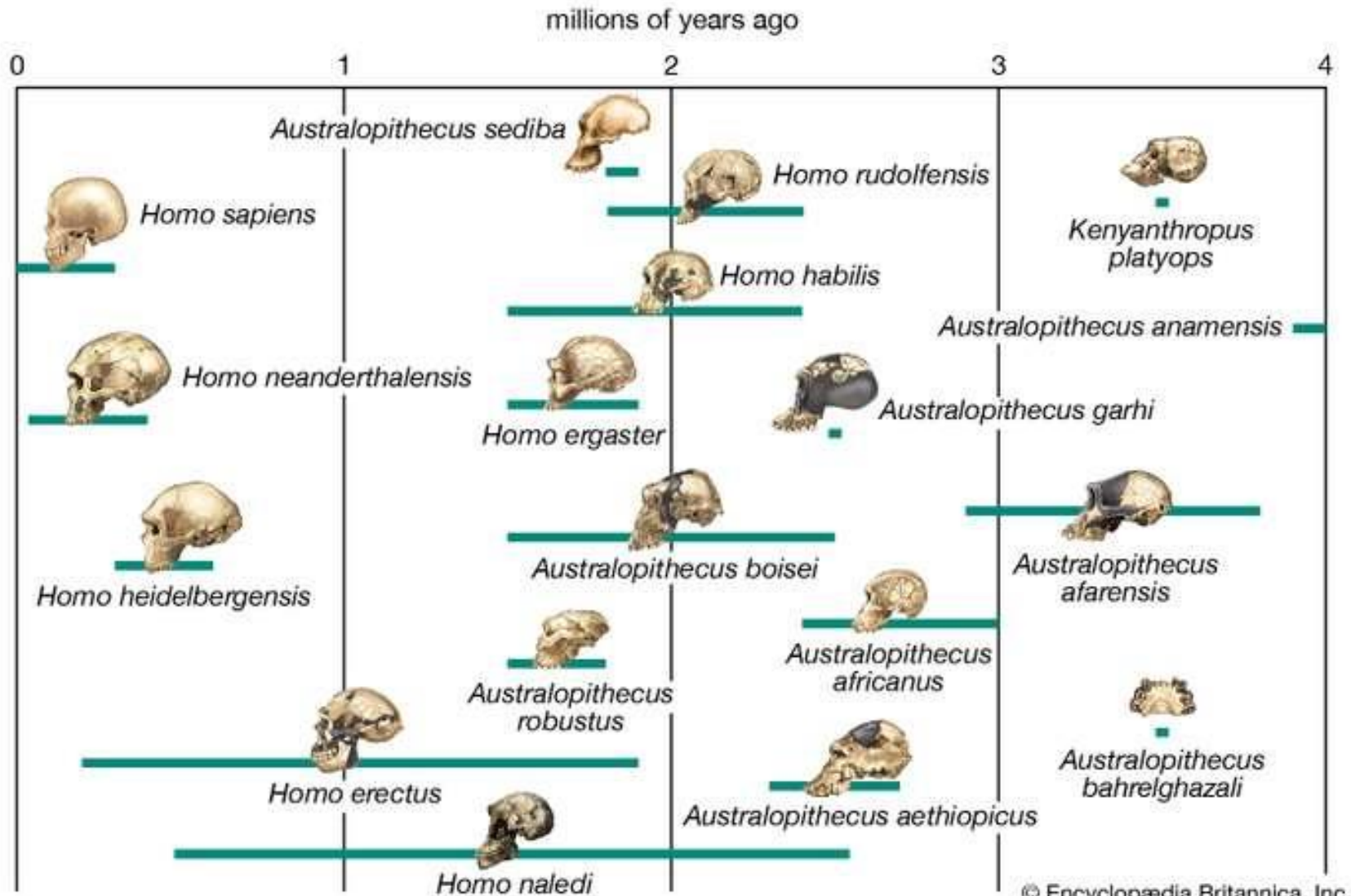
These adapted traits are a very small component of the *Homo sapiens* genome, but include various characteristics such as skin color and nose form, in addition to internal characteristics such as the ability to breathe more efficiently at high altitudes

