BLOCK 2

EARLY HOMINIDS

UNIT 4 HISTORY OF HUMAN EVOLUTION*

Contents

Learning Objectives:

After reading this unit you will be able to:

- analyze the major trends in human evolution;
- review characteristics which distinguish human from their primate ancestors;
- learn anatomical and cultural changes associated with the process of hominization; and
- comprehend the significance of these changes during evolution of human.

4.0 INTRODUCTION

Humans first evolved in East Africa about 2.5 million years ago from an earlier genus of apes called *Australopithecus*, which means 'Southern Ape'. About 2 million years ago, some of these archaic men and women left their homeland to journey through and settle vast areas of North Africa, Europe and Asia. Since survival in the snowy forests of northern Europe required different traits than those needed to stay alive in Indonesia's steaming jungles, human populations evolved in different directions. The result was several distinct species, to each of which scientists have assigned a pompous Latin name. Humans in Europe and western Asia evolved into *Homo neanderthalensis* ('Man from the Neander Valley'), popularly referred to simply as 'Neandethals'. *Neanderthal*s, bulkier and more muscular than us *Sapiens*, were well adapted to the cold climate of Ice Age western Eurasia. The more eastern regions of Asia were populated by *Homo erects*, 'Upright Man', who survived there for close to 2 million years, making it the most durable species ever. On the island of Java, in Indonesia, lived *Homo soloensis,* 'Man from the Solo Valley', who was suited to life in the tropics. On another Indonesian island – the small island of Flores – archaic humans underwent a process of dwarfing. Over the generations, the people of Flores became dwarves. This unique species, known by scientists as *Homo floresiensis*, reached a maximum height of only one meter and weighed no more than twenty-five kilograms. In 2010 another lost sibling was rescued from oblivion, when scientists excavating the Denisova Cave in Siberia discovered a fossilized finger bone. Genetic analysis proved that the finger belonged to a previously unknown human

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species, which was named as *Homo denisova.* While these humans were evolving in Europe and Asia, evolution in East Africa did not stop. The cradle of humanity continued to nurture numerous species, such as *Homo rudolfensis*, 'Man from Lake Rudolf', *Homo ergaster,* 'Working Man', and eventually our own species, which we've immodestly named *Homo sapiens*, 'Wise Man' (Harari, 2014).

4.1 TRENDS IN HUMAN EVOLUTION: UNDERSTANING PRE MODERN HUMANS

As you can see, the middle Pleistocene hominins are a very diverse group, broadly dispersed through time and space. There is considerable variation among them, and it's not easy to get a clear evolutionary picture. We know that regional populations were small and frequently isolated, and many of them probably died out and left no descendants. So it's a mistake to see an "ancestor" in every fossil find. Still, as a group, these Middle Pleistocene pre-moderns do reveal some general trends. In many ways, for example, it seems that they were *transitional* between the hominins that came before them (*H. erectus*) and the ones that followed them (modern *H. sapiens*). It's not a stretch to say that all the Middle Pleistocene pre-moderns derived from *H. erectus* forebears and that some of them, in turn, were probably ancestors of the earliest fully modern humans (Jurmain et al., 2011).

Paleoanthropologists are certainly concerned with such broad generalities as these, but they also want to focus on meaningful anatomical, environmental, and behavioral details as well as underlying processes. So they consider the regional variability displayed by particular fossil samples as significant-but just *how* significant is up for debate. In addition, increasingly sophisticated theoretical approaches are being used to better understand the processes that shaped the evolution of later *Homo* at both macroevolutionary and microevolutionary levels. Paleoanthropologists who advocate an extreme lumping approach recognize only one species for all the premodern humans. These premoderns are classified as *Homo sapiens* and are thus lumped together with modern humans, although they're partly distinguished by such terminology as *"archaic H. sapiens."* As we've noted, this degree of lumping is no longer supported by most researchers. Alternatively, a second, less extreme view postulates modest species diversity and labels the earlier premoderns as *H. heidelbergensis*. At the other end of the spectrum, more enthusiastic paleontological splitters have identified at least two (or more) species distinct from *H. sapiens*. The most important of these are *H. heidelbergensis* and *H. neanderthalensis* (Jurmain et al., 2011).

All these hominins are closely related to each other as well as to modern humans. And everyone agrees that only some of the fossil samples represent populations that left descendants. Where paleoanthropologists disagree is when they start discussing which hominins are the most likely to be closely related to later hominins. The grouping of hominins into evolutionary clusters (clades) and assigning of different names to them is a reflection of differing interpretations-and, more fundamentally, of somewhat differing philosophies(Jurmain et al., 2011).

The hominins that best illustrate these issues are the *Neanderthal*s. Fortunately, they're also the best known represented by dozens of well-preserved individuals. *Neanderthal*s are certainly very closely related to modern *H. sapiens*.They are physically and behaviorally distinct from both ancient and fully modern humans. *Neanderthal*s are not a fully separate biological species from modern people. We can view *Neanderthal*s as a distinctive side branch of later hominin evolution. It is not unreasonable to say that *Neanderthal*s were likely an incipient species. Given enough time and enough isolation, they likely would have separated completely from their modern human contemporaries. The new DNA evidence suggests that they were well on their way, very likely approaching full speciation from *Homo sapiens*. However, some fossil and archaeological data continue to suggest that *Neanderthal*s perhaps never quite got that far. Their fate, in a sense, was decided for them as more successful competitors expanded into *Neanderthal* habitats. These highly successful hominins were fully modern humans (Jurmain et al., 2011).

Check Your Progress

1) Which human species is popularly known as 'Upright Man'?

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2) Which human species is considered to be the most closely related to the modern *H. sapiens*?

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4.2 HOMINIZATION

During Miocene epoch, the global climatic changes lead to the cold environment on the earth which induced open terrestrial biomes and reduction of tropical forest. Over time, the size of tropical forest decreased and broke up into mosaic where patches of forest were interspersed with savannah grassland. As forest shrank, the traditional ape food available on trees became scarce. In response to these ecological change primates came down from the trees and inhabited the terrestrial ecosystem (Havilandet *et al.,* 2011). They used to spend more time on the ground. This necessitated foraging food on the ground such as seeds, grasses, roots and others. Eventually they became adapted to exposed terrestrial environment. In due course of time evolution lead to biped locomotion, large brain size, tool making behaviour, development of language and culture, which are significant in defining what makes a hominid a hominid. These evolutionary processes which lead to the development of human characteristics distinguished from primates are known as hominization. Thus, hominization could be understood as a multidimensional morphogenesis arising from the interplay of ecological, cerebral, socio-cultural and genetic factors. The process of hominization was intensified by the prolonged infancy and childhood which demand affective ties between generation and associated potential for cultural learning (Wulf, 2012). Now, we humans or *Homo* sapiens are a culture-bearing, upright-walking species that lives on the ground and evolved between 100,000 and 200,000 years ago (Encyclopedia Britannica).

In the present unit we will provide an overview of the evolutionary changes which lead to the emergence of human features distinguished from primates.

4.2.1 Bipedalism

Of all extant primates, humans are the only obligate bipeds (Harcourt-Smith and Aiello, 2004). The erect bipedal posture we possess have been evolved from an knuckle-walking ancestor (Richmond *et al*., 2001). Though some of the primates can assume bipedal posture but only for a short duration that is when peering over tall grass or carrying objects in the hands. Chimpanzee and Gorilla are capable of much longer periods of bipedality but when on the ground they are normally quadrupedal and in knuckle walking stance. True bipedalism is represented only by humans (Swindler, 1996). Over the last several million years of evolution, these characteristic have developed independently at different rates. These patterns, in which physiological and behavioural systems evolve at different rates is called mosaic evolution (Jurmain *et al*., 2014).

Bipedalism in humans is the outcome of a large number of adaptive musculoskeletal traits which completely transformed human lineage. Such adaptive traits have resulted from long term modifications in the vertebral column, the pelvis, the lower limb and the foot.

Check Your Progress

3) What is meant by Hominization?

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4) Define Mosaic Evolution.

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Evidences for Bipedalism: The fundamental distinction between us and our closest relatives is not our language, not our culture, not own technology. It is that we stand upright, with our lower limbs for support and locomotion and our upper limbs free from those functions", said Richard E. Leakey, a palaeontologist. Paleoanthropologists mark the divergence between apes and hominids with the adaptation of bipedalism five to six million years ago. However, the process of becoming a fully efficient biped took much longer and was not complete until *Homo erectus* at 1.8 million years ago (Friedman, 2006). Hominid footprints preserved in the ash fall of a volcanic eruption some 3.5-3.8 million years ago (during Pliocene period) at Laetoli site in northern Tanzania represent the earliest evidence of bipedalism in human evolution. These footprints were discovered by Mary Leakey in the late 1970s and are believed to be the imprints of *Australopithecus afarensis*, the earliest known hominid group (evolutionary lineage that also includes our species *Homo sapiens*; Jurmain*et al.,* 2014)

Early researchers hypothesized that brain enlargement was the first hallmark of the hominid lineage setting them apart from the apes. In 1828, embryologist Karl Ernst von Baer wrote, "Upright posture is only the consequence of the higher development of the brain....... all differences between men and other animals depend upon construction of the brain" (Gould, 1977). However, the discovery of early hominid fossils exhibiting ape-sized brains and bipedally-adapted morphology showed that bipedalism evolved a few million years before brain. In 1924, an anatomist Raymond Dart discovered the skull of Australopithecine fossil, known as the Taung Child, from South Africa. This specimen belonged to the species *Australopithecus africanus*. The brain size was similar to modern apes but the foramen magnum positioned forward indicated that it held its head erect and walked upright. This was demonstrated most impressively by the finding of nearly complete fossilized skeleton of Lucy (female), a member of the species *Australopithecus afarensis* by Donald Johanson, at Hadar, Ethiopia in 1974. The limb and pelvic fossils provided indisputable evidence of bipedality and erect posture. She had the anatomy of a biped, including a broad pelvis and thigh bones that angled in toward the knees, which brings the feet in line with the body's center of gravity and creates stability while walking (Wayman, 2012).

Anatomical Changes: Have you ever noticed the movement of your limbs when you walk? We maintain the balance on one leg when the other leg swings. Both feet are simultaneously on the ground only about 25 per cent of the time and this figure becomes even smaller as speed of the locomotion increases. Thus, maintaining a stable center of balance during upright walking necessitated many drastic structural and functional changes particularly in the limbs and pelvis.

a) Shortening and broadening of pelvis and stabilization of weight transmission

   Quadraped have vertically elongated hip bones positioned parallel to each other along the sides of the lower portion of vertebra. In contrast, hominin illium of hip bone became comparatively shorter and broader. Remodelling of pelvis lead to basin shaped structure that support abdominal organs and allows transmission of weight from lower back to hip joint during erect posture (Jurmain, 2012). This increased the distance between thorax and pelvis and freed the lumbar region from within the pelvis. This modification allowed lower back to move for a greater distance than Great Ape (Lovejoy, 2005). The alteration in pelvis also brought the sacroiliac and hip joints into close proximity, reducing force transmission stress to the ilium (Aiello and Dean, 1990). Modifications of the pelvis *i.e* expanded and anteriorly projecting iliac blade with respect to the ischium repositioned the gluteal musculature. In quadrupeds, it is positioned to the side of hip bone and function to pull the thigh to the side and away from the body while in humans it is positioned behind the hip, which along with hamstrings muscle help to extend and pull thigh to rear during walking or running (Jurmain*et al.,* 2014)

The fossils of *Australopithecus afarensis* also known as 'Lucy' presents a shift towards the human pelvic condition. This shift facilitated adaptations to the bipedal locomotion including many changes such as a broad sacrum, a widened inter-acetabular distance and pronounced lateral iliac flare (Berge, 1994).

