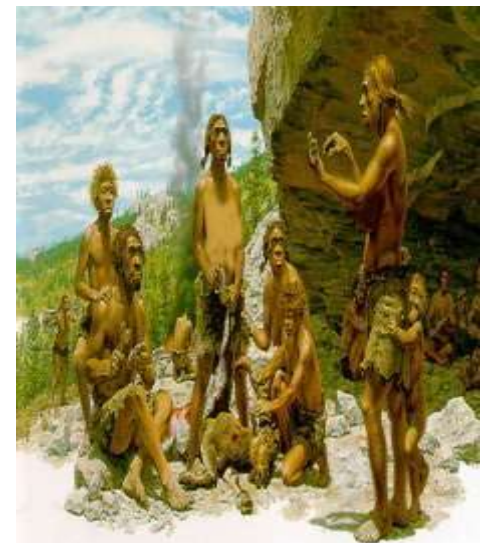


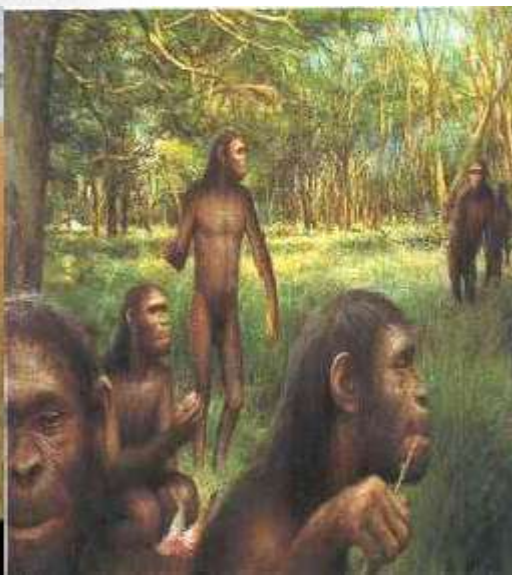


HUMAN EVOLUTION

SEM IV PG




Australopithecus africanus



Introduction

"Hominid" refers to members of the human family, Hominidae, which consist of all species from the point where the human line splits from apes towards present day humans.

Habitual bipedal locomotion (movement on two legs), an upright position, and a large brain that has lead to: tool use, language, and culture characterize hominids.



History



1856-Neander Valley

Discovery of a skull that was not quite human

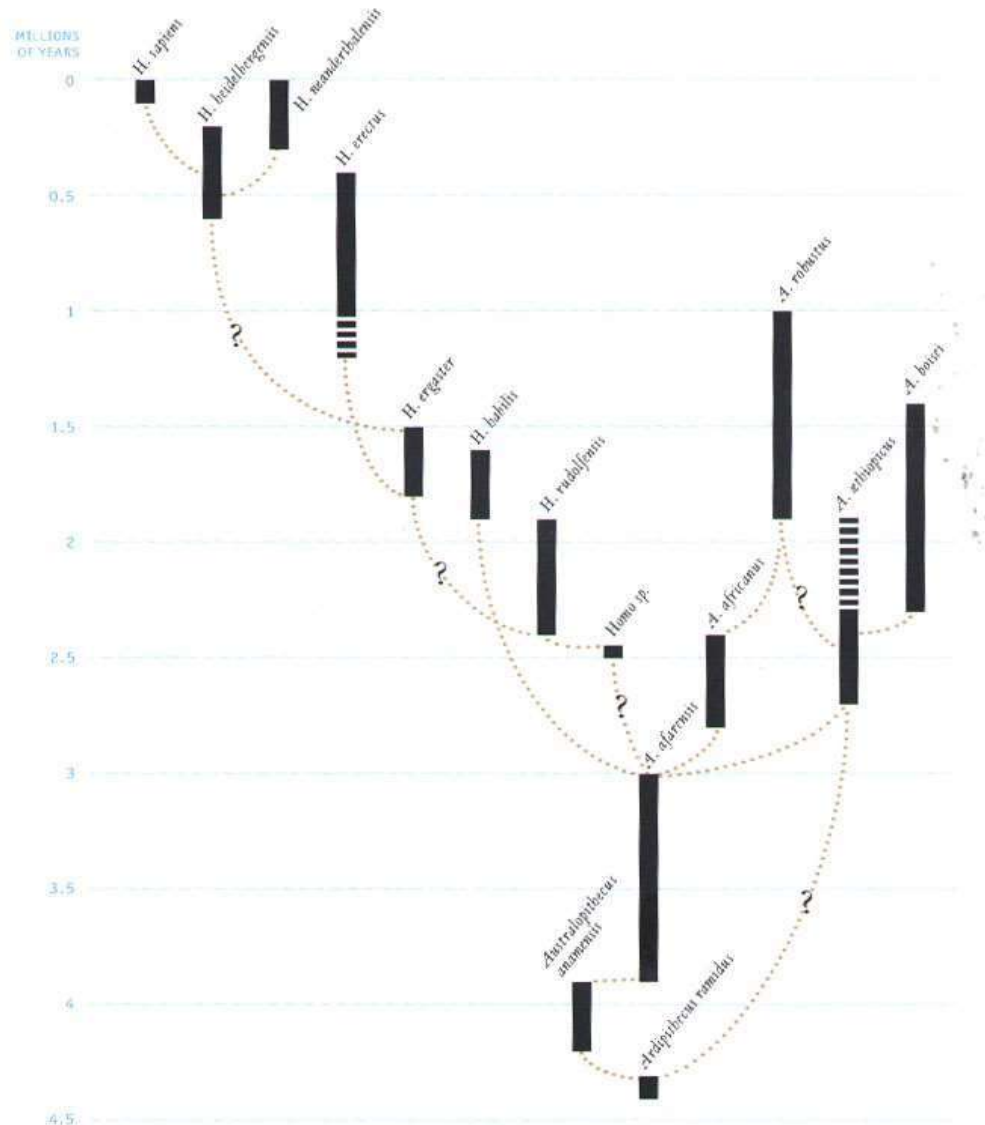


**1859 – Darwin
publishes ‘The
Origin of Species’**

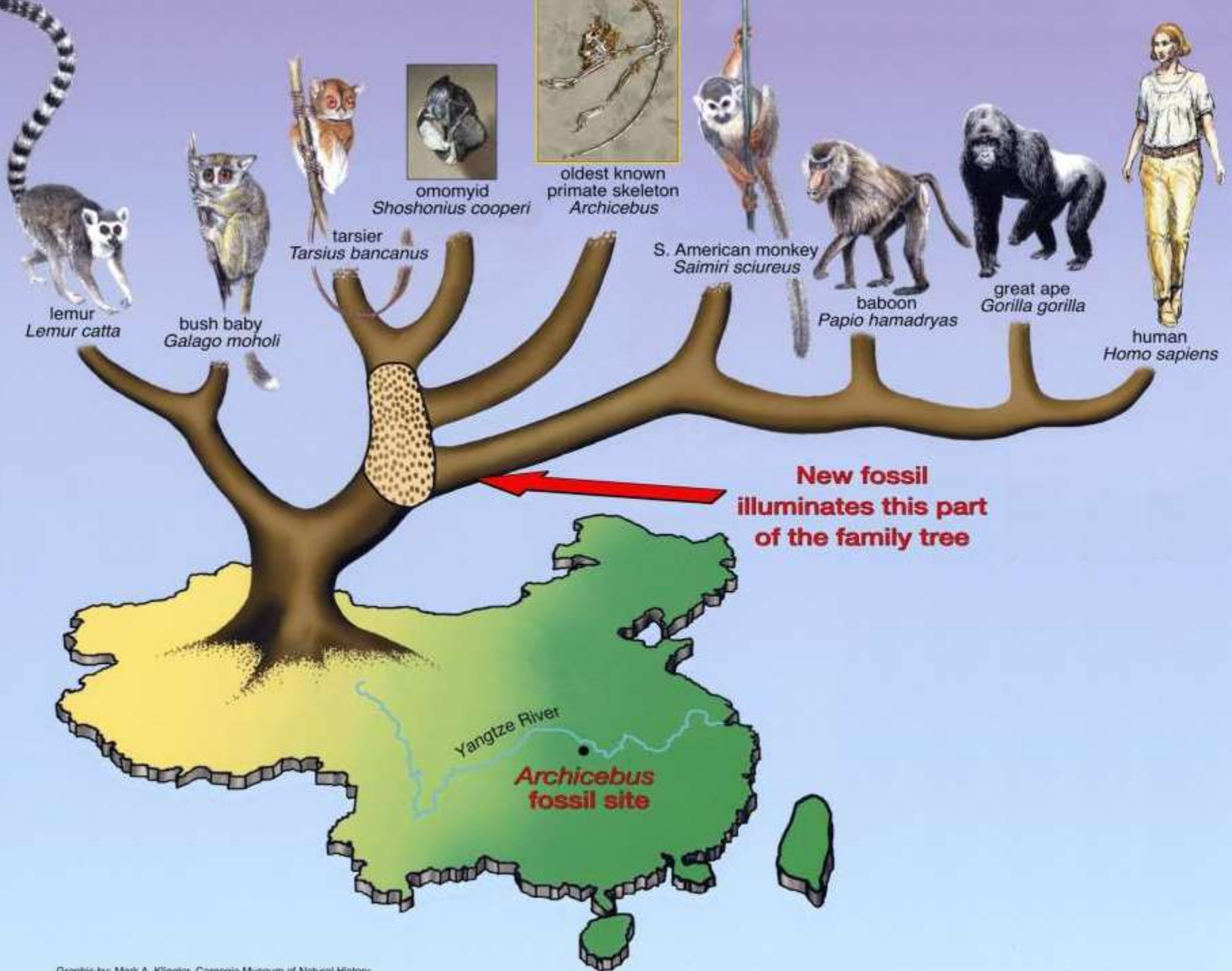
**1871- Darwin
predicts that
ancestors of
humans would be
found in Africa**