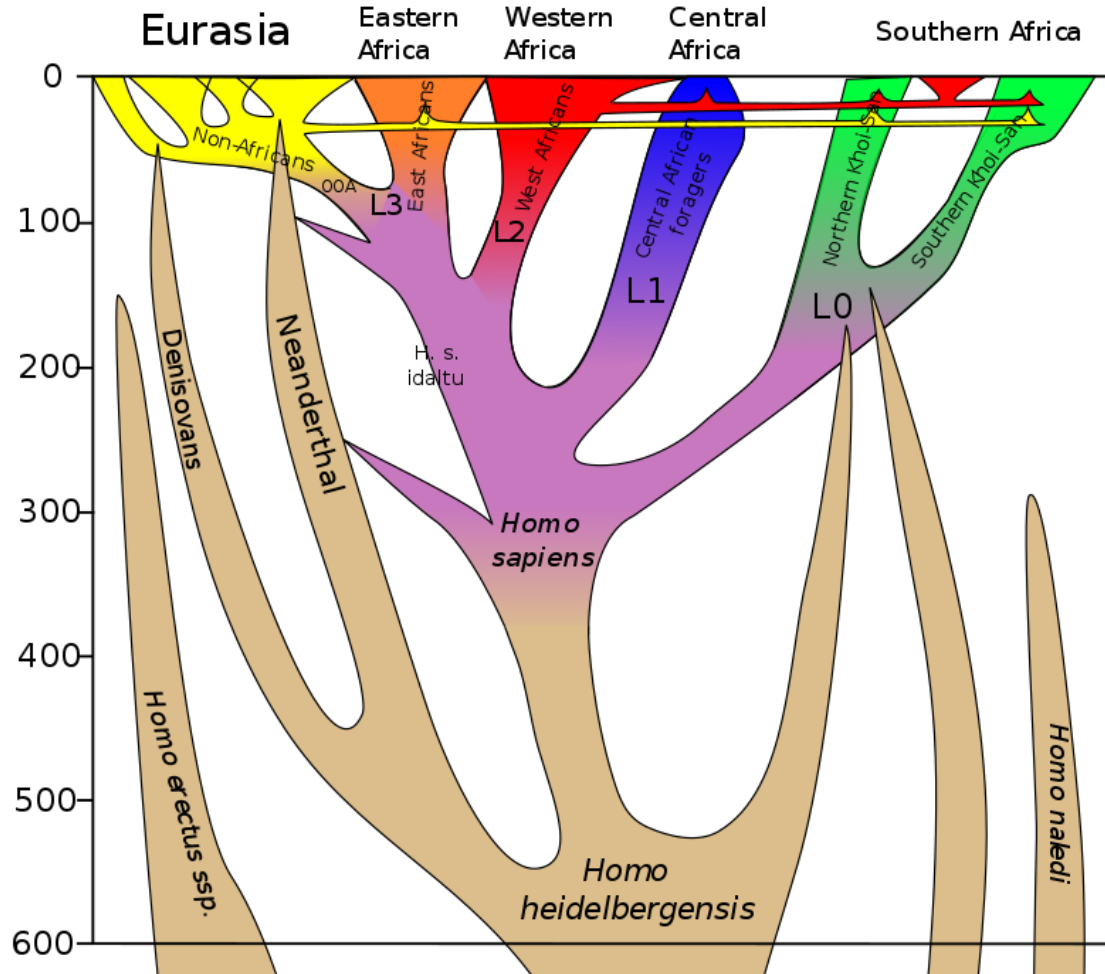
***H. sapiens idaltu*, from Ethiopia, is an extinct subspecies from about 160,000 years ago**