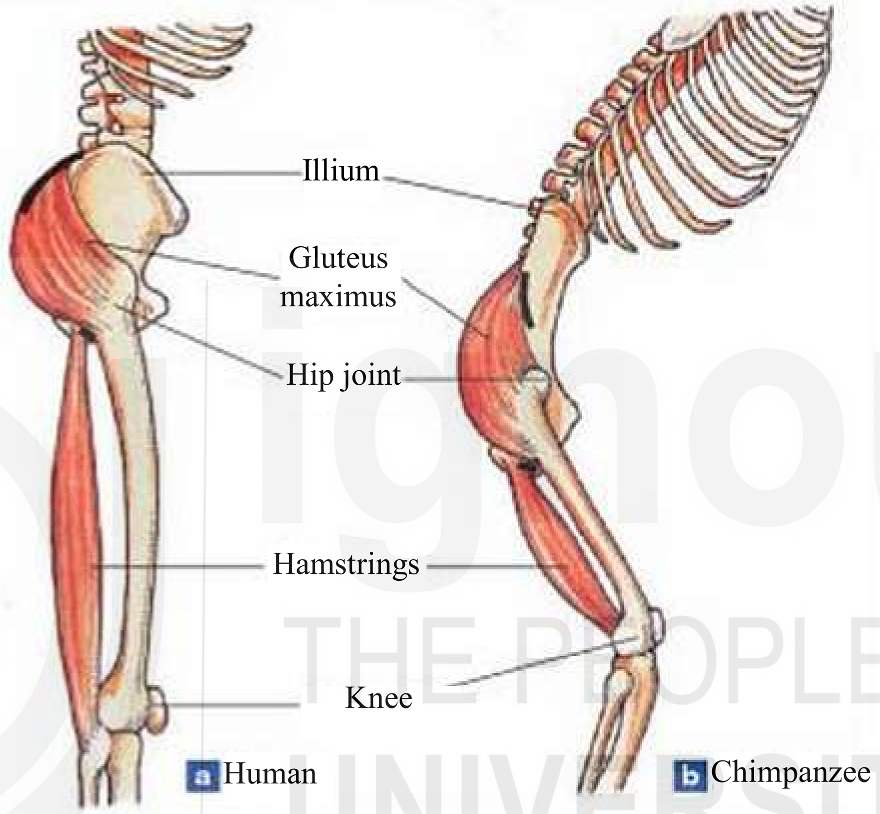

Fig 1. Pelvis bone with the attachment of muscle

Source: Jurmain *et al.,* 2014

Check Your Progress

5) What is considered as the earliest evidence of bipedalism in human evolution?

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6) How did shortening and broadening of pelvis helped in developing upright posture.

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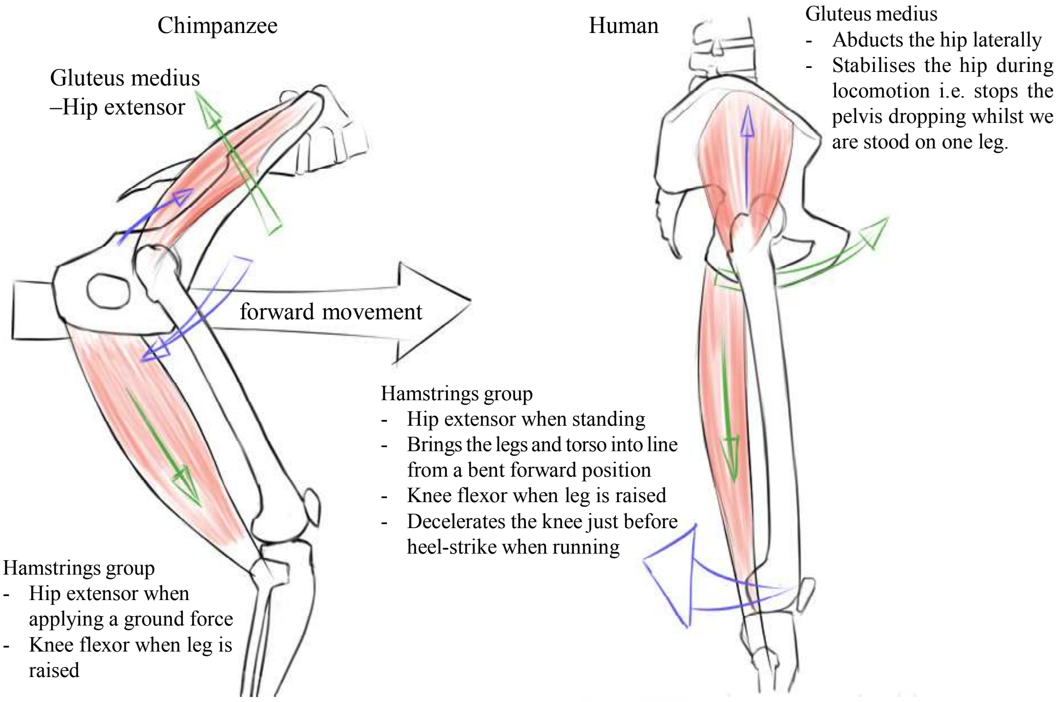
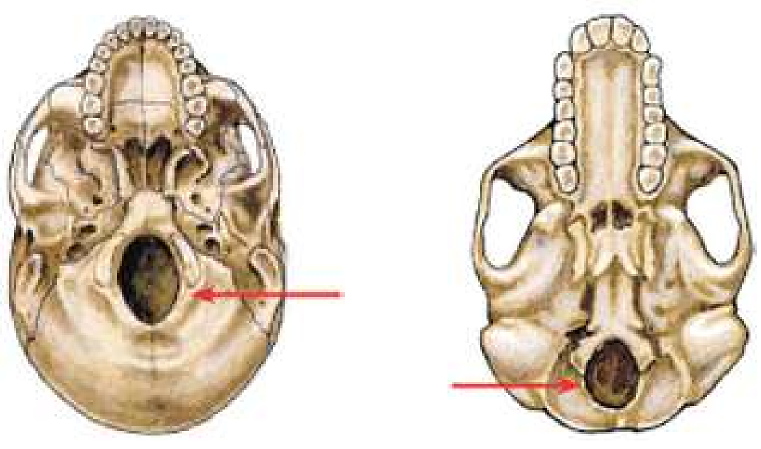


Fig 2. Function of limb muscles

Source: http://anthroanatomica.blogspot.in/2013_04_01_archive.html

b) Repositioning of foramen magnum forward, the opening at the base of skull from which spinal cord emerges.

In comparison to other primates, humans possess foramen magnum in anterior position which is considered as an adaptation for maintaining balance of the head atop the cervical vertebral column. In contrast, Quadrupeds with posteriorly positioned foramen magnum require well-developed musculature and ligaments to bear the weight of head. The unique position of the foramen magnum associated with bipedalism and erect posture, in humans compared with other living orthograde primates, suggest that foramen magnum position may be used to identify bipedal adaptations in fossil hominins (Jurmain, 2012; Lovejoy, 2005; Aiello and Dean, 1990; Jurmain*et al.,* 2014; Berge, 1994; Russo and Kirk, 2013).



A) Human B) Chimpanzee

Fig 3. Position of foramen magnum

Source: Adapted from Jurmain*et al.,* 2012

c) Addition of curves (backward-thoracic, forward-lumbar) in spinal cord to transmit the weight of the upper body to hips in upper in an upright position.

To maintain the bipedal posture under the effects of gravity, an effective transmission of the upper body weight is required. This transmission is done from the trunk, through the pelvic girdle to the lower limbs.The adaptive change in relation to weight transmission included a posterior concavity of the vertebral column in the lumbar region and convexity in thoracic region. The curvature also helps to absorb the force exerted during walking or running and allows flexion and extension of the trunk (Jamie Kendrick, 2014). Lack of such characteristic flexibility in extant primates restricts their lower back mobility. It also allowed centre of mass to lie centrally and vertically above the hips which consequently balance the body while striding in upright posture. The spinous process of more than half of the vertebrae point caudally. This change in orientation is related to the rearrangement of the muscles of the back which allow erect posture of trunk region (Buttner-Janusch, 1969).

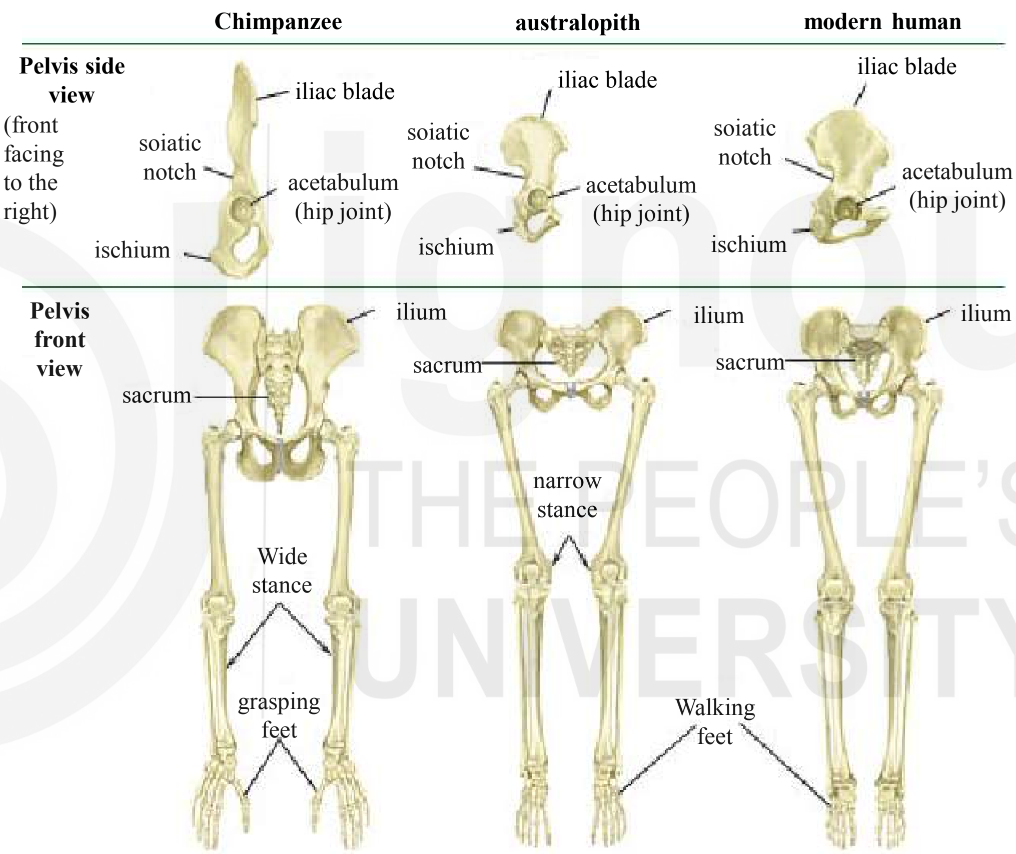


Fig 4. Anatomical changes in pelvis

Source: www.encyclopediabritinnica.com

d) Lengthening of hind limb and large bicondylar angle

Humans have comparatively longer lower limbs than extant primates which contribute to longer stride length. The femoral bicondylar angle distinguishes bipedal humans from quadrupedal apes as it aligns the body's midline with the distal end of the femur, knee and lower leg. This helped in body's centre of mass to lie directly over the stance leg while walking (Aiello and Dean, 1990). This angle ranges between 8 to 11° in humans while it averages 1-2° in African apes. A prominent inter-trochanteric line, gluteal tuberosity and a raised lineaaspera enhanced attachments for muscles and ligaments in humans that also assisted to maintain upright posture.