1970s - present

- more fossils
- molecular techniques
- 'tree model' of human evolution



TIME RANGES	MYR				
<i>A. ramidus</i>	4.4	<i>A. boisei</i>	2.3-1.4	<i>H. ergaster</i>	1.8-1.5
<i>A. anamensis</i>	4.2-3.9	<i>A. robustus</i>	1.9-1.0	<i>H. erectus</i>	1.2-0.4
<i>A. afarensis</i>	3.9-3.0	<i>H. sp.</i>	2.5-?	<i>H. beidelbergensis</i>	0.6-0.2
<i>A. africanus</i>	2.8-2.4	<i>H. rudolfensis</i>	2.4-1.9	<i>H. neanderthalensis</i>	0.3-0.03
<i>A. ethiopicus</i>	2.7-1.9	<i>H. habilis</i>	1.9-1.6	<i>H. sapiens</i>	0.1-0.0

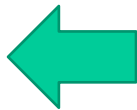


The precursors of the modern human being




The earliest ancestors of humans (**hominids**) diverged from apes about **8 million** years ago.

First Europeans:
approx. 780,000
years ago




THEORIES OF HUMAN EVOLUTION

1. Theory Of Special Creation:- (Father Suarez 1548-1671)

- Living organisms on the earth were created by divine power
 - He believed that universe was created in 6days
 - Purely a mythological belief followed until middle of 19th century.
- 

2. Cosmozoic theory or Panspermia

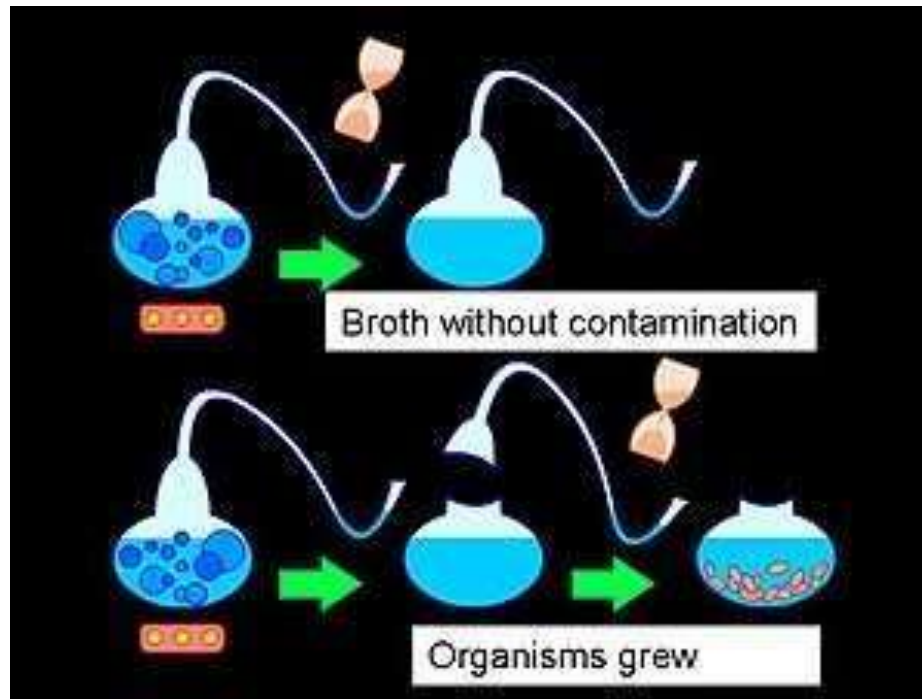
- Life is distributed all over cosmos in the form of resistant spores.
 - Resistant spores living organisms called cosmozoa.
 - Spores with cosmic dust might have reached the earth accidentally from other planets of universe
- 

3. Theory of spontaneous generation or Abiogenesis

- It explained that life originated from nonliving substances.
- Worms → Manure
- Insects → Dew, rotten slime, dry wood, sweat and meat.
- Frogs & salamanders → slime.
- Toads, Snakes & Mice → Mud of Nile
- *Aristotle, Thales, Plato* and *Von Helmont* believed abiogenesis until 17th century.
- *Franceo Redi, Spallanzani* and *Louis Pasteur* experimentally disproved abiogenesis theory.

4. Biogenesis theory (Louis Pasteur)


- Biogenesis theory states that living organisms originate from the pre-existing organisms.
- Swan-neck flask experiment




Theory of Catastrophism (Cuvier)

- He advocated that the earth was subjected to periodic catastrophes.
- These catastrophes destroyed the life from time to time and created new and special form of life.

Theory of Organic Evolution

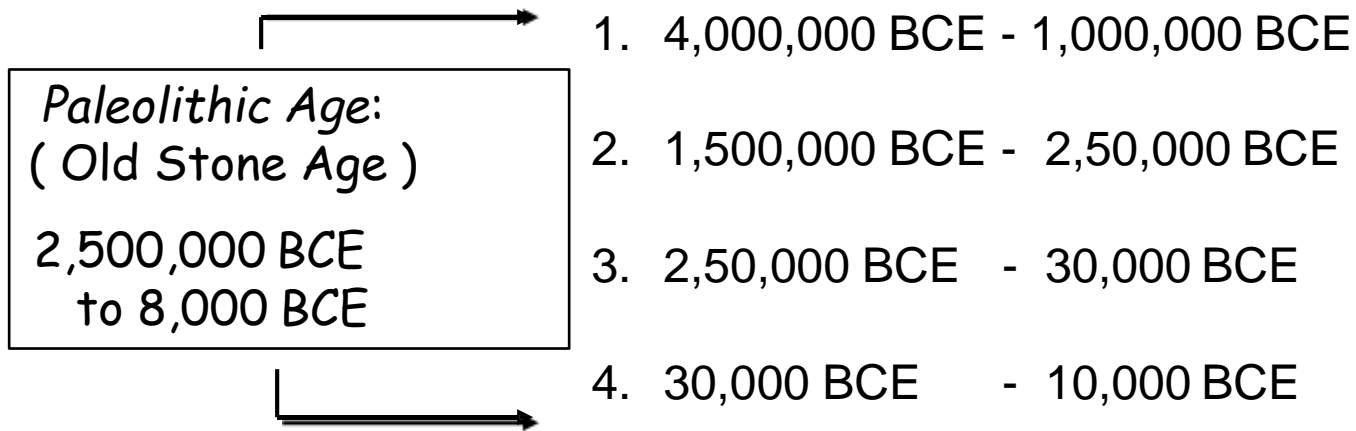
- The origin of primordial life on the earth was associated with the origin of universe.
 - Primitive organisms evolved spontaneously from the inorganic matter as a result of formative action of physical forces like electric charges, U.V radiations, and radiations of radio-active elements.
 - This theory was strongly supported by Darwin, *Haldane*, *A.I.Oparin*, *H.Urey* and *Stanley Miller*.
- 

- Darwin, *Haldane & A.I.Oparin* the first phase of the origin of life was the spontaneous generation of early molecules.
 - These molecules later transformed into protobionts.
 - Protobionts evolved in to early living organisms
 - Thus origin of life is a phenomenon of chemical evolution that led to biological evolution
- 

TOOLS USED TO STUDY EVOLUTION

1. Homologous organ
2. Analogous organ
3. Fossil fuel
4. Vestigial organ

Stages of Early Human Development



The Paleolithic Age

“PALEOLITHIC” – OLD STONE AGE

- 2,500,000 BCE - 10,000 BCE
- Made tools



- hunting (men) & gathering (women)
→ small bands of 20-30 humans
- NOMADIC

The Paleolithic Age

- Humans during this period found shelter in caves.
- Cave paintings left behind.



← Purpose??
↓

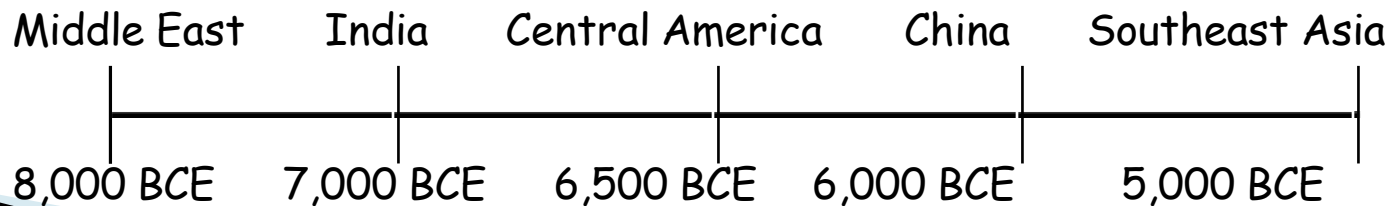


The Neolithic Age

- "Neolithic" → "New Stone" Age
- 10,000 BCE - 4,000 BCE
- Gradual shift from:
 - Nomadic lifestyle → settled, stationary lifestyle.
 - Hunting/Gathering → agricultural production and domestication of animals.

