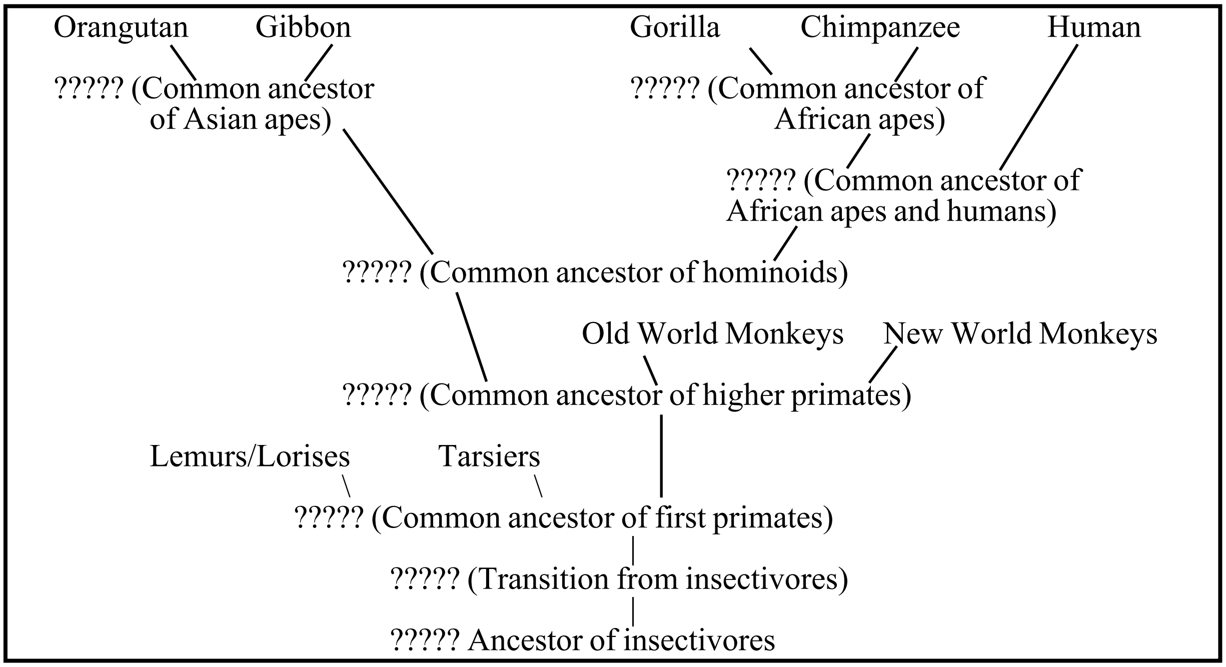
CHAPTER 10 - EOCENE TO MIOCENE APES AND MONKEYS

The next two chapters will deal with the question of whether the evidence indicates that we humans evolved from some sort of ape. Though no one believes we came from any of the living apes (gorilla, orangutan, chimpanzee, or gibbon), many believe that we came from some sort of Last Common Ancestor (LCA) shared with one of those types.

Visual
10-1



Visual
10-2

Those who believe we share ancestry with the living apes appeal to two lines of evidence: (1) molecular comparison of our DNA with theirs, and (2) the fossil record.

There are two possible explanations for DNA similarities: common ancestry or common design.

I. BASIC BELIEFS OF INITIAL COMPLEXITY VS. INITIAL DISORGANIZATION.

A. CONTRADICTORY EXPLANATIONS FOR SIMILAR FEATURES.

Visual
10-3

Initial Disorganization (evolution) leads to the belief that every living thing came from a Last Universal Common Ancestor (LUCA), and that there have been a great many parent taxa that were the ancestors of parallel sister groups.

Initial Complexity (creation), on the other hand, involves the idea that all the major types of animals and plants were brought into existence at around the same time. Subdivisions within each group (e.g., multiple species or even genera) could have appeared as a result of a large initial quantity of genetic information that became expressed in later generations, but these subdivisions did not evolve as a result of new genetic information. There should be many "sister" taxa but no legitimate "parents."

1. INITIAL COMPLEXITY: COMMON DESIGN.

Visual
10-4

Initial Complexity says that the similarities between living things belonging to different groups (e.g., the common pattern of four limbs in land animals) are due to common design.

There were many different groups with similar features from the beginning. Variations and diversification within the groups would likely be due to extra genetic information placed into the original specimens. The information was not needed by those individuals and may not have been expressed, but most of it passed down through the generations after being sorted out through breeding. Information that had not been eliminated by natural selection or mutation would be available for expression in future generations.

2. *INITIAL DISORGANIZATION: COMMON ANCESTRY OR CONVERGENT EVOLUTION.*

Initial Disorganization says that similarities between different groups are due either to common ancestry or convergent evolution. The first forms are described as "primitive" or "stem," and those considered to be most highly evolved as called "derived" or "crown."