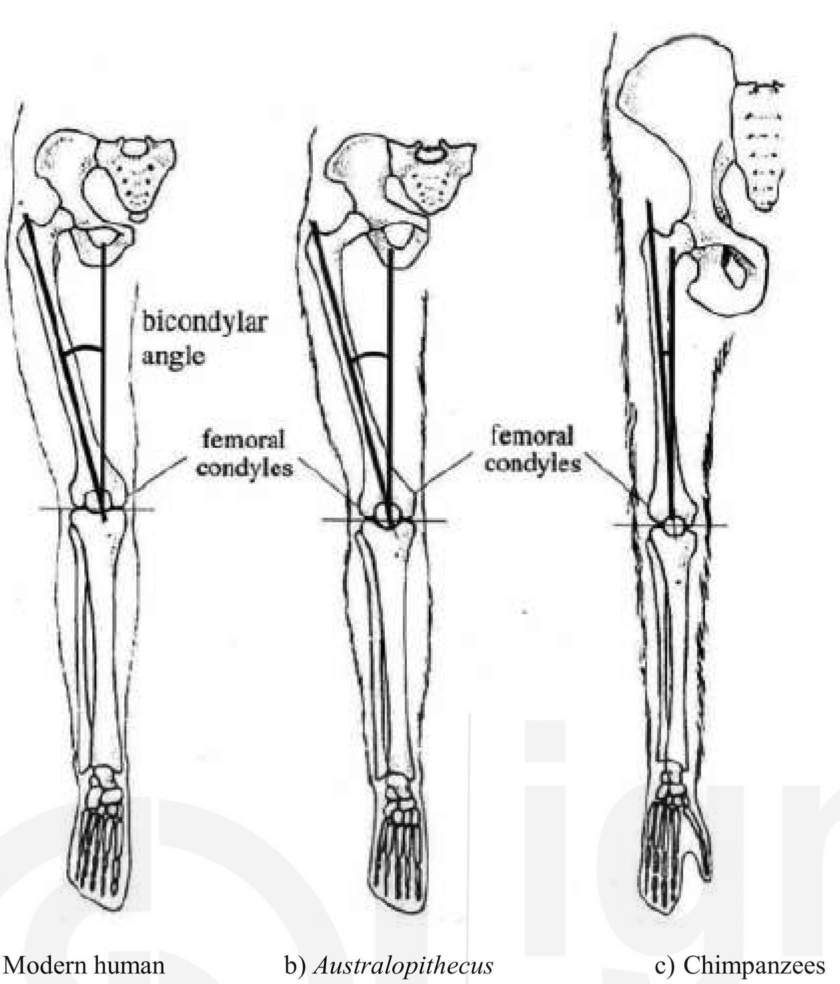


Fig 5. Femoral- Bicondylar angles

Source: Adapted from Shefelbine*et al.,* 2002

e) Structural changes in foot

Throughout evolution, primates have retained an arboreal lifestyle, and foot shape characterised by a grasping (opposable) hallux and elongated distal segments. Acquisition of habitual bipedalism involved various anatomical changes (D'Aoutand Aerts, 2008):

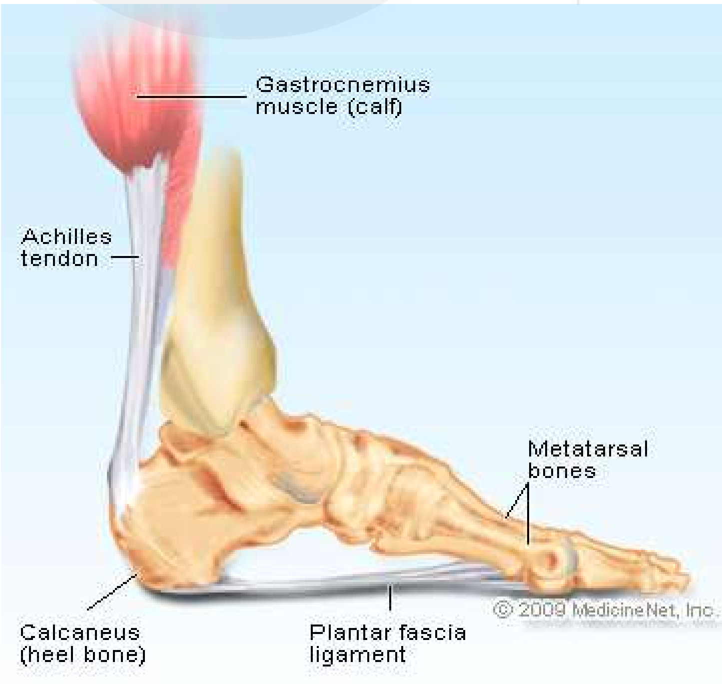


Fig 6. Achilles tendon

Source: www.emedicinehealth.com

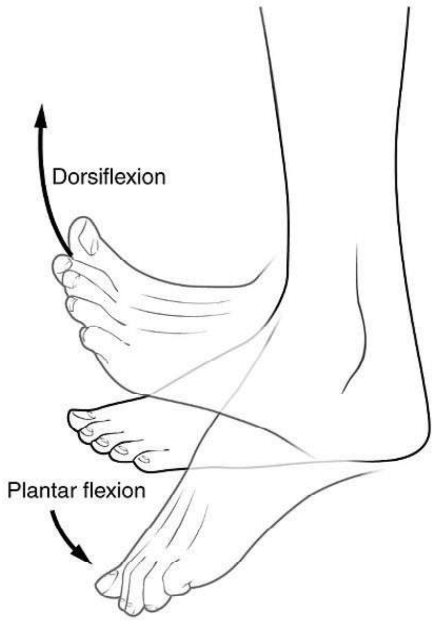


Fig 7. Movement of foot

Source: www.wikipedia.com

- A stabilized plantar arch which allow the foot to support body weight,
- loss of hallux (known as big toe in human) opposability and its alignment parallel to other phalanges,
- the proportions of the foot with relatively short phalanges, making it a more effective lever,
- a long and well developed calcaneal tubercle (heel bone) with a long Achilles tendon which impact postural orientation,

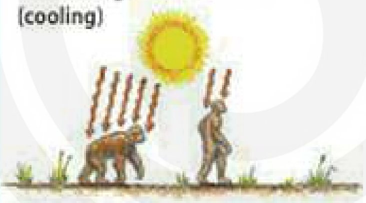
Factor	Speculated Influence	Comments
Carrying (objects, tools, weapons, infants) 	Upright posture freed the arms to carry various objects (including offspring).	Charies Darwin emphasized this view, particularly relating to tools and weapons; however, evidence of stone tools is found much later in the record than first evidence of bipedalism.
Hunting 	Bipedalism allowed carrying of weapons, more accurate throwing of certain weapons, and imporved long-distance walking.	Systematic hunting is now thought not to have been practiced unitl after the origin of bipedal hominins (see issue, Chapter 12).
Seed and nut gathering 	Feeding on seeds and nuts occurred while standing upright.	Model initially drawn from analogy with gelada baboons (see text).
Thermoregulation (cooling) 	Vertical posture exposes less of the body to direct sun; increased distance from ground facilitates cooling by increased exposure to breezes.	Works best for animals active midday on savanna; moreover, adaptation to bipedalism may have initially occurred in woodlands, not on savanna.
Visual surveillance 	Standing up provided better view of surrounding countryside (view of potential predators as well as other group members).	Bhevaiour seen occasionally in terrestrial primates (e.g. baboons): probably a contributing factor, but unlikely as "prime mover".
Long-distance walking 	Covering long distances was more efficient for a biped than for a quadruped (during hunting or foraging); mechanical reconstructions show that bipedal walking is less energetically costly than quadrupedalism (this is not the case for bipedal running).	Same difficulties as with funting explanation; long-distance foraging on ground also appears unlikely adaptation in earliest hominins.
Male provisioning 	Males carried back resources to dependent females and young.	Monogamous bond suggested; however, most skeletal data appear to falsify this part of the hypothesis (see text).

Fig 8. Factors influencing evolution of bipedalism

Source: Adapted from Lewis *et al.,* 2010)

- Talocrural joint (ankle joint) act as synovial hinge joint permitting dorsi-flexion and plantar flexion movement of the foot.

Bipedalism freed the forearm for use and manufacturing of tools. In bipeds, less portion of body is directly exposed to sun which provides thermo-regulatory advantage and aid in cooling of the body. Moreover, as greater portion of body is away from ground. It prevents warming of body by heat radiation from the ground**.** Bipedal stance provided wider view of the surroundings and early spotting of prey. They became efficient in covering long distance and hunting. Pelvic changes associated with bipedalism resulted in smaller birth canal. Evolutions lead to the birth of an infant at a stage when the head can fit through the birth canal, but induced prolonged growth and dependency periods. This consequently encourage male to guard female with depend infants and development of affectionate relationship (Jurmain*et al.,* 2012).

4.2.2 Opposable Thumb and Manual Dexterity

A diminutive thumb with long and curved fingers is typical characteristics of a primate hand (Midlo, 1934). In contrast, the human hand has an opposable thumb combined with fingers that have shortened and straightened. Although apes also share the trait of opposability of thumb but it is only the ability of humans to grip objects firmly in order to manipulate them (Marzke and Marzke, 2000). Human thumb also displays a greater degree of mobility in comparison to other primates which makes it unique and distinctive (Young, 2003).

Figure 9a
Chimpanzee hand

Figure 9b
Human hand

A model for the hand of the hominid ancestor

Source: Adapted from Napier, 1956

The discovery of fossil hand bones assigned to a 1.8-million-year-old specimen human ancestor *Homo habilis* at Olduvai Gorge in the early 60's, has put forth a general agreement that the anatomical reconstruction of the hand during human evolution was somehow linked with tool behaviour. This approach is consistent with evidence that early hominid bipedal behaviour would have 'freed the hands' for greater use of tools (Young, 2003).

During the prolonged period of evolution, the hand underwent profound changes that adapted it for grasping objects in a manner that allows gripping with strength sufficient to withstand a violent impact and precise control of release. Napier identified them as 'power' and 'precision' grips. In the power grip, the object may be held in a clamp formed by the partly flexed fingers and the palm where counter pressure being applied by the thumb lying more or less in the plane of the palm while in the precision grip, the object may be pinched between the flexor aspects of the fingers and the opposing thumb (Napier, 1956).

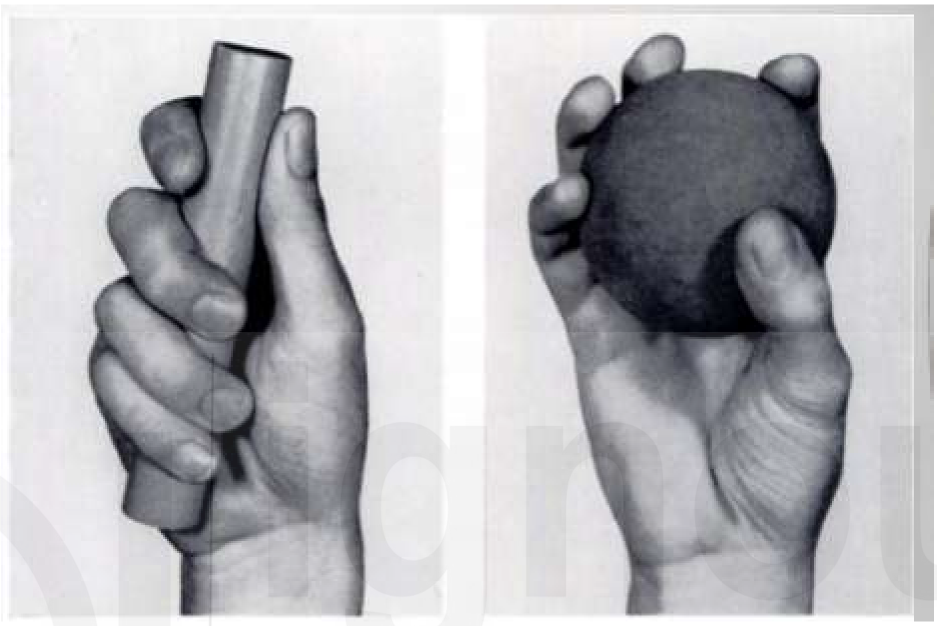


Fig 10.a Power grip **Fig.10.b Precision grip**

Source: Adapted from Napier, 1956

In figure 10.a, the hand gripping the hammer stone displays the power grip. This grip controls the striking point and absorbs the shock. Core tool is held in a power grip so that it doesn't exit the hand on being stroked.