The Agricultural Revolution

- 8,000 BCE - 5,000 BCE
- Agriculture developed independently in different parts of the world.
 - SLASH-AND-BURN Farming



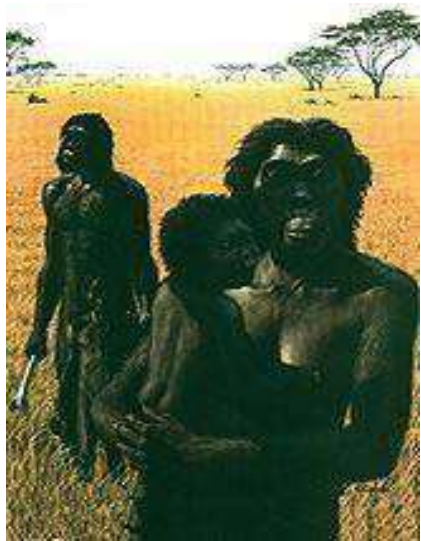
Humans have evolved from 2 species:

1) Australopithecine species

2) Homo species

Stage 1

4,000,000 BCE - 1,000,000 BCE



- Hominids --> any member of the family of two-legged primates that includes all humans.



- **Australopithecines**


- **An
Opposable
Thumb**

The Australopithecines

- Generally refers to any species in the related genera *Australopithecus* and *Paranthropus*.
- Occurred in the Plio-Pleistocene era
- The genus *Homo* (humans, appear about 2.4 million years ago with *Homo habilis*) appear to be descended from australopithecine ancestors, more precisely from *Kenyanthropus platyops* branching off *Australopithecus* some 3.5 million years ago.



Characteristics

- i. Bipedal and dentally similar to humans**
 - ii. Brain size not much larger than modern apes**
 - iii. Lacking the encephalization characteristics of the genus *Homo*.**
- 

Australopithecus afarensis


One of the earliest of modern man's ancestors.


They lived between 3.2 to 4 million years ago in eastern Africa.

Fossils are found in Tanzania and Ethiopia .




Features

- i. Long curved fingers, **long arms** relative to the length of their legs.
 - ii. Small brain capacity (**380-430 cc**).
 - iii. Had a **large face** relative to the rest of the cranium. The forehead is very small.
 - iv. The Zygomatic arches flair to the side and produce the characteristically **broad face**.
- 

- v. **Sagittal ridge** where strong chewing muscles are attached.
 - vi. Marked **prognathism** of the face.
 - vii The cranium attaches to the backbone in a relatively **backward** position when compared with humans.
- 

Dentition status:

- i. Large pointed dimorphic upper canines
 - ii. Presence of primate spaces
 - iii. The molars are larger in size than in modern humans
 - iv. The arcade is **omega** shaped, intermediate between the **box row in apes** and the **parabolic curve** in humans.
- 

Australopithecus africanus


Lived between 2.3 to 3.0 million years ago, mostly in South Africa although remains have been found else where.

First discovered by Raymond Dart in 1925.

Direct descendent of *A. afarensis*.



Characteristics

- i. **Cranial capacity - between 435cc and 530cc.**
 - ii. **Body consists of longer arms and shorter legs as compared to *A. afarensis* .**
 - iii. **The *zygomatic arch* is less robust than other australopithecines**
 - iv. **No *sagittal ridge* or crest.**
 - v. **Less prognathic than *A. afarensis* with a more rounded jaw and larger back teeth and canines.**
- 

Dentition status:

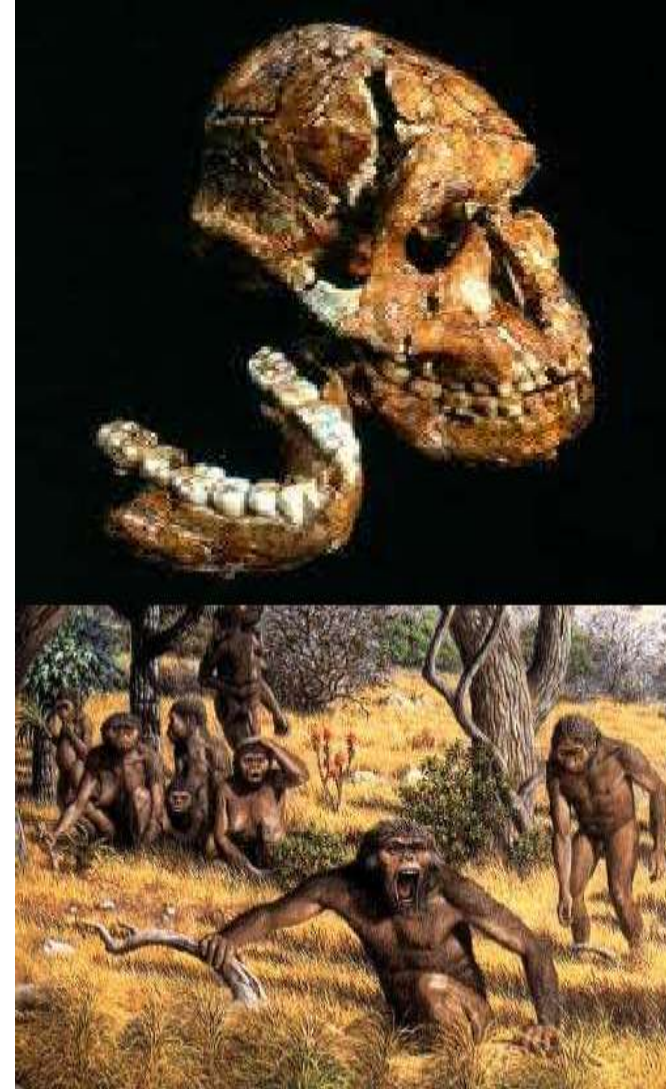
- i. Specialized than the dentition of *A. afarensis*.**
- ii. The size of *A. africanus* teeth are larger**
- iii. The molar teeth are relatively larger in size than the earlier form, for powerful chewing.**
- iv. The rows of teeth in *A. africanus* are more parallel rather than being parabolic.**
- v. The incisors are angled forward instead of being vertical in position.**

Paranthropus robustus


First appeared about 1.8 million years ago and disappeared around 1 million years ago.

This species was first discovered and named by Dr. Robert Broom.

Mostly lived in eastern Africa.



Characteristics:

- i. Dish-shaped face**
 - ii. Forward migration of the cheekbones**
 - iii. Prominent sagittal crest in males**
- 

Paranthropus boisei


Lived from around 1.3 million years to about 2.2 million years ago.

The first specimen of this species was discovered by Mary Leaky in 1959.

Found in East Africa, Ethiopia, Kenya and Tanzania.



CHARACTERISTICS

- i. Slightly larger cranial capacity (490-530cc) than early hominids**
 - ii. Huge chewing apparatus with enormous molar teeth**
 - iii. Thick jaw and cheek bones**
 - iv. More pronounced cranial crest**
- 

Stage 2

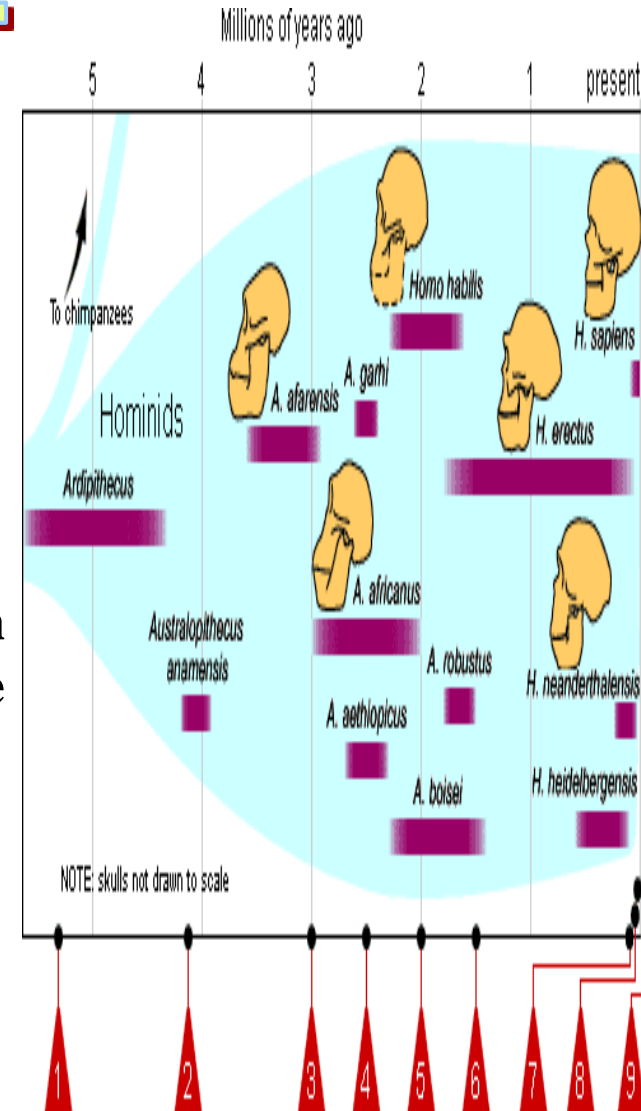
HOMO SPECIES

It is the genus that includes modern humans and species closely related to them.