Human evolutionary pathways

Possible pathways in the evolution of the human lineage

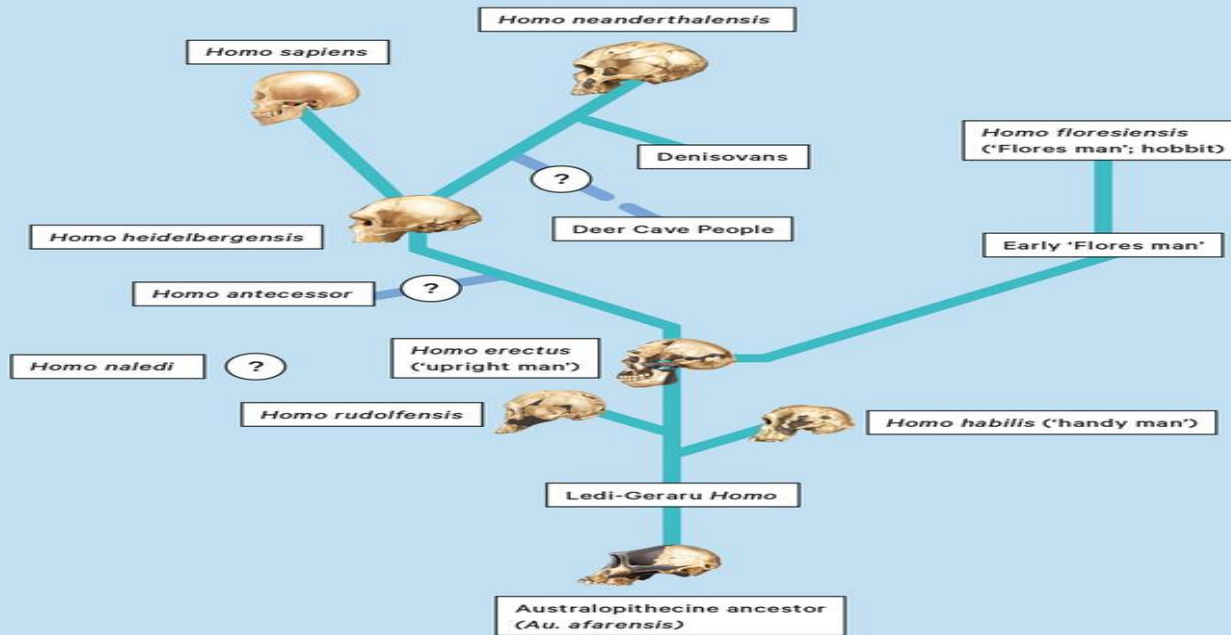




A model of the phylogeny of *H. sapiens* during the Middle Paleolithic. The horizontal axis represents geographic location; the vertical axis represents time in thousands of years ago. *Homo heidelbergensis* is shown as diverging into Neanderthals, Denisovans and *H. sapiens*. With the expansion of *H. sapiens* after 200 kya, Neanderthals, Denisovans and unspecified archaic African hominins are shown as again subsumed into the *H. sapiens* lineage. In addition, admixture events in modern African populations are indicated

A
CLOSER
LOOK

HOMININ FAMILY TREE



SPECIES

LEDI-GERARU HOMO

HOMO RUDOLFENSIS

HOMO HABILIS — 'handy man'

HOMO ERECTUS — 'upright man'
(including *Homo ergaster*)

HOMO ANTECESSOR

HOMO HEIDELBERGENSIS
(including *Homo rhodesiensis*)

FLORESIENSIS-LIKE HOMININ

HOMO FLORESIENSIS — 'Flores man', 'Hobbit'

HOMO NEANDERTHALENSIS

DENISOVANS

RED DEER CAVE AND LONGLIN PEOPLE

HOMO SAPIENS

HOMO NALEDI

WHEN THEY LIVED

2.8 million years ago

2.1 – 1.8 million years ago

1.9 – 1.4 million years ago

1.9 million years ago
– 100,000 years ago

~1.2 million years ago

700,000 – 200,000 years ago

700,000 years ago

100,000 – 60,000 years ago

500,000 – 40,000 years ago

100,000 years ago

14,000 – 10,000 years ago

~180,000 years ago – present

undetermined

WHERE THEY LIVED

Eastern Africa

Eastern Africa

Eastern and Southern Africa

Africa and Asia

Spain

Africa, Europe, and possibly Asia

Indonesia (Flores Island)

Indonesia (Flores Island)

Western Eurasia (as far east as Siberia)

Siberia

Southwest China

Worldwide

South Africa