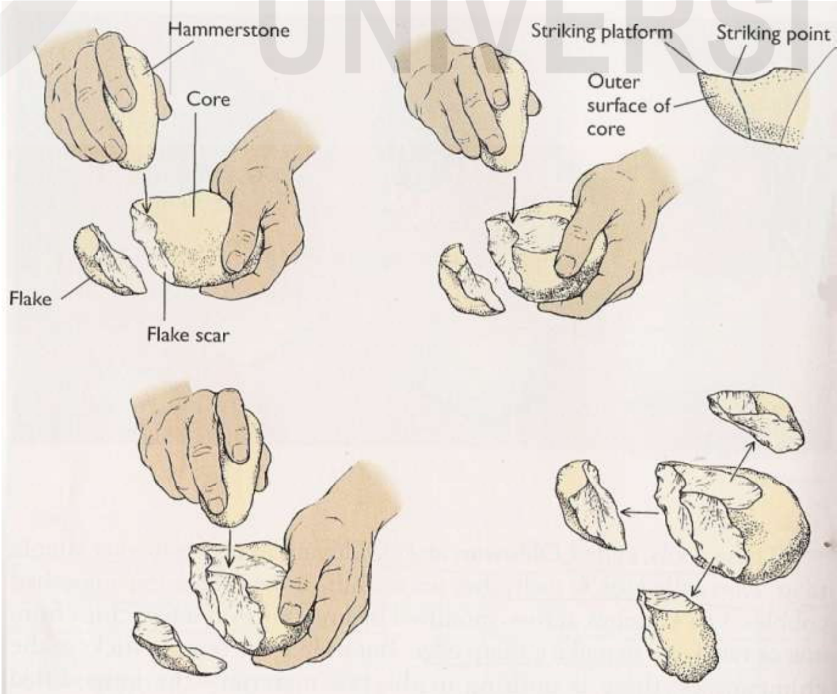


Fig 11. Hand grip during making a tool

Source: http://www.gavilan.edu.pdf

When the core or other weapons were used for throwing to strike an enemy they would have needed precision grip. These grips are commonly referred to as the cylinder (power) and ball (precision) grips.

The remodelling of hand not only included anatomical changes in bone and muscles of wrist and finger (metacarpals) but also neurological basis for voluntary control developed. These modifications (a) relieved the stresses which were formed due to opposition of the thumb while manipulating an object and (b) allowed manual dexterity to grip object more firmly or enabled to throw it. Humans also possess flexor pollicislongus muscle which provides strength and control to the movement of thumb (Bade *et al.,* 1993, Marzke and Marzke, 2000).

Check Your Progress

7) What do you understand by power and precision grip?

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8) Write down the neurological changes that supported in remodelling of hand during the hominization.

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4.3 SUMMARY

Evolution of humans has a long history ranging from an earlier genus of apes called *Australopithecus* to modern *Homo sapiens*. Middle Pleistocene period reveals transitional phase of human evolution between the hominins that came before *Homo erectus* and the ones that followed modern *Homo sapiens*. Artifactual trace of prehistory often provides speculative evidences to paleoanthropologist to understand the hominin adaptation to changing environment and new behaviour adopted. Survival and proliferation of population in the new environment demands not only anatomical or physiological changes but also cultural and genetic transmission of favourable traits and behaviour from generation to generation.

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4.5 ANSWERS/HINTS TO CHECK YOUR PROGRESS

1) *Homo erectus* is popularly known as 'Upright Man'.

2) *Homo neanderthalensis* are considered to be the most closely related to the modern human *Homo sapiens.*

3) During the course of evolution many changes took place which was considered significant in defining what makes a hominid. These include biped locomotion, large brain size, tool making behaviour, development of

language and culture. These evolutionary processes which lead to the development of human characteristics distinguished from primates are known as hominization.

4) Mosaic evolution is defined as the patterns in which physiological and behavioural systems evolve at different rates. For further details refer section 4.2.1

5) Hominid footprints preserved in the ash fall of a volcanic eruption around 3.5-3.8 million years ago (during Pliocene period) at Laetoli site in northern Tanzania represents the earliest evidence of bipedalism in human evolution.

6) Quadraped have vertically elongated hip bones positioned parallel to each other along the sides of the lower portion of vertebra. In contrast, hominins illium of hip bone became comparatively shorter and broader. Remodelling of pelvis lead to basin shaped structure that support abdominal organs and allows transmission of weight from lower back to hip joint during erect posture. For further details refer section 4.2.1.

7) In power grip, the object may be held in a clamp formed by the partly flexed fingers and the palm where counter pressure being applied by the thumb lying more or less in the plane of the palm while in the precision grip, the object may be pinched between the flexor aspects of the fingers and the opposing thumb.

8) The neurological modifications that supported in remodelling of hand: (a) Relieving of stress which were formed due to opposition of the thumb while manipulating an object and (b) Enabling of manual dexterity to grip object more firmly or to throw it. For further details refer section 4.2.2.

UNIT 5 AUSTRALOPITHECINES*

Contents

Learning Objectives

After reading this Unit, you will be able to:

- understand the concept and events in human evolution;
- describe the various Australopithecine finds and discoveries; and
- comprehend the various characteristic features that differentiate Gracile *Australopithecus* from Robust forms.

5.0 INTRODUCTION

Human evolution has been defined by four major key events:

- Origin of terrestrially (coming to the ground from the trees),
- Bipedalism (upright walking),
- Encephalization (i. e brain expansion in relation to body size), and
- Culture (or civilization).

As the current fossil and archeological records indicate, these novelties arose at separate intervals throughout hominin evolution. In different words, hominins show a pattern of mosaic evolution. Today, anthropologists acknowledge that each humans and apes show advanced biological process options, and dissent equally (but in separate ways) from their common ascendant.

All of the upright-walking species, including us, are called hominids, from the family Hominidae. A ”Hominid” is the member of the primate-family ‘Hominidae’. Recent classification schemes for the apes place extinct and existing

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humans, chimpanzees, gorillas, and orangutans in Hominidae, and thus technically hominid refers to members of these groups. However, traditionally and even in some current classification schemes, mammal family is restricted to humans and their close, extinct relatives—those more similar to humans than to the (other) great apes, which were placed in another family. The term hominid refers only to humans and such forebears as *Australopithecus*, *Homo habilis*, and *Homo erectus*.

The tertiary period ended with Pliocene epoch, and the Quaternary period is divided into two epochs- Pleistocene and Holocene. The evolution of man from an ape-like creature to *Homo sapiens* was largely accomplished in the Pleistocene epoch. Therefore, this epoch may be regarded as the epoch of man. As mentioned above, in the course of human evolution three major stages may be recognized. These are, in sequence the stage of Australopithecine, the stage of *Homo erectus* and the stage of Neanderthal man. After that we meet the builder of the upper Paleolithic culture, the Cromagnon, Grimaldi and Chancelade, who belonged to the Late Pleistocene Epoch (Copeland, 2011).

Stone-tool manufacturing seems to have originated at roughly the equivalent time as substantial brain growth, roughly 2.5 million years ago. The earliest hominin fossils discovered so far are from Ethiopia and Kenya dated 2 million years earlier; they show significant adaptation to bipedalism in combination with a hominin dental pattern that has distinct apelike overtones. It is indeed possible that the first hominin may have been apelike in all cases, with the exception to adaptation to upright walking. If true, then "bipedalism" would represent the key hominin adaptation.

The oldest hominid fossil is dated to less than 4 mya. The earliest hominids were known from one genus, *Australopithecus*, found mostly in two key areas of Africa: a series of limestone caves in South Africa and in sedimentary basins and associated stream drainages within the Eastern Rift Valley (part of the ·Great Rift Valley) in "Ethiopia", "Kenya", and "Tanzania".

The human beings are referred to as *Homo sapiens*, thereby, belonging to the genus *Homo*. There are many extinct members of the genus Homo. One is *Homo neanderthalensis*, with whom we have interbred, while another is *Homo erectus,* which is our most recent ancestor*;* *Homo habilis*, which is known for being one of the early stone tool users. *Australopithecus* is another hominid genus that evolved prior to Homo. In fact, genus Homo seems to have evolved from genus "*Australopithecus*". The hominid family tree is grouped by genus, or by related genera in the case of the earliest grouping.

5.1 *AUSTRALOPITHECUS* (4-1 MILLION YEARS AGO) – AN INTRODUCTION

The Australopithecines are represented by hundreds of fossils of as many as nine species from one genus, *Australopithecus*. The terms australopithecine come from a former classification as members of a distinct subfamily, the Australopithecinae. The Australopithecines occurred in the Plio-Pleistocene era of the geological time scale. The various species of *Australopithecus* lived 4.4 million to 1.4 million years ago, during the Pliocene and Pleistocene epochs which lasted from 5.3 million to 11,700 years ago and were bipedal, dentally similar to humans, but with a brain size not much larger than that of modern apes, with lesser encephalization than in the genus *Homo*. The etymology of the genus *Australopithecus* is based on '*australo*', a Latin word meaning 'southern' and '*pithecus*', a Greek word meaning 'ape'. The genus name refers to the first fossils found, which were discovered in South Africa. This genus is a group of extinct primates closely related to, if not actually ancestors of, modern human beings and known from a series of fossils found at numerous sites in eastern, north-central, and southern Africa (Rafferty, 2011) (https://www.britannica.com/biography/Lee-Berger). *Australopithecus* can be classifiedas the "Gracile Australopithecines", and Paranthropus or "Robust Australopithecines".

Check Your Progress

1) What is a hominid?

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2) Briefly explain the evolution of Australopithecine lineages.

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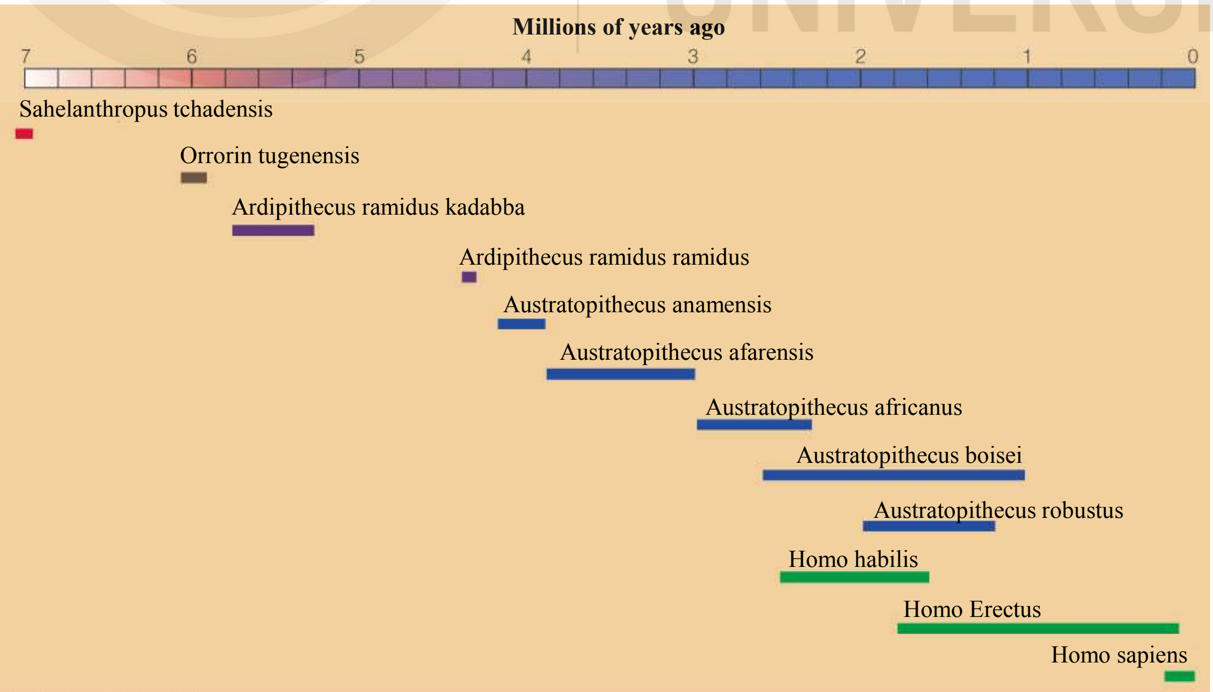


Fig. 1: Phylogenetic Status of *Australopithecus*

Source: Thomson Reuters (2007)

5.2 *AUSTRALOPITHECUS* – DISCOVERY AND FINDS

Raymond Dart made a key discovery of an Australopithecine in 1924 which was extracted from the cave-breccia of a South African mine and was named as Taung, after the site from where it was found. It was an odd, immature skull of a small-brained creature which was designated as *Australopithecus africanus*, or "Southern Ape from Africa" by Dart. He published an account of his findings in 1925. Ales Hrdlicka visited the site after discovery and recognized the importance of the Taung Skull. Hrdlicka considered this Taung specimen an anthropoid ape on the basis of molar and craniofacial morphology. Although he did not confirm any hominid affinities due to relatively young age, still attributed its importance based on being a more southerly range of apes in Africa (Dart, 1925).