The genus is estimated to be about 2.3 to 2.4

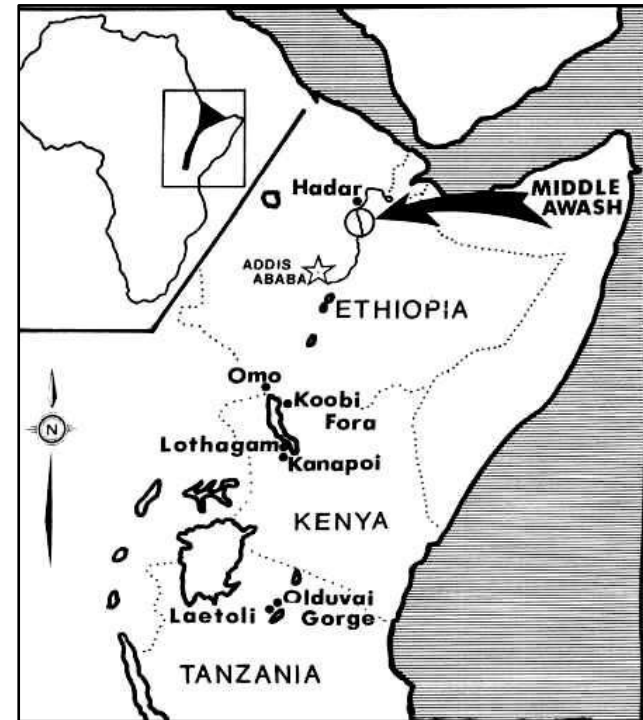
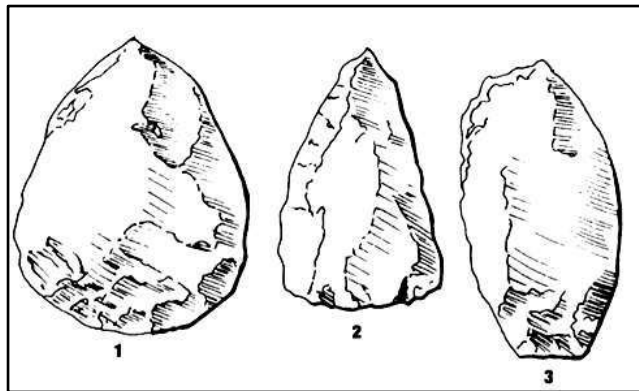
million years old evolving from the australopithecine ancestors with the appearance of *Homo habilis*.

All species of the genus except *Homo sapiens* (modern humans) are extinct.



- HOMO HABILIS
("Man of Skills")

- found in East Africa.
- created stone tools.



Homo habilis

First appeared around 2.5 million years ago at the beginning of the Pleistocene period.

Fossils were first discovered in Tanzania, East Africa between 1962 and 1964.

Named by Louis Leakey, Phillip Tobias, and John Napier.



Tool making

Homo habilis onwards


- Tool-making was considered a 'human trait'




H. heidelbergensis made Hand axes, wooden spears etc.

Oldowan Tools

CHARACTERISTICS

- i. Handy man/ tool user hominid.**
 - ii. Bipedal, larger cranial capacity (700 cc) than australopithecines (500 cc).**
 - iii. An “apelike” (long arms and a small body) body structure was characteristic of the Homo habilis.**
- 

- **Dentition status:**

- i. Flat face and large molars.**
 - ii. Molar teeth present a more squared outline and are more identifiably modern.**
 - iii. Posterior teeth & canines have undergone a reduction as compared to *A. africanus*.**
 - iv. Crenulations are lost**
 - v. Maxilla and mandible are decreased in size and bone thickness because the teeth are decreased in size.**
- 

Stage 3

1,600,000 BCE - 30,000 BCE

- HOMO ERECTUS
("Upright Human Being")

➤ BIPEDALISM

- Larger and more varied tools --> primitive technology
- First hominid to migrate and leave Africa to Europe and Asia.
- First to use fire (500,000 BCE)

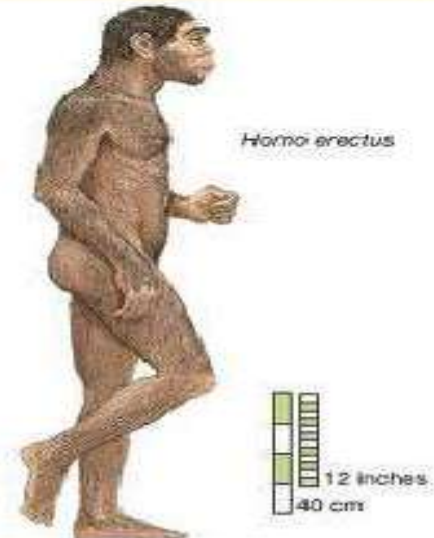
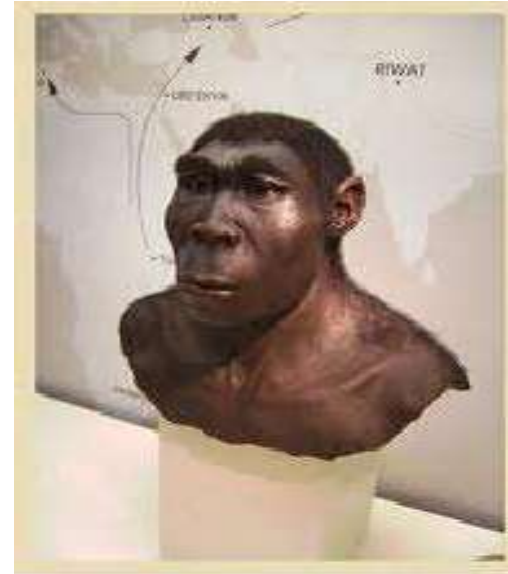


Homo erectus

Extinct species of hominid that originated in Africa and is the first species which move out of Africa.


Lived about 1.6 million years ago to around 400,000 years ago.

It was first discovered in 1891 by Dr. Eugene Dubois.



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CHARACTERISTICS


- i. Systematic hunting and 'home base camps' for living.**
 - ii. Systematic tool-making**
 - iii. Controlled fire for cooking food and other purposes**
 - iv. Sexual dimorphism**
 - v. Relatively greater cranial capacity (800 - 1300 cc)**
- 

vi. Orthognathy

vii. Dental size reduction

viii Greater body size

Dentition status

- i. Jaws and teeth are still larger compared to those of modern humans but smaller than those of earlier hominids.
 - ii. Sizes of the back teeth are decreased as compared to Australopithecines.
 - iii. Anterior teeth are larger than those of modern humans.
 - iv. Upper central incisors are distinctively shovel-shaped.
- 

Stage 4

200,000 BCE - 10,000 BCE



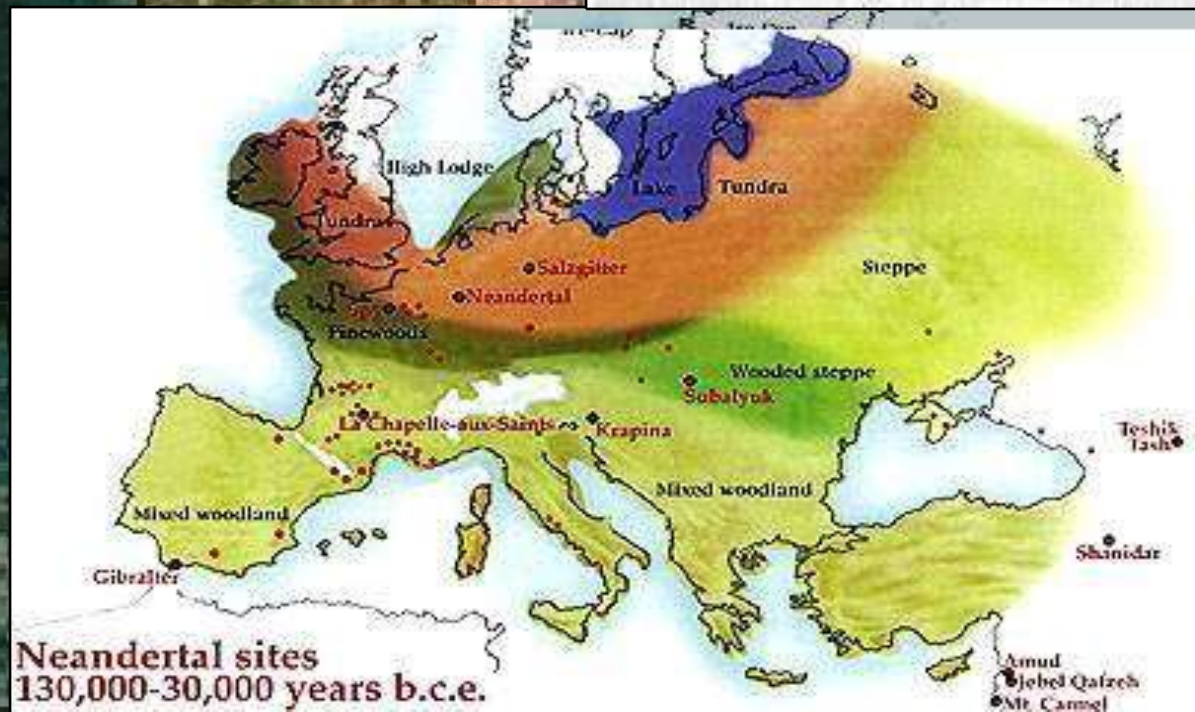
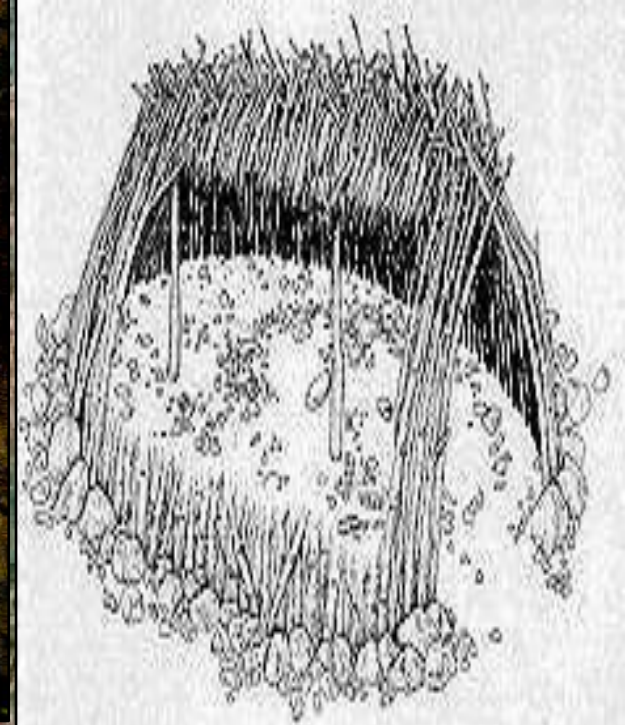
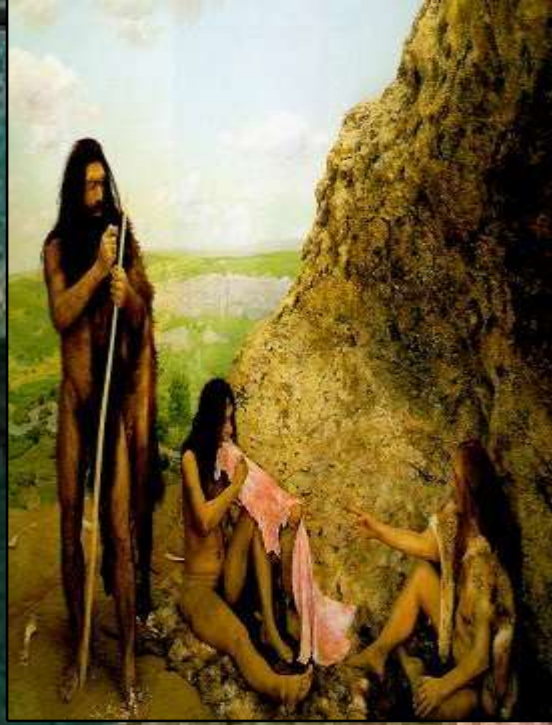
HOMO SAPIENS
("Wise Human Being")

Neanderthals
(200,000 BCE - 30,000 BCE)

Cro-Magnons
(40,000 BCE - 10,000 BCE)

NEANDERTHALS

- Neander valley, German(1856)
- Made clothes from animal skins
- Live in caves and tents.



CHARACTERISTICS

- i. Short build dominated by enormous noses**
- ii. Barrel-shaped chest**
- iii. Slightly bent thigh bones**
- iv. Stronger fingers and toes**
- v. Severe arthritis**

vi. Worn teeth


vii. Fractures like rodeo riders

viii. Large brain (average 1400 cc, up to 1750 cc)

ix. Low forehead



Dentition status

- i. Jaw was massive and large and lacked a prominent chin**
 - ii. Large wisdom tooth with ample retro-molar space**
 - iii. Taurodontism**
 - iv. Very large canines and incisors relative to their molars and premolars.**
- 

The First Humans

Theories on prehistory and early man constantly change as new evidence comes to light.

- Louis Leakey, British paleoanthropologist



Stage 5

CRO-MAGNONS:

- Homo sapiens sapiens
("Wise, wise human")



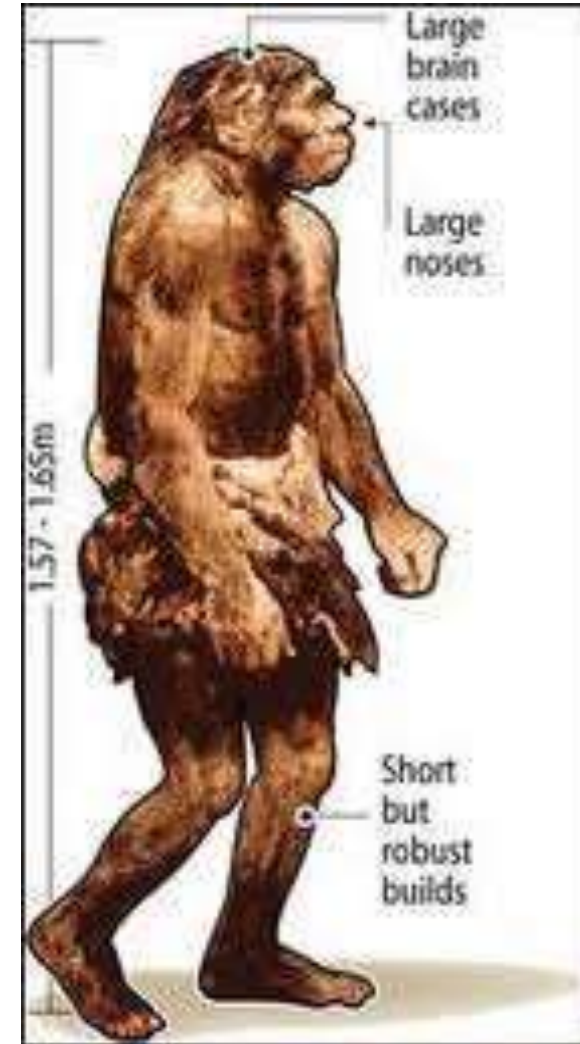
- By 30,000 BCE they replaced Neanderthals.

Homo neanderthalensis

Extinct member of the genus *Homo*.

Lived around 50,000 years ago .

Found in Europe and parts of western and Central Asia.





Homo sapiens

Only living species in the *Homo* genus.

Anatomically modern humans originated in Africa about 200,000 years ago, reaching full behavioural modernity around 50,000 years ago.

CHARACTERISTICS

- i. Skulls were slightly rounder and larger.
 - ii. Forehead rises vertically above the eye orbits and does not
 - iii. slope as in Neanderthal.
Brow ridges are small.
 - iv. **Orthognathic face with a strong chin**
 - v. **Teeth and jaws were noticeably smaller as compared to other previous species.**
- 

- vi. Brain capacity averaged an impressive 1,350 cc.**
 - vii. Bipedal locomotion.**
- 

Dentition status

Larger back teeth with massive muscular structures to aid chewing.

parabolic shape of the palate.

Modern humans arose about 200,000 years ago.

Homo sapiens fossils date to 200,000 years ago. Human evolution is influenced by a tool-based culture.

There is a trend toward increased brain size in hominids.