After the initial discovery of Australopithecine, the consideration of Taung as a member of the human lineage remained a matter of debate for many years which was primarily because of preconceived notions of features of the human predecessor (Berger & Clarke, 1995). In addition to it, even after the lack of supporting evidences, many palaeoanthropologists who were contemporary to Dart convinced that the human line made its beginning in Asian continent and not in the African continent. Later on, *Australopithecus* was recognized as a hominid by William King Gregory who emphasized the fact that it possessed a progressive anthropoid brain and a primitive human dentition.

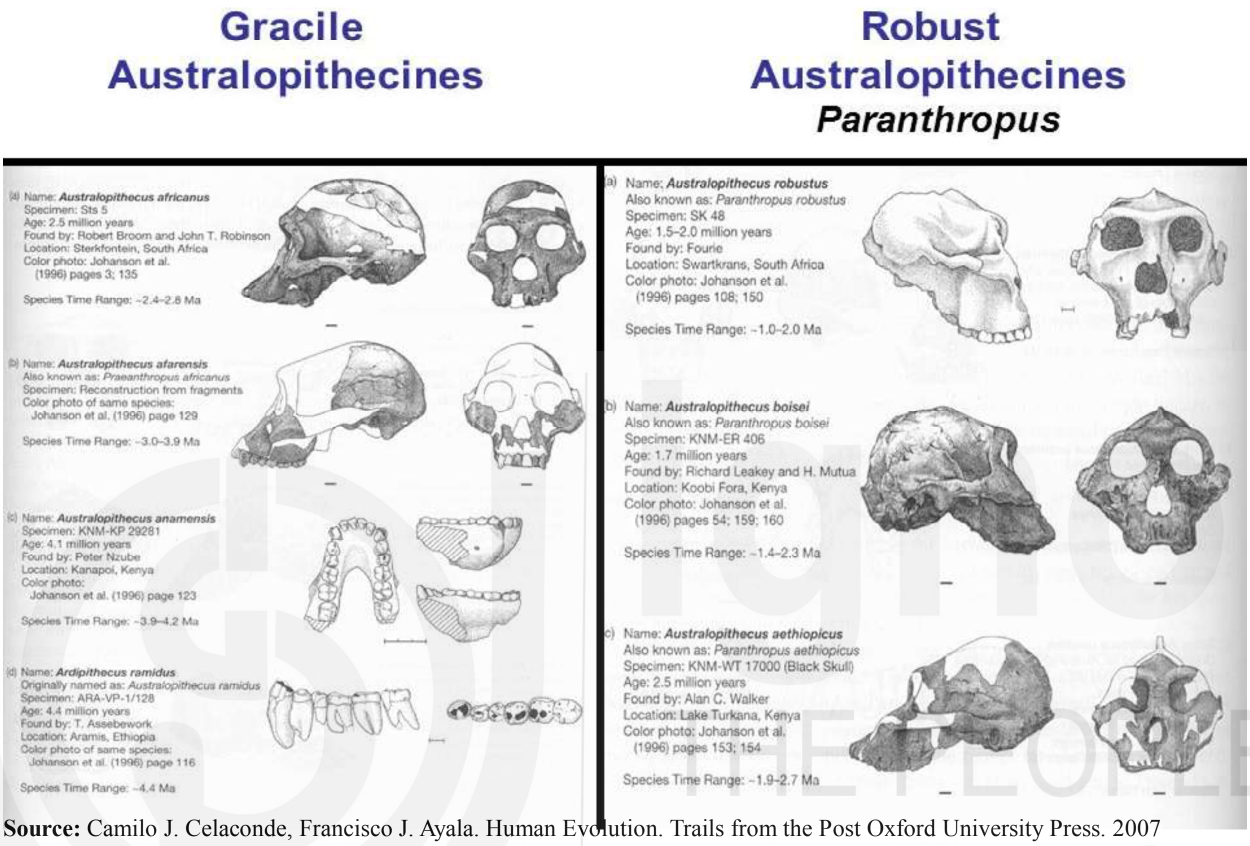
In 1936, Robert Broom recovered a fragmentary adult cranium with teeth in a quarry at Sterkfontein, which he named *Australopithecus transvalensis*(later pleisanthropus) (Broom, 1938). This specimen confirmed *Australopithecines* as hominds, which represented an ancestral human stock. The work of Broom, Robinson with Dart between the period of 1930s and 1940s at Kromdraai, Sterkfontein, Swartkrans and Makapansgat resulted in a series of fossil finds that concluded that in the skull, dentition and postcranium the South African 'ape-man' were indeed more human-like than ape-like.In 1954, Robinson proposed the taxonomy to accommodate the series of fossil finds. He included the hominid from Taung, Makapansgat and Sterkfontein under *Australopithecus africanus*. Hominids from Kromdraai and Swartkrans were combined in *Paranthropus robustus* (now known as *Australopithecus robustus*), also from Swartkrans come the remains of species known as *Telanthropus.* Its teeth are smaller than those of *Paranthropus* discovered in the same site which is relatively younger in age (Sponheimer, 2006).

The year 1960s brought further discovery of homind-bearing sites in the East African Rift valley by L.S.B. Leakey and his wife Mary Leakey. They discovered 1.8 million year old *"Zinjanthropus boisei"* complete cranium at Olduvai Gorge in Northern Tanzania, which is today believed to be the local variant of *A. robustus* and is known as *Australopithecus boisei*. The presence of another hominid species from the same bed being relatively smaller in size was found along with stone tools which came to be known as Homo habilis. The comparison between the remains of bed from Olduvai Gorge and the material from South Africa revealed that morphologically, it is advanced as compared to that of South Africa.

The *Later Australopithecines* were distinguished along two lines on the basis of geographic distributionand general morphological features. The geographical based subdivision of these hominids were South African and East African groups while groupings based on morphological features weregracile (lightly built), or robust (heavily built) types.

5.3 CLASSIFICATION OF *AUSTRALOPITHECUS*

The *Australopithecus* are a morphologically diverse group and they occur in two forms: theGracile type and the Robust type.



Source: Camilo J. Celaconde, Francisco J. Ayala. Human Evolution. Trails from the Post Oxford University Press. 2007

GracileAustralopithecenes	**Robust Autralopithecene**
Represented by *Australopithecus africancus*, *Australopithecus afarensis*, *Australopithecus anamensis*, Ardipithecusramidus	Represented by *Australopithecus robustus*, *Australopithecus boisei*, *Australopithecus aethiopicus*
Smaller in size	Larger in Size
Specimens found at Taung and Makapansgat belong to this group	Specimens found at Kromdraii and Swartkrans belong to this group
Saggital Crest-Absent	Crest-Present
Supra-orbital Region-lack of development	Large Supra-orbital ridges
Mastoid Process-slightly developed	Mastoid Process-not developed
Jaws-Large and extremely prognathous	Massive but less prognathus
Pelvic and Leg bones-Very close to the hominid pattern	Pelvic and leg bones- a combination of the gorilloid and the hominoid pattern
Non-divergent big toe	Divergent big toe
Dental arcade-parabolic	Less parabolic
All these characters indicated that the Gracile type was biped and erect in posture	Inefficiently bipedal and less erect than the Gracile type

5.4 BRIEF ACCOUNT OF VARIOUS *AUSTRALOPITHECUS* FINDS

5.4.1 *Australopithecus Anamensis* (4 Mya)

The oldest australopithecine species, *Australopithecus anamensis* (anam means "lake" in the Turkana language), was named and studied by the American paleoanthropological team of Meave Leakey, Carol Ward, and Alan Walker. *A. anamensis* dates to about 4 mya and was found in the eastern and southern ends of Lake Turkana, Kenya. Reflecting its relatively early place in australopithecine evolution, *A. anamensis* has a number of primitive, apelike characteristics, including enormous canines, parallel tooth rows in the upper jaw, and a lower third premolar with both a very big outer cusp and a very small inner cusp.

5.4.2 *Australopithecus afarensis*(3.6-3.0 Mya)

Fossils representing *Australopithecus afarensis* have been found in four main sites: Laetoli, in Tanzania, and Hadar, Korsi Dora, and Dikika, all in Ethiopia. The most spectacular of the *A. afarensis* fossils are three partial skeletons from Hadar, Korsi Dora, and Dikika. They represent respectively an adult female-nicknamed "Lucy", an adult male, and a three-year-old child. The cranial capacity of this creature is about 430 cc, that of a small brain, the size of an ape's. The canines are large in comparison with later hominids. *A. afarensis* lived in various habitats such as forests, woodlands, and open country savannahs.These diverse environments indicate that hominids became more successful at this time, especially after 4 mya, in adapting to and exploiting new habitats.

5.4.3 *Australopithecus africanus*(3.0- 2.0 Mya)

Fossils representing *Australopithecus africanus* was primarily found at the South African sites of Sterkfontein and Makapansgat, in addition to Taung. *A. africanus* were habitual bipeds with shoulder and hand bones adapted for climbing. Upwardly-oriented shoulder joints; long arms relative to legs; and long, curved hand and finger bones were purposed for climbing. There were characteristic lower limb adaptations as well. According to McHenry and Berger (1998); Green et al. (2007) they may have been more arboreal than *Australopoithcus afarensis*. They had a combination of human-like (bipedal locomotion) and ape-like (relatively long arms, a strongly sloping face that juts out from underneath the braincase with a pronounced jaw) features. The similarity with *Australopoithcus afarensis* exhibited in postcranial anatomy, with elements of the pelvis, ribs, and vertebrae (McHenry, 1998).

5.4.4 *Australopithecus robustus* (2.0- 1.5 Mya)

Australopithecus robustus is also an early hominin, originally discovered in Southern Africa in 1938. *Paranthropus* means "beside man". *Paranthropus robustus* is an example of a robust australopithecine that probably descended from the gracile australopithecine hominids (Holloway, 1988). Found primarily in cave deposits estimated at 1½ - 2 million years ago from Swartkrans and Kromdraai in South Africa. The *A. robustus* remains were found from major three sites: Swartkrans, Dreimulen, and Kromdraai. Till date, the largest of these sites is Swartkrans. One of the major problems with these South African sites is dating, but generally, *robustus* fossil remains can be securely placed from 2.0–1.0 myr, and maybe even earlier.

The species -*Australopithecus robustus* was first discovered by the well-known Dr. Robert Broom. When Broom bought a fossil jaw fragment and molar in 1938 that didn't look anything like some of the *A. africanus* fossils he'd found during his career, he knew he was onto something different. After exploring Kromdraai located in South Africa, - the site where the fascinating fossils came from, Dr Robert Broom collected many more bones and teeth that together convinced him that he had a new species that he named *Paranthropus robustus.* It was represented by a part of skull, parts of some long bones like humerus and ulna, some carpel and tarsel bones, etc (Broom, 1938).