Australopithecus
afarensis

Homo habilis

Homo
neanderthalensis

Homo sapiens

5 million

4 million

3 million

2 million

1 million

Present

Ardipithecus ramidus

Australopithecus anamensis

Australopithecus africanus

Paranthropus boisei

Australopithecus afarensis

Paranthropus aethiopicus

Homo habilis

Homo ergaster

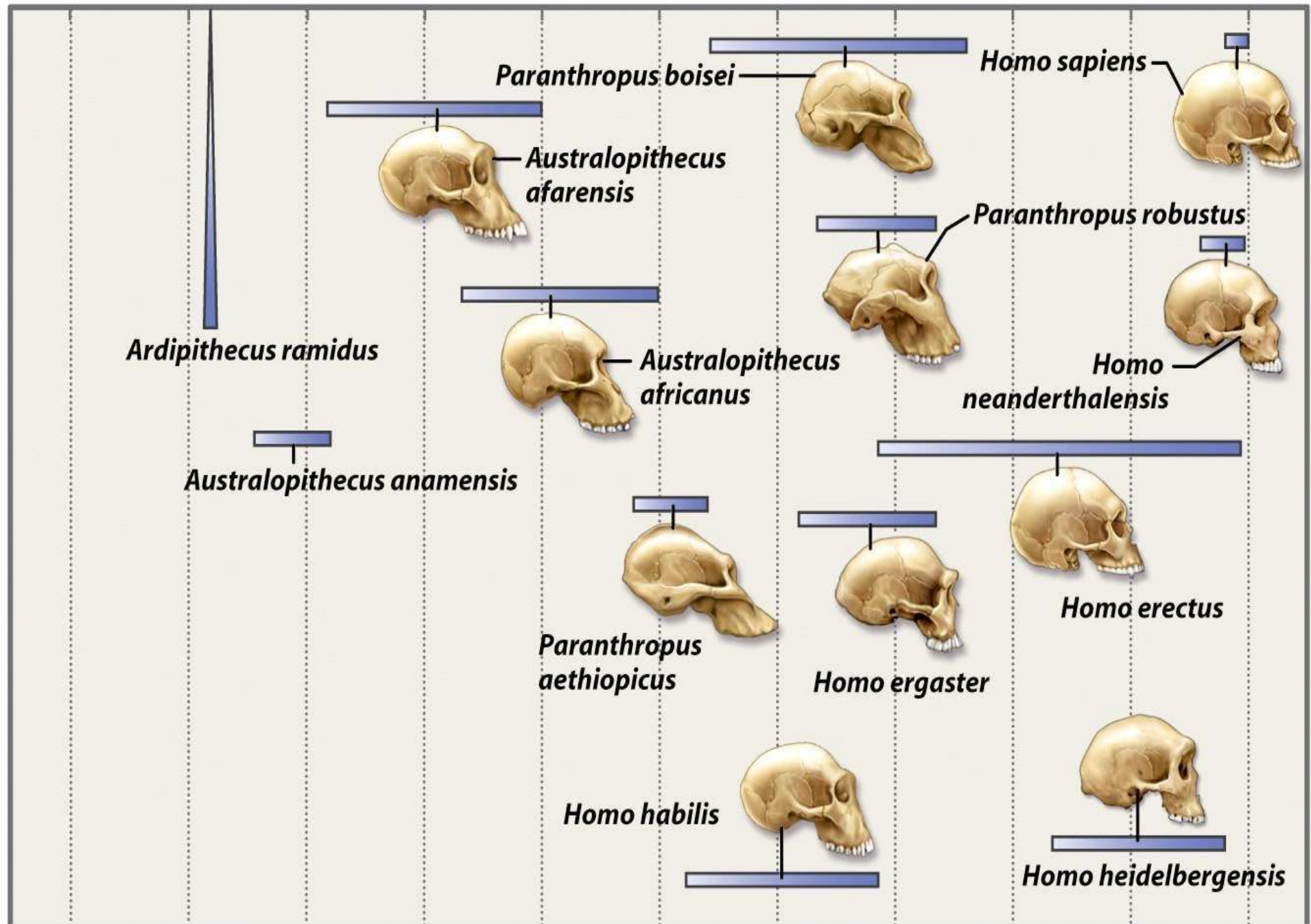
Paranthropus robustus

Homo neanderthalensis

Homo erectus

Homo heidelbergensis

Homo sapiens





Australopithecus afarensis



Homo erectus

**Homo
heidelbergensis**



**Homo
Cro-Magnon**




**Homo
neanderthalensis**



Homo sapien



Human characteristics

1. **Bipedal gait**
 2. **Big brain**
 3. **Tool making**
 4. **Social relationships, Art & Culture**
- 

What differentiates Ape from Man?

Critical Characteristics:

Large brain

Foramen magnum

Dentition – Teeth

Bipedal skeletal structure & musculature

S-shaped spinal column [not C]

→ pelvic structure [shortening-bowl shaped]

→ muscular (gluteal & hamstring)

→ lengthening of lower limb [femur]

→ changes in feet to become weight-bearing structures



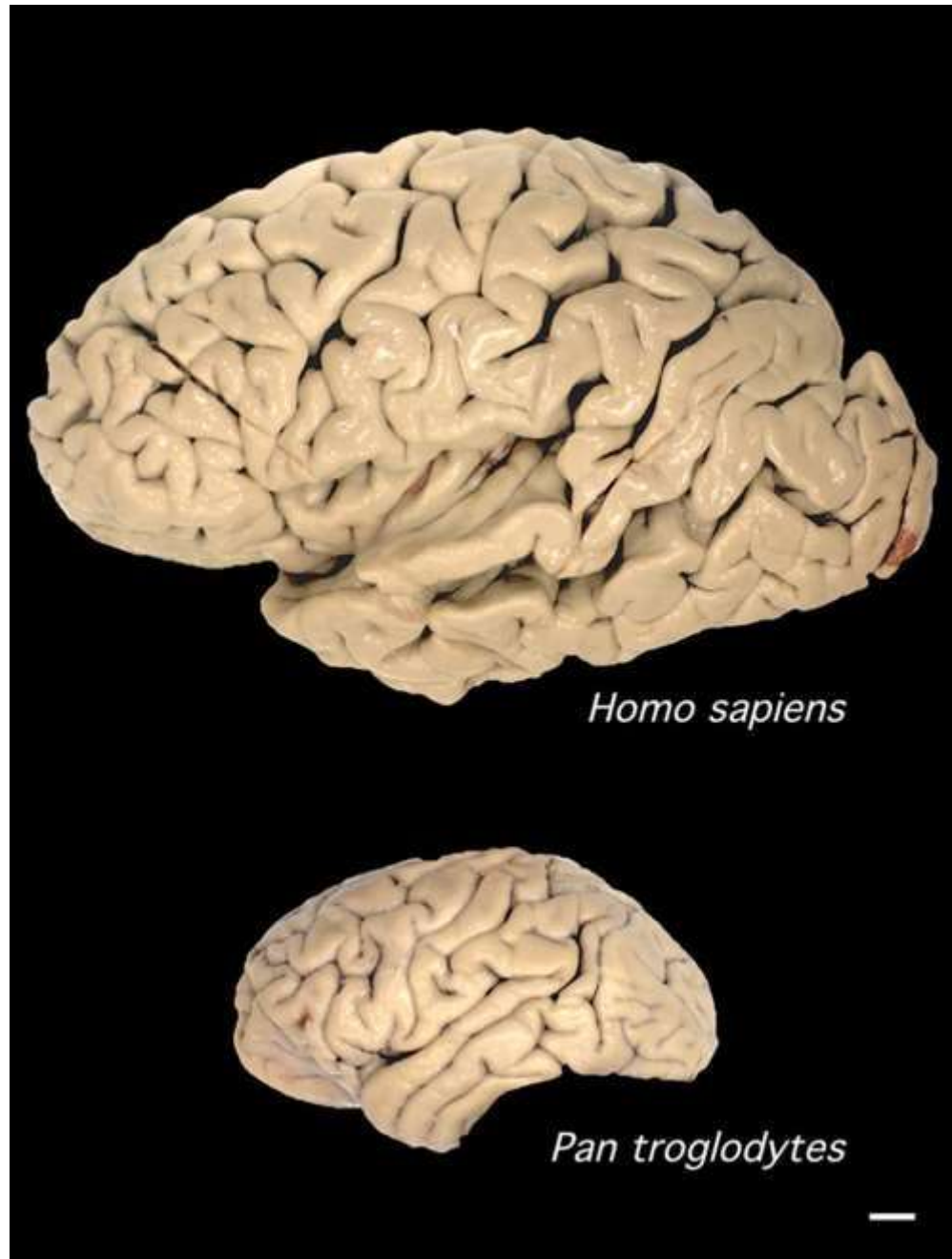
Bipedalism

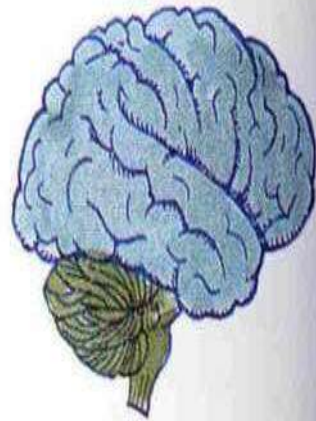
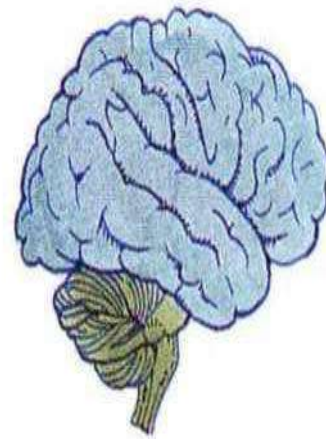
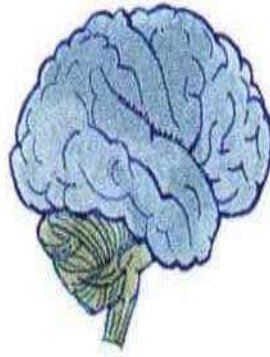
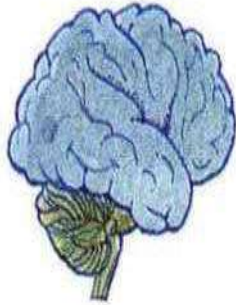
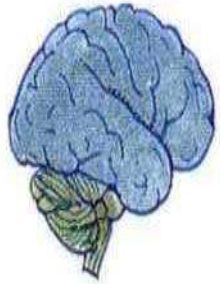
- **Advantages:**
 - **Freed hands to carry objects**
 - **See predators better in grasslands**
 - **Access to foods not previously available**
 - **Carry children**
 - **Protection from sun in grasslands**