Habitually, Broom bought fossil remains from a lime quarry worker, and on a particular visit on June 8, 1938, he bought a maxillary fragment containing a first molar. The shape and the size of the molar convinced him that this was a different species than *A. africanus* (Broom's transvaalensis), which upon added investigation, observed that the specimen had been found by a young boy who worked in the cave as a guide on Sundays. Broom searched for the boy (GertTerblanche) and located him at school. He lectured the boy's class on the cave sites of the area, and was then led to the place of the specimen's discovery, Kromdraai. Broom found numerous other cranial and mandibular fragments connected with the original maxillary specimen, and this partial cranium (TM 1517) became the type specimen for *A. robustus*.

5.4.5 *Australopithecus garhi* (2.5 MYA): The First Maker, and User of Tools

Found in Bouri, in Ethiopia's Middle Awash region, it dated to about 2.5 mya. *A. garhi* is represented by bones, teeth, a partial skeleton, and a skull. Its teeth were larger than the earlier *Australopithecines*'. Paleoanthropologists have found very primitive stone tools from a number of sites in East Africa dating to the late Pleistocene, 2.5-2.0 mya. These stone tools are part of the Oldowan Complex, the first hominid culture and the earliest culture of the Lower Paleolithic, named by Louis and Mary Leakey from their work at Olduvai Gorge. Evidences indicated that that *A. garhi* used stone tools in order to process animal remnants for food.

Table 1: Distribution and Key features of various *Australopithecus* finds

Sl. No.	Hominid	Date	Location	Key features
1	*Australopithecus africanus*	3.0- 2.0 mya	Taung, South Africa Key features: Sterkfontein, South Africa Makapansgat, South Africa	☐Skulls, teeth, endocast (impression of brain), postcrania, two partialadult skeletons found ☐Small brain (450 cc) ☐Moderate-size teeth ☐Equal-size cusps on third premolar ☐Phalanges not curved ☐Adult partial skeleton has apelike leg-to-arm ratio (short legs, long arms) ☐Lived in open grasslands
2	*Australopithecus anamensis*	4 mya	Lake Turkana, Kenya Awash River Valley, Ethiopia	☐Skull fragments, teeth, postcrania found ☐Large outer cusp (like apes') on third premolar ☐Large canines#Parallel tooth rows in upper jaw (like apes')

				☐Curved hand phalanx ☐Less than 4 ft (1 m) tall ☐Lived in wooded setting
3	*Australopithecus afarensis*	3.6-3.0 mya	Hadar, Ethiopia	☐Skulls, teeth, postcrania (hundreds of pieces)found#Partial adult skeleton (Lucy) ☐Partial juvenile (three-year-old) skeleton ☐Small brain (430 cc) ☐Hyoid like apes' ☐Mandible larger in earlier Laetoli than in later Hadar ☐Smaller canines than in earlier species ☐Equal-size cusps on third premolar (like humans') ☐Parabolic tooth rows in upper jaw ☐Curved hand phalangesShort legs ☐Footprints indicate bipedal foot pattern with no divergent big toe ☐Lived in wooded setting, but a more open one than associated with Ardipithecus or A. anamensis
4	*Australopithecus platyops*	3.5 mya	Lomekwi, Kenya	☐Skull and teeth found ☐Flat face#Small brain (400- 500 cc) ☐Contemporary with A. afarensis, signaling split of australopithecine lineage into two ☐Lived in woodlands
5	*Australopithecus garhi*	2.5 mya	Bouri, Ethiopia	☐Skull, teeth, postcrania found ☐Small brain (450 cc) ☐Equal-size cusps on third premolar ☐Teeth larger than in earlier A. afarensis ☐Ratio of upper arm length to upper leg length more humanlike than apelike ☐Curved foot phalanx (like A. afarensis's) ☐Lived in grasslands, on lakeshore ☐Tool maker/user (animal butchering)
6	*Australopithecus boisei*	2.3-1.2 mya	Olduvai, TanzaniaLake Turkana, Kenya	☐Skull and teeth found#Small brain (510 cc) ☐Massive posterior teeth ☐Rubust skull with sagittal crest ☐Lived in open grasslands
7	*Australopithecus aethiopicus*	2.5 mya	Lake Turkana, Kenya	☐Skull and teeth found ☐Small brain (410 cc) ☐Massive posterior teeth ☐Robust skull with sagittal crest ☐Lived in open grasslands
8	*Australopithecus robustus*	2.0- 1.5 mya	Swartkrans, South AfricaKromdraai, South AfricaDrimolen, South Africa	☐Skull and teeth found#Small brain (530 cc) ☐Massive posterior teeth ☐Robust skull with sagittal crest ☐Lived in open grasslands

Check Your Progress

3) Name a few species of the genus *Australopithecus*.

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4) What are the characteristic features of *Australopithecus*?

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5) Differentiate between gracile and robust forms of *Australopithecus*.

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5.5 TOOLS USAGE BY THE *AUSTRALOPITHECUS*

The earliest evidence of tool use in the genus-*Australopithecus* is the possible association between *Australopithecus garhi* and the butchered remains of animals about 2.5 million years ago in Ethiopia. Fossils of *Australopithecus garhi* are associated with some of the oldest known stone tools-pebble tools, along with animal bones that were cut and broken open with stone tools. It is possible, then, that this species was among the first to make the transition to stone tool making and to eating meat and bone marrow from large animals. At other sites in eastern and southern Africa, stone tools are found in the same beds and even at the same localities as the remains of robust Australopithecines. Hand anatomy also gives us a small clue that the robust Australopithecines may have been capable of tool production. The robusts share thumb anatomy that is similar to that of tool-making hominins such as us and other members of the genus Homo, but earlier species of *Australopithecus* such as *Au. Afarensis* lack this anatomy. This may indicate that the robusts could make stone tools, although it does not tell us whether they did. If tool production requires sophisticated cognitive skills, then the Australopithecines were at least as sophisticated as living great apes. However, it is not until around 2.5 million years ago, well into the australopithecine radiation, that we see the first use of stone tools. Thus the additional access to resources that these tools provide could not have been among the primary reasons that the genus arose. The benefits of bipedalism as a foraging strategy appear to be the primary advantage that early hominins had over their quadrupedal relatives.

5.6 DIETARY PATTERN

Australopithecus (4 million to 2 million years ago),which represented both ape and human-like forms occupied the Miocene and the Pliocene epoch when the climate was increasingly cooler and drier, and the tropical forests shrank. Consequently, many areas that had once been heavily forested became open woodland and savanna. *Australopithecus* line probably represented by *Ramapithecus* lived at the edges of the tropical forests where there was access to both trees and open country. With the reduction of the forests, these early hominids found themselves spending more and more time on the ground and had to adapt to this new open environment. Procuring food could have been one obvious problem faced by these early hominids in their new environment. As the forests shrank, the traditional ape type foods found in trees became less available to them. Therefore, more emphasis was placed on foraging on the ground for foods such as seeds and grasses. Eventually, it is believed that they supplemented their diet with another food “meat “which was readily available in the savannas. Thus members of the hominid stock eventually became omnivorous *i.e.* eaters of both plant and animal foods.

Dental characteristics and the alleged evidence for habitual bipedal gait are two aspects of the Australopithecine morphology that were hailed by evolutionists most widely. They had cheek teeth, thus possessing massive jaws. Their front teeth (incisors and canines) were relatively small in comparison to their cheek teeth as compared to the relative size of front teeth to cheek teeth in modern apes (Leakey 1971). Numerous studies on the teeth of *A.anamensis* to *A.afarensis* to *A. africanus* propose that hard and harsh foods had gained importance throughout the Pliocene period (Teaford and Ungar 2000).

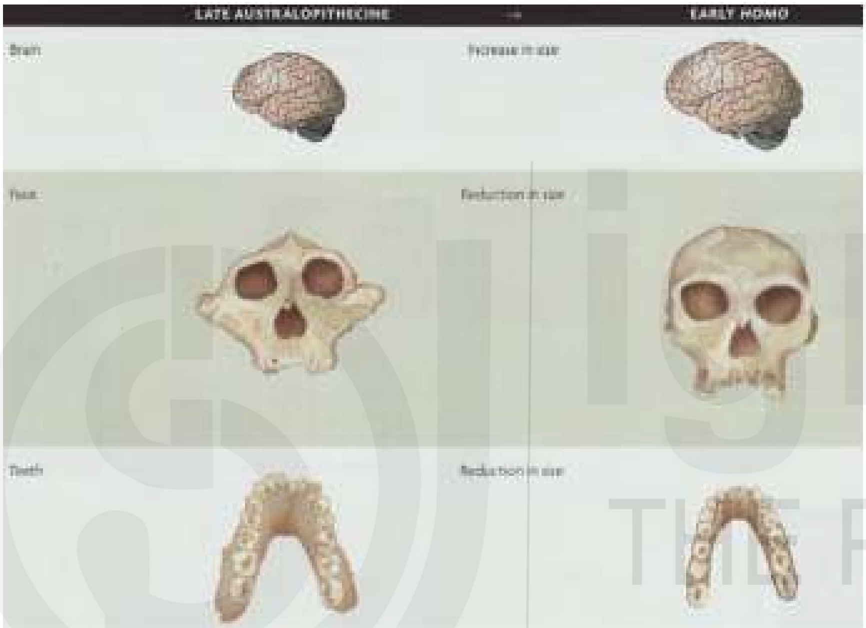
Studies on the teeth of Australopithecines have shown that they had larger molar teeth space than today’s great ape. Also, these species had an oversized type of tooth sizes and variation in tooth size shows adaptation to numerous sorts of foods reckoning on their shapes, sizes and abrasiveness (Teaford and Ungar 2000). Lucas and Peters (2000) have claimed that the Australopithecines were dentally adapted to consuming meat. It can be hypothesized that, with the use of tools for cutting and grinding, the need for carnivore adaptive characteristics such as strong jaw bones, large canines and stronger masticatory muscles started to decrease. Despite various views, the first hint of increased meat eating comes from the *Australopithecines*, even though vegetable food probably continued to account for the bulk of their diet. Eating meat could have possibly been due to the changing environment and the extensive use of tools by the Australopithecines.

5.7 EVOLUTION AND EXTICTION OF THE *AUSTRALOPITHECUS*

From the late Miocene through the Pliocene and into the Pleistocene-about -1 mya-the earliest hominids began to evolve. These diverse hominids had increasingly specialized diets, and their cranial morphology reflected this specialization. They experienced no appreciable change in brain size or body size. Thus, evolution focused on mastication. A new genus of and species of hominid, Homo habilis-having a larger brain and reduced chewing complex-made its appearance. At that time, Australopithecines were diverse, evolving, and a significant presence on the African landscape. This gracile hominid-Homo habilis likely evolved from an australopithecine, and the ancestor may have been *A. garhi*. This point in human evolution is critically important because it is the earliest record of a remarkable adaptive radiation, leading to the most prolific and widespread species of primate: which is US.

Changing Trends from Late Australopithecine to Early Homo:

1) Increase in Brain Size
2. Reduction in the size of face
3. Reduction in chewing complex



Source: Camilo J. Celaconde, Francisco J. Ayala. Human Evolution. Trails from the Post Oxford University Press. 2007

5.8 SUMMARY

Hominins lived during the late Miocene, Pliocene (5.0 to 2 m.y.a.), and Pleistocene (2 m.y.a. to 10,000 b.p.) epochs. The Australopithecines had appeared by 4.2 m.y.a. The six species of *Australopithecus* were *A. anamensis* (4.2 to 3.9 m.y.a.), *A. afarensis* (3.8 to 3.0 m.y.a.), *A. africanus* (3.0? to 2.0? m.y.a.), *A. garhi* (2.5 m.y.a.), *A. robustus* (2.0? to 1.0? m.y.a.), and *A. boisei* (2.6? to 1.2 m.y.a.). *A. afarensis* and its recently discovered predecessors were definite hominins. In *A. afarensis* this is confirmed by large molars and, more important, by skeletal evidence (e.g., in Lucy) for upright bipedalism.Remains of two later groups, *A. africanus* (graciles) and *A. robustus* (robusts), were found in South Africa. Both groups show the australopithecine trend toward a powerful chewing apparatus. They had large molars and premolars and large and robust faces, skulls, and muscle markings. All these features are more pronounced in the robusts than they are in the graciles. The basis of the australopithecine diet was savanna vegetation. These early hominins may also have hunted small animals and scavenged the kills of predators. Early *Homo, H. habilis* (2.4 to 1.4 m.y.a.), evolved into *H. erectus* (1.9 m.y.a. to about 300,000 b.p.). The australopithecine trend toward dental, facial, and cranial robustness continued with *A. boisei,* but these structures were reduced in *H. habilis and H. erectus.* Pebble tools dating to between 2.5 and 2.0 m.y.a. have been found in Ethiopia, Congo, and Malawi. Scientists have disagreed about their maker, some arguing that only early *Homo* could have made them. Evidence has been presented that *A. garhi* made pebble tools around 2.5 m.y.a. Cultural abilities developed exponentially with Homo's appearance and evolution.

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5.10 ANSWERS TO CHECK YOUR PROGRESS

1) Hominids are defined by two obligate behaviors: bipedal locomotion and non honing chewing.

2) The evolution of the australopithecine lineages resulted in generally increased robusticity of the chewing complex, no change in brain size, and eventual extinction. The change in the chewing complex reflected an increasing emphasis on eating hard foods, especially plants.

3) *A. afarensis, A. garhi, A. africanus* and *A. robustus.*

4) '*Australo*', is a Latin word meaning 'southern' and *'pithecus'*, is a Greek word meaning 'ape'. The genus name refers to the first fossils found, which were discovered in South Africa and is a group of extinct primates closely related to, if not actually ancestors of, modern humans. The various species of *Australopithecus* lived 4.4 million to 1.4 million years ago, during the Pliocene and Pleistocene epochs (which lasted from 5.3 million to 11,700 years ago) and were bipedal, dentally similar to humans, but with a brain size not much larger than that of modern apes, with lesser encephalization than in the genus *Homo*.

5) Gracile forms were small sized with no saggital crest but developed mastoid processes. They were biped and erect in posture. On the other hand, Robust forms of *Australopithecus* were large sized with saggital crest but no well-developed mastoid processes. They were inefficiently bipedal and less erect than the Gracile type.

UNIT 6 *HOMO HABILIS**

Contents

Learning Objectives

After reading this unit, you will be able to:

- learn evolution and distribution of hominids;
- know the characteristics and lifeways of *Homo habilis*; and
- understand its phylogenetic status and implications.

6.0 INTRODUCTION

Before we proceed about the species *Homo habilis* under the genus *Homo,* it is imperative to talk about hominid evolution. Dating to the end of the Miocene, the earliest hominid traces that have been found so far included primarily dental and cranial pieces. And what have been preserved of the copious hominoid fossils from throughout the Miocene are mainly teeth and jaws. But dental features alone do not describe the special features of hominids and are not the most distinctive of the later stages of human evolution. Modern humans as well as our most immediate ancestors are distinguished from the great apes by certain characteristics such as bipedal locomotion, large brain size and tool making behaviour as being significant in defining a hominid. It is also emphasized that all these characteristics developed simultaneously or at the same pace. Over the last several million years the components of dentition, locomotion, brain size and tool making have developed at quite different rates. A pattern of evolution where physiological or behavioural systems evolve at different rates is called mosaic evolution. It is important to note that the single most important defining characteristic for the full course of hominid evolution is bipedal locomotion. In the earlier stages of hominid emergence, skeletal evidence indicating bipedal locomotion is the only truly reliable indicator that the fossils were indeed hominids. However, in the later stages of hominid evolution, other features like brain development and behaviour have become highly significant.

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Table 1: Mosaic evolution of hominid characteristics

	Locomotion	Brain	Dentition	Toolmaking Behaviour
Modern *Homo sapiens*	Bipedal: shortened pelvis, body size larger, legs longer, fingers and toes not as long	Greatly increased brain size	Small incisors, canines further reduced, molar tooth enamel thick	Stone tools found after 2.5 mya, increasing trend of cultural dependency apparent in later hominds
Early Hominid	Bipedal: shortened pelvis, some differences from later hominids, showing smaller body size and long arms relative to legs, long fingers and toes, probably capable of considerable climbing	Larger than Miocene forms but small compared to modern humans	Moderately large front teeth (incisors), canines somewhat reduced, molars quite large large with very thick enamel	In earliest stages unknown, no stone tool used prior to 2.5 mya, probably somewhat more oriented toward tool manufacture and use than chimpanzee
Miocene generalized hominid	Quadrupedal: long pelvis, some forms capable of considerable arm swinging, suspensory locomotion	Small compared to hominids, but large compared to other primates	Large front teeth(including canines), molar teeth variable, depending on species, some have thin enamel caps, others thick enamel caps	Unknwon- no stone tools, probably had capabilities similar to chimpanzees

6.1 DISTRIBUTION AND AGE OF EARLY HOMINIDS

The first finds of the hominid fossil was from South Africa but by the 1970s, East Africa (particularly along the Rift valley in Ethiopia, Kenya and Tanzania) had taken pre-eminence. The geological circumstances found in East Africa produce a clearer stratigraphic picture and better association of hominids with archaeological artifacts and equally important is that these materials are much more easily datable. According to Kimbel & colleagues (1997) the earliest fossils of our own genus, *Homo,* are found in East Africa and dated to 2.3 mya. These early specimens showed similar brain and body size with *Australopithecus*, but differences in their molar teeth suggested that there was a change in diet. But others have opined that by at least 1.8 mya, early members of our genus were using primitive stone tools to butcher animal carcasses, which indicated that there is addition of energy-rich meat and bone marrow to their plant-based diet.

Blumenschine et al. (2003) were of the view that the oldest member of the genus *Homo*, *Homo habilis* (2.3–1.4 mya) is found in East Africa and is associated with the use of simple stone tools and butchered animal. According to them, the more formidable and widespread descendant, of *H. erectus*, is found throughout Africa and Eurasia which is believed to have existed from 1.9 mya to 100 kya, and perhaps even later (Anton, 2003). Like modern humans, *H. erectus* lacked the forelimb adaptations for climbing seen in *Australopithecus*. The global expansion of *H. erectus* suggests its ecological flexibility, with the cognitive capacity to adapt and thrive in vastly different environments. Not surprisingly, it is with *H. erectus* that we begin to see a major increase in brain size, upto 1,250 cc for later Asian specimens (Anton, 2003). Molar size is reduced in *H. erectus* relative to *Australopithecus*, reflecting its softer, richer diet.

Around 700 kya, and perhaps earlier, *H. erectus* in Africa gave rise to *H. heidelbergensis*, a species very much like humans in terms of body proportions, dental adaptations, and cognitive ability (Rightmire, 2009). *H. heidelbergensis,* was an active big-game hunter, produced sophisticated Levallois style tools, and by at least 400 kya had learned to control fire and was often referred to as an "archaic" *Homo sapiens*, (Roebroeks and Villa, 2011). Neanderthals (*H. neanderthalensis*) are also cold-adapted hominins with stout physiques, complex behaviors, and brain size similar to the present day humans. They are thought to have evolved at least 250 kya from *H. heidelbergensis* populations in Europe (Rightmire, 2008; Hublin, 2009).

Fossil and DNA evidences suggest that *Homo sapiens*, evolved in Africa 200 kya (Relethford, 2008; Rightmire, 2009), probably from *H. heidelbergensis*. The increased behavioral sophistication of *Homo sapiens*, as indicated by large brains (1,400 cc) and archeological evidence of a broader tool set and clever hunting techniques, allowed the species to flourish and grow on the African continent. By 100 kya, *Homo sapiens* spilled into Eurasia, eventually expanding across the entire globe into Australia and the Americas (DiGiorgio et al. 2009). Along the way the species of *Homo sapiens* displaced other hominins they encountered, including Neanderthals in Europe and similar forms in Asia. Studies of ancient DNA extracted from Neanderthal fossils suggest the *Homo sapiens* species may have occasionally interbred with them (Green et al., 2010). Cultural innovations such as agriculture and urbanization shape the landscape and species around us but the increasing global impact continues today.

The approximate dates of widely recognised members of the hominin family tree are shown in Table 2 based on Lewin and Foley (2004).

Table 2: Dates and distributions of commonly recognised hominin species

	Date(mya)*	**Geographical distribution**
Earliest hominins		
Sahelanthropus tchadensis	*7.5*	Central Africa: Chad
Orrorin tugenensis	*6*	East Africa: Kenya
Ardipethicus ramidus	4.5	East Africa: Ethiopia
Gracile Australopithecines		
Australopithecus anamensis	*4.5*	East Africa: Kenya
Australopithecus afarensis	*4.3*	East Africa: Ethiopia, Kenya, Tanzania
Australopithecus africanus	*3.5.2*	South Africa: South AfricaCentral Africa: Chad
Australopithecus bahrelghazali	3.6	
Robust Australopithecines		
Australopithecus aethiopicus	*2.5-1*	East Africa: Ethiopia, Kenya
Australopithecus boisei	*2-1*	East Africa: Tanzania
Australopithecus robustus	2-1	South Africa: South Africa
Transitional Homo species		
Homo rudolfensis	2.5-1.8	South Africa: Malawi
Homo habilis	1.8-1	East Africa: Kenya, Tanzania; South Africa: South Africa
Homo		
Homo erectus	1.8-1	East Africa: Ethiopia, Kenya, Tanzania; South Africa: South Africa;

Homo heidelbergensis *Homo neanderthalensis* *Homo sapiens*	*0.5-0.2* *0.2-0.1* 0.2-present	North Africa: Morrocco; Europe: Italy; Asia: Indonesia, China Europe, Africa, Asia Europe Global

*mya – millions of years before present
Source: Lewin & Foley, 2004

Fig. 1: Distribution of early hominids
Source: Encyclopaedia Britannica

6.2 *HOMO HABILIS*

In mankind's evolutionary journey to the present, there were many starts and stops, most attempts didn't work out well but with each try by the scientists, we got a little better and moved to a little closer to whatever we are today. *Homo habilis* is the one that is believed to be the first of the "great Ape" type creatures to have evolved to the point where he could be called "*Homo*" (Man). This was possible with the discovery of fragmentary remains at Olduvai Gorge by Louis Leakey in the early 1960s. This suggested a significantly larger brain than seen in australopi thecines which signalled the earliest appearance of genus *Homo* in East Africa. The name *Homo habilis* meaning 'handy man' was given by Louis Leaky because they were the early Olduvai toolmakers and that they were the human ancestors. *Homo habilis* is now extinct, but had inhabited parts of sub-Saharan Africa about 2 million to 1.5 million years ago. *Homo habilis* is generally accepted as following Australopithecus and preceding *Homo erectus*. *Homo habilis* was the earliest creature to make tools for specific purposes. For instance, if he needed a sharp edge to cut meat, he would strike two pieces of flint against each other, and the pieces that broke away would usually have a sharp edge and serve as an instant knife.

Check Your Progress

1) When were the earliest fossils of genus *Homo* found? Write down their characteristics.

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2) Who discovered *Homo habilis*? Why it is known as "Handy Man"?

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6.2.1 Morphological Features

The fossil remains of *Homo habilis* were discovered by Leakey at Olduvai Gorge in East Africa in 1962. The remains consist of parts of skull, upper jaw and lower jaw. *Zinjanthropus* and *Homo habilis* seem to have lived during the same time. Homo habilis, however, represents a more advanced type. According to Leakey, Tobias and Napier *Homo habilis* represents a hominid stage of evolution between *Australopithecus* and *Homo erectus*, and therefore, they want to establish a new genus for *Homo habilis*. To establish their claim they have demonstrated that in respect of cranial vault, nuchal region, dentition etc. *Homo habilis* resembles *Homo sapiens*. But others do not agree it. To them *Homo habilis* is a variety of Australopithecine and may be regarded as a relatively progressive *Australopithecus* (Das, 1993).