Brain Size

- modern man 1000 - 2000 cc
- chimps 280 - 400 cc





Australopithecus robustus

Homo habilis

Homo erectus

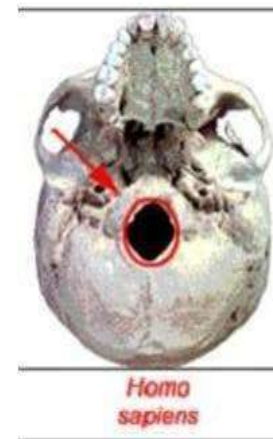
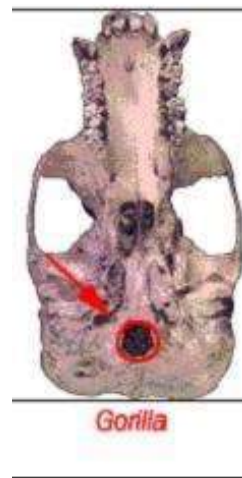
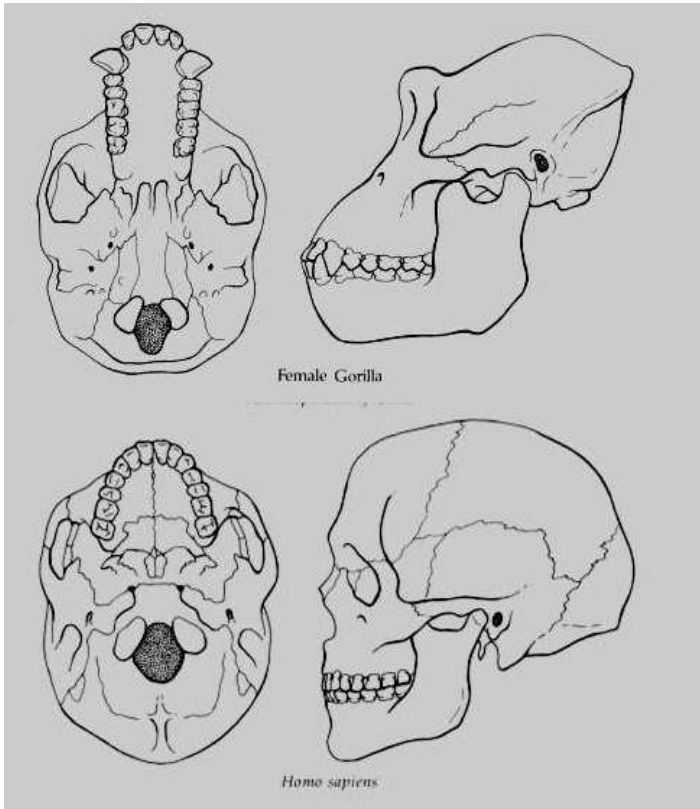
Homo sapiens neanderthalensis

Homo sapiens sapiens

Foramen Magnum

**Position of foramen magnum
strong indicator of the angle of
the spinal column to the head**

Habitual bipedalism

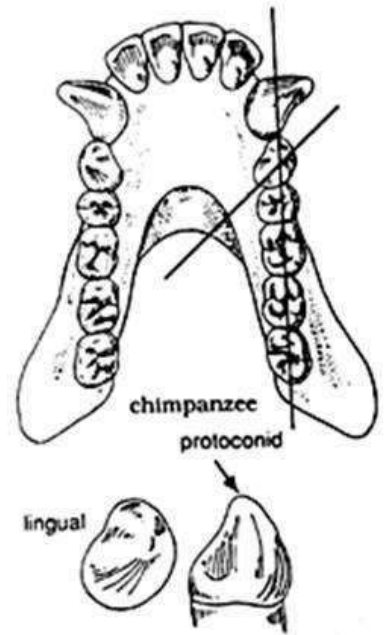


Dentition / Teeth

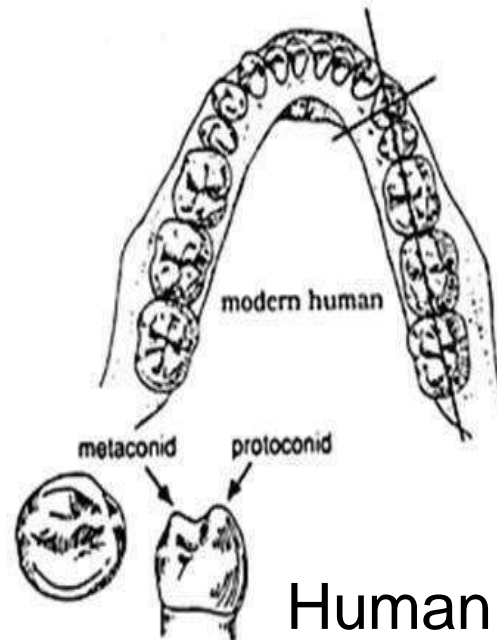
Reduction in size of incisors & canines

Ape canines → displays of aggression and as defensive weapons

Premolar & molar with flat occlusal wear pattern



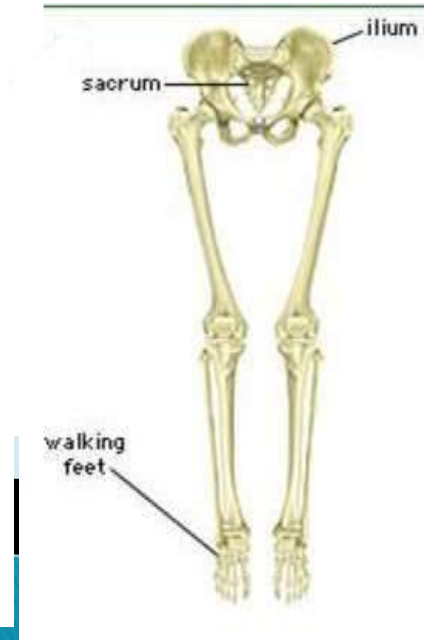
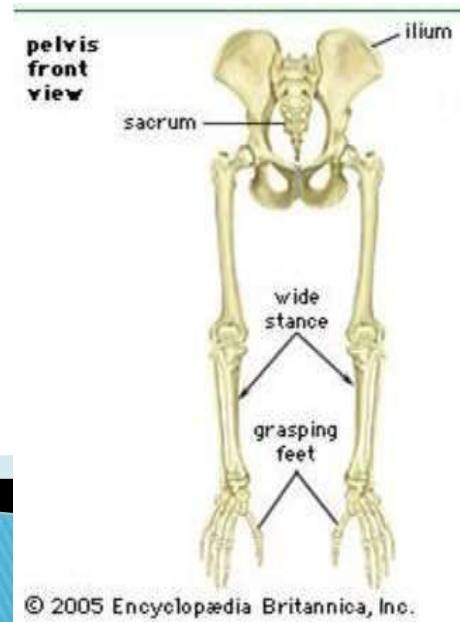
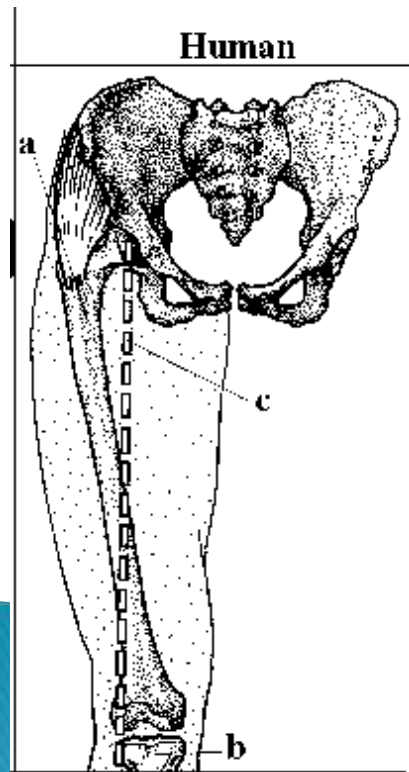
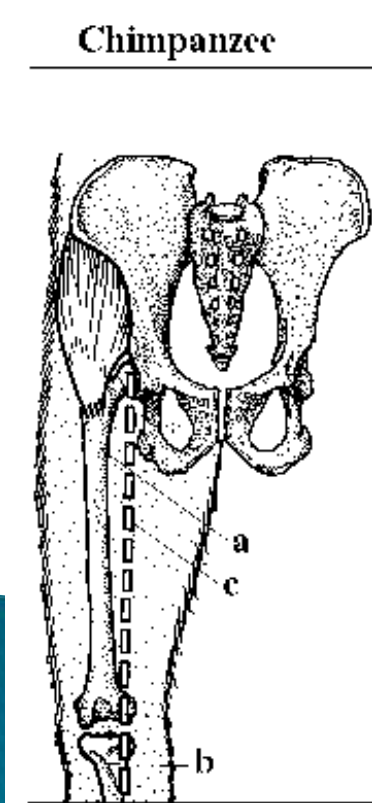
Chimpanzee



Human

Skeletal Structure

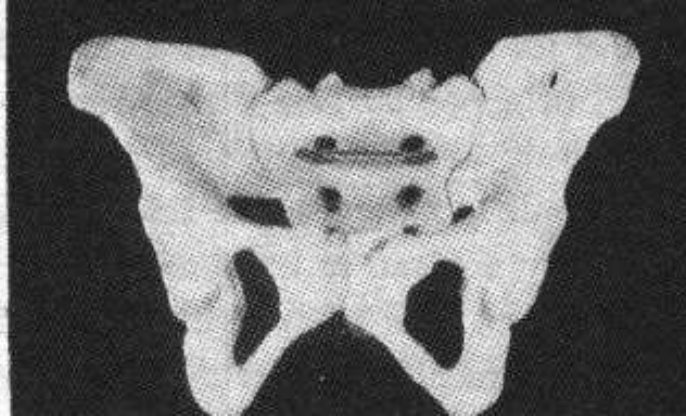
Upper legs angled inward from hip joints position knees to better support body during upright walking [apes away from side to side]



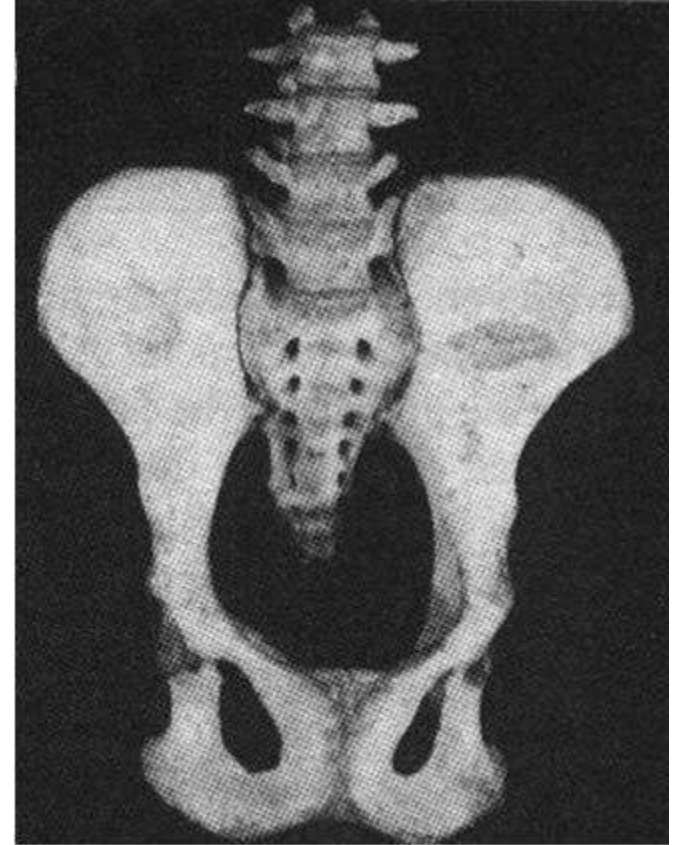
A = femur b = tibia c = weight-bearing axis

Comparison of Pelvis Structure

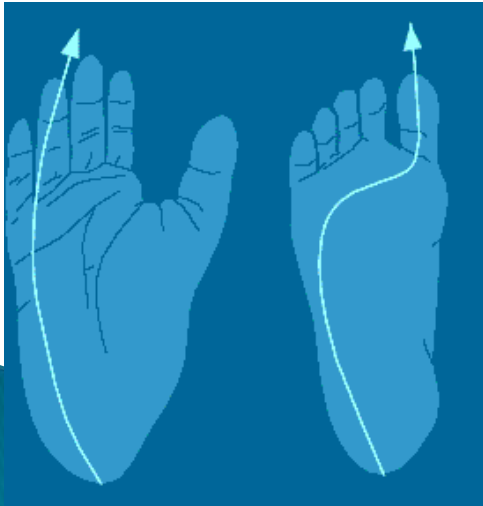
Human Ilium shorter and broader allows hip muscles to steady the body during each bipedal step



Human Pelvis



Chimpanzee Pelvis



- position of big toe
- Foot shorter – less flexible toes → more rigid lever for pushing off with each step
- Arch → shock absorber

Gorilla vs. Human Skeleton Comparisons

Shape and position of the skull

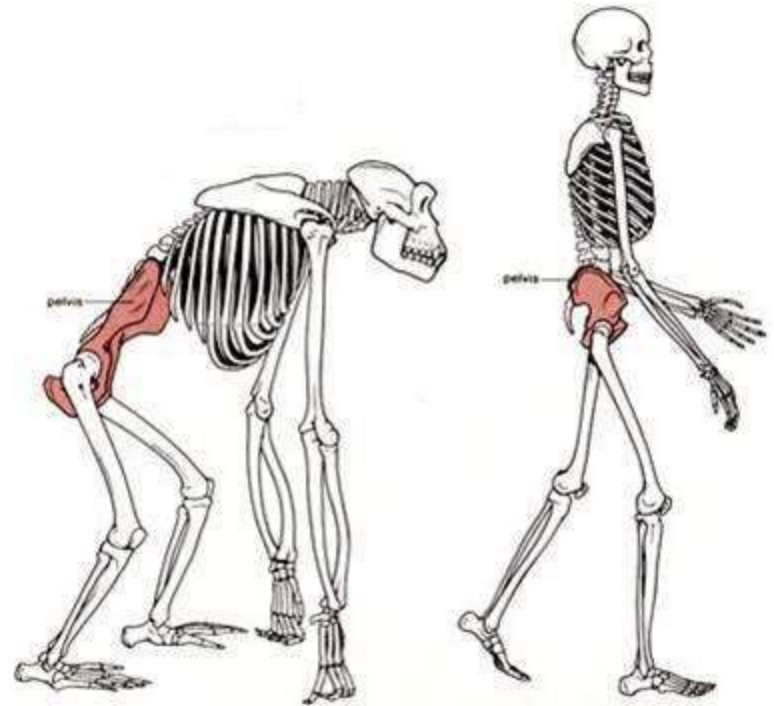
Relative size of the neck

Relative length of the arm

Relative length and shape of pelvis

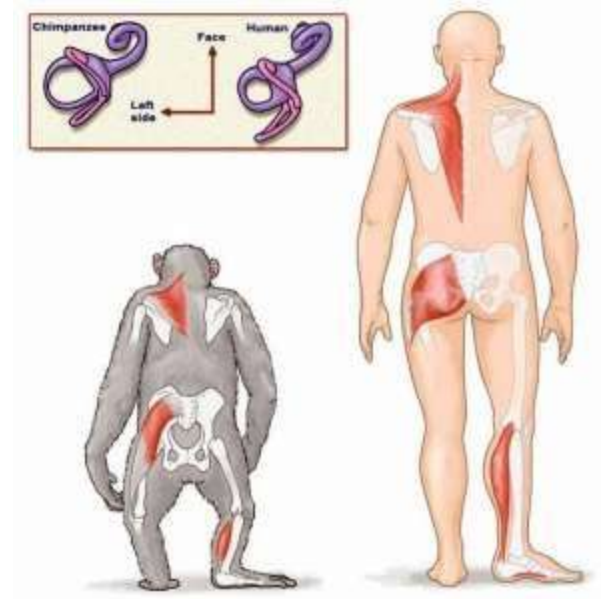
Posture especially shape of the spine

C-shaped vs. S-shaped



Comparison of some soft tissue involved in biomechanical differences between chimps and humans [[American Museum of Natural History webpage](#)]

- **Humans → 2 of 3 semicircular canals [balance] specialized to stabilize head**
- **Less muscle between head and shoulders in humans**
 - Chimps have to fight gravity to hold heads up while walking.
 - Our head just sits on our necks
- **Humans → more gluteus maximus muscle**
 - Stabilizes femur into pelvis and helps keeps trunk and leg moving together.
- **Achilles tendon and tendon of arch of the foot larger in humans**
 - In running, act like springs, absorbing and releasing energy



Social relationships, art, and culture

- ***Homo sapiens* survived extinction in late Pleistocene**
 - 'bottlenecks' (drastic reduction in population size)
 - cultural explosion
 - Societies became co-operative ('troop-to-tribe transition')

Indian evolution

1. It is not definitely known when civilization has actually started in India. Whether *Vedic culture*(1750–500 BCE) has pre-existed *Harappan* (3300–1300 BCE) civilization.
2. They very unambiguously stated that “Gods” are inventions of and created by, humans.
3. The evolution of Indian culture will be followed here by observing the evolution of spiritual texts, religions, social institutions, social and political philosophies, social justice movements, which have influenced the origin, being and advancement of various schools of thought and cultures.