Homo habilis is characterized by the following features: A mean cranial capacity greater than that of members of the genus *Australopithecus*; but smaller than that of *Homo erectus*; muscular ridges on the cranium ranging from slight to strongly marked; chin region retreating; maxillae and mandibles smaller than those of *Australopithecus* and within the range for *Homo erectus* and *Homo sapiens*; dentition characterized by incisors which are relatively large in comparison with those of both *Australopithecus* and *Homo erectus*; canines which are proportionately large relative to the premolars; premolars which are narrower (in bucco-lingual breadth) than those of *Australopithecus*, but which fall within the range for *Homo erectus*; molars in which the absolute dimensions range between the lower part of the range in *Australopithecus* and the upper part of the range in *Homo erectus*; a marked tendency towards bucco-lingual narrowing and mesiodistal elongation of all the teeth, which is especially evident in the lower premolars (where it expresses itself as a marked elongation of the talonid) and in the lower molars (where it is accompanied by a rearrangement of the distal cusps); the sagittal curvature of the parietal bone varies from slight (within the hominine range) to moderate (within the australopithecine range); the external sagittal curvature of the occipital bone is slighter than in *Australopithecus* or in *Homo erectus*, and lies within the range of *Homo sapiens*; in curvature as well as in some other morphological traits, the clavicle resembles, but is not identical to, that of *Homo sapiens sapiens*; the hand bones differ from those of *Homo sapiens sapiens* in robustness, in the presence of broad, stout, terminal phalanges on fingers and thumb; in many of the characters the foot bones lie within the range of variation of *Homo sapiens sapiens*; the hallux is stout, adducted and plantigrade; there are well-marked longitudinal and transverse arches; on the other hand, the 3rd metatarsal is relatively more robust than it is in modern man, and there is no marked difference in the radii of curvature of the medial and lateral profiles of the trochlea of the talus (Leakey et al., 1964).

Morphologically, *Homo habilis* is said to have had a larger brain than *Australopithecus*, (it has been estimated at 680 c.c.), and a smoother skull, especially in contrast to the robust form of australopithecine. The teeth attributed to *Homo habilis* are supposed to be more modern than those of any comparable early hominid. Leakey argues that the foot skeleton derived from Bed I, Olduvai Gorge belongs to *Homo habilis*.it is said to be similar to the foot of modern man and could morphologically allow upright posture, walking, and running. Leakey, as well as Napier, places the Bed I hand bones with *Homo habilis*. Some of the material found at Omo by the 1967 expedition has also been associated with *Homo habilis* (Poirier, 1973). *Homo habilis* has similar skull proportions and, like *Australopithecus africanus*, brow ridges, a prognathous face, and a cranium that is broader at the base than at the parietal level; it is probable that the two species were similar in appearance (Laet et al., 1994).

6.2.2 Lifeways

Homo habilis was a meat-eater, as indicated by the shape of their teeth, and was the first of our ancestors to use stone tools. Stone tools are used by meat-eaters but not by plant-eaters because plants do not run away. *Homo habilis* was the first of our ancestors whose diet consisted of an appreciable amount of meat. This shift in traits was necessary because of the change in available food resources in the drier climate of the East-African savannah. An animal species that eats both plants and animals is more likely to continue to exist through a climate change than is an animal species whose diet is restricted to just plant, or to just meat. The previous existence of our opposable thumb, social groupings, increased brain size, and the climate-caused shift to a meat-eating diet played a large part in our development of stone tools. Oldowan stone technology was associated with *Homo habilis*, from 2.5 to 1.4 million years ago. These stone tools were simply broken to give a sharp edge; No additional modification was done to change the shape of the rock. Acheulean stone technology was used from 1.4 million years to 50,000 years ago, and was begun by the hominid named *Homo erectus*. In this case, the shape of the rock was changed to produce either a sharper surface or a pointed end. Microscopic examination of stone cutting surfaces indicates that some stones were used to cut just meat, just wood, or just plants. Through time, we found ways to obtain more cutting edge per pound of stone (Dalling, 2006).

Fig. 2: Chopper tools Used by Homo habilis

Source: https://pages.vassar.edu/realarchaeology/2017

In *Homo habilis*, humankind reached a new evolutionary level which was to influence the whole of its subsequent development. The evidence of that Cultural Revolution comes mainly from eastern Africa. Flake tools, choppers, and chopping tools are the most frequently preserved objects, although there can be no doubt that bone and especially wood must have played an important or even essential role. The preservation of the latter, unfortunately, is mostly a matter of chance, and it is less easy than in the case of stone objects to be sure of intentional fabrication or retouch. Stone, bone and wooden tools, however, are only one facet of the cultural life of these first humans, even though they are the most tangible, the most measurable. Several eastern African sites in Ethiopia, Kenya and Tanzania have given us an image of their daily life that is moving and instructive, if still somewhat lacking in clarity. The DK I site at Olduvai and Gombore I at Melka Kunture are the most famous. These are riverside living floors where *Homo habilis* made permanent settlements. A circle of large stones at Olduvai and a raised emplacement at Melka Kunture suggest a first organizing of space which prefigures the partitioning of dwelling space we find with *Homo erectus*. The ground is strewn with waste flakes, abandoned tools and split bones. A breakdown of the anatomical elements of the species represented shows that only certain parts of the hunted beasts or of corpses disputed with other scavengers were brought back to camp; the large animals were torn to pieces where they had died (examples of such butchery sites, too, are known); hippopotamus, antelope, zebra and giraffe were the commonest prey. Yet the animal component of the diet must be overrepresented, since vegetable remains do not preserve nearly so well (Laet et al., 1994).

Homo habilis were the first of our ancestors to begin using base camps. We know that the large brains of our babies today result in infants who are born early and are especially helpless for many months (For many other mammal species, infants are ready to run with the herd within a few minutes). Given the increased helplessness of its infants, it is easy to believe that base camps served as a place for mother and child to stay and for the child to grow. Base camps soon led to other social changes, such as increased labor differences among group members (Dalling, 2006).

Evidence of intense social and family life, with complex relations inside the group, has led to the suggestion that a language was used which was more elaborate than that of the apes, even if it was far from having the complexity of our own. The production of phonemes and their rapid association to form words entails also the power to form and co-ordinate through the interplay of palate, tongue and lips, sounds produced by the vocal chords. In humans of the modern type, the palate is deep, the tongue mobile and the larynx low, this arrangement leaves the bucco-pharyngeal cavity enough space for ample and complex movements. In the apes, the palate is shallow, the tongue less mobile because the chin recedes and the larynx is high, so that certain processes of the base of the skull have a different orientation. These bone arrangements are to be found in *Homo habilis* and would seem to indicate that the latter, like apes, had a bucco-pharyngeal cavity that was not large enough for the emission of articulated sounds. Anatomical study of the production of sounds and their cerebral control can provide a clear answer to this question of the mastery of articulated language by Homo habilis (Laet et al., 1994).

Check Your Progress

3) Write a comparative note on the morphology of *Australopithecus* and *Homo habilis*.

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4) Write a short note on the stone tool technology of *Homo habilis*?

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6.3 PHYLOGENETIC STATUS OF *HOMO HABILIS*

According to Leakey, and those who agree with him, *Homo habilis* lived side by side with the robust australopithecines in East Africa between one and two million years ago. Leakey argues that the shape of their heads was very close to that of modern man, only smaller; they walked erect; their hands allowed manufacture of precision tools; and they built shelters. Leakey believes that *Homo habilis* represents an independent line of hominid evolution. It is this form, he argues, that made the stone tools found throughout East and South African Lower Pleistocene depositions. Leakey is convinced that *Homo habilis* is on the direct line leading to modern man; other claimants to that position should be pushed aside. Thus, the australopithecines who lived contemporaneously in east Africa would represent an evolutionary dead end. On the other hand, many maintain that the form that Dr. Leakey calls *Homo habilis* is nothing other than a gracile austalopithecine, *A. africanus*. Some view habilis as merely an advanced member of the gracile australopithecine group, a form on its phylogenetic way toward producing the next hominid stage in human evolution (Poirier, 1973).

Several lists of fossil hominid specimens assignable to *H. habilis* have been made, notably by Howell, Campbell and Tobais. The specimens which all three investigators have identified as belonging to *Homo habilis* have come from Olduvai, Koobi Fora, Omo and Sterkfontein. In 1964, Koenigswald and Tobias claimed to recognize what is called the habiline grade of organization in some Javanese hominids, such as the type mandible of *Meganthropus palaeojavanicus*. Opinions still differ on the precise hypodigm of *Homo habilis* among known early African hominid fossils (Tobias, 1989).

In preparing the diagnosis of *Homo habilis*, this fact has not been overlooked that there are several other African (and perhaps Asain) fossil hominids whose status may now require re-examination in the light of the new discoveries and of the setting up of this new species. The specimens originally described by Broom and Robinson as *Telanthropus capensis* and which were later transformed by Robinsosn to *Homo erectus* may well prove, on closer comparative investigation, to belong to *Homo habilis*. The Kanam mandibular fragment, discovered by the expedition in 1932 by L. S. B. Leakey, and which has been shown to possess archaic features, may well justify further investigation along these lines. The Lake Chad craniofacial fragment, provisionally described by M. Yves Coppens in 1962, as an australopi*the*cine, is not a member of this sub-family. The discoverer himself, following his investigation of the australopi*the*cine originals from South Africa and Tanganyika shares this view. It is believed that australopi*the*cine is very probably a northern representative of *Homo habilis*. Outside Africa, the possibility will have to be considered that the teeth and cranial fragments found at Ubeidiyah on the Jordan River in Israel may also belong to *Homo habilis* rather than to *Australopithecus* (Leakey, 1964). A general meeting of the minds is evidently not available, so we must await further developments.

6.4 SUMMARY

In the early 1960s L. B. S. Leakey discovered and named the new hominid species, *Homo habilis*, to accommodate a cluster of Olduvai fossils. These specimens showed a number of morphological traits which seemed to preclude their owners from membership of *Australopithecus africanus*, *A. robustsus, A. boisei, Homo erectus* or *Homo sapiens*, the five principal hominid taxa most widely recognized and accepted at the time. It seemed to its nomenclators that its morphology, perhaps its place in time and its inferred phylogenetic status marked it as a homind more advanced than *A. africanus* but not as hominized as *H. erectus* (Tobais, 1989). *Homo habilis* were the earliest creature who made stone tools for particular purposes. They also had intense socio-cultural life and used language which was more complex than apes.

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6.6 ANSWERS TO CHECK YOUR PROGRESS

1) According to Kimbel & colleagues (1997) the earliest fossils of our own genus, *Homo*, are found in East Africa and dated to 2.3 mya. These early specimens showed similar brain and body size with *Australopithecus*, but differences in their molar teeth suggested that there was a change in diet. For more details kindly refer section 6.1.

2) *Homo habilis* was discovered by Louis Leakey in the early 1960s. He gave the name handy man to *Homo habilis* because they were the early Olduvai toolmakers and that they were the human ancestors.

3) Morphologically, *Homo habilis* is said to have had a larger brain than *Australopithecus*, (it has been estimated at 680 c.c.), and a smoother skull, especially in contrast to the robust form of australopithecine. For more details kindly refer section 6.2.1.

4) Oldowan stone technology was associated with *Homo habilis*, from 2.5 to 1.4 million years ago. These stone tools were simply broken to give a sharp edge; No additional modification was done to change the shape of the rock. Acheulean stone technology was used from 1.4 million years to 50,000 years ago, and was begun by the hominid named *Homo erectus*. For more details kindly refer section 6.2.2.