Visual
10-5

Though most scientists admit that the driving force behind evolution would have to be random mutations, even today some publications (e.g., Almécija et al., 2021, who believe that bipedalism arose because of need for travel on the ground) hint at the Lamarckian belief that use and disuse of body functions would enhance or diminish those functions and that the changes would be passed on to future generations. This falsified concept is sometimes expressed as "form follows function" – that is, use and disuse determine physical structures.

If we exclude Lamarckianism from consideration, then saying that several types of primates are "derived" from a common ancestor implies one of two things.

a. *Parallel beneficial mutations.*

The evolving lines of descendants acquired a great many parallel beneficial mutations, starting with the DNA of the ancestors. For instance, hominids (the group that includes humans, chimpanzees, bonobos, gorillas, and orangutans) all have a similar overall body plan but a great many differences.

- Human hands and feet would have had to develop through mutations beneficial to us, while the DNA of all the other hominids would have had to acquire different mutations that were nevertheless beneficial to those types.
- Various types of hominid skulls would have had to evolve to different sizes.
- The skulls would have had to evolve to different shapes.
- They would have had to evolve to different orientations with respect to the spine. In humans, the skull is more or less in line with the spine so that the face is almost perpendicular to it. In other primates, e.g., gorillas, the face looks forward because the skull is nearly perpendicular to the spine, which is nearly parallel to the ground.
- The arms, legs, digestive systems, teeth, and so on of each type would have to evolve separately by independent yet parallel mutations.

In each case, it seems likely that there would have been harmful as well as beneficial mutations. However, the individuals that acquired the harmful mutations are not known from fossils.

b. *Sexual reproduction.*

Visual
10-6

The evolving members of each species that reproduces sexually would have had to undergo a similar process. At least one male would have had to acquire enough beneficial mutations to move him in the direction of a new species while at the same time and place, at least one female would have had to acquire enough of the same beneficial mutations to move *her* in the direction of a new species. However, it would not be enough for each of them to acquire only identical mutations. At some point, the males and females of the evolving line – still at the same time and place as each other – would have to acquire complementary mutations so that their reproductive systems would still function together. This process would have had to repeat countless times to produce different genera, families, and so on.

b. Large amount of initial genetic information.

In order for each new type to have been derived, it had to have something to be derived from. The original members of each clade would have had enough genetic information to give rise to all the later types descended from them.

The fact that this idea is similar to Initial Complexity would make it unacceptable to most who accept the idea of Initial Disorganization. It ignores the question of where the original information came from. Nevertheless, there would have had to be some ancestors with enough genetic information to mutate without killing all the later generations of descendants.

Those who believe in Initial Disorganization automatically assume that common ancestry is correct. Those who believe in Initial Complexity assume that common design is correct. Since we cannot go back to prehistoric times, there is no way to test either of these assumptions. Instead, we will focus on the fossil record.

B. CONTRASTING INTERPRETATIONS OF THE ROCK STRATA.

As noted in Chapter Five, there is nowhere in the world where all the geologic strata occur together. Nevertheless, they have been arranged according to the simple-to-complex model into a hypothetical sequence known as the geologic column. The column is subdivided into several dozen eras, periods, and epochs. Each geologic stratum is assigned an age determined by the characteristic suite of fossils it contains.

1. INITIAL COMPLEXITY - Strata represent ecological Communities.

Visual # 10-7

Life began in a complex condition. All of the higher taxa of animals and plants were present from the beginning, though they may not all have been preserved as fossils. There should be many representatives of the major types in the lowest fossil-bearing layers.

The fossil record should indicate that animals and plants in the past lived in interdependent ecological communities or biomes just as they do today. Strata should show clear cut worldwide patterns of fossil distribution indicating distinct communities.

The fossil suites discovered one on top of another did not necessarily live in that sequence. Rather, the conditions at the time of burial would have been such that the first group was buried, than later the second was swept from some other area and deposited on top of the first, and so on.

The majority of fossils were probably formed under catastrophic conditions such as flooding conditions or volcanic mud or ash flows. Such conditions lead to unpredictable results.

2. INITIAL DISORGANIZATION - Strata represent time periods.

Visual # 10-8

Life began in a disorganized condition. The first living thing belonged to only one kingdom, phylum, class, order, and so on. As time went on, its descendants diversified into more and more different types. They should increase in complexity higher in the geologic column.

Strata represent time periods. Since the simplest fossils would have had to evolve before the more complex, they are the oldest.

There has never been a worldwide Flood. The rock strata and the fossils were laid down by uniformitarian processes, slowly and gradually at uniform rates. In general, the lower the rock, the older it is.

Since the mutations that caused living things to evolve were random, they would have evolved at different rates at different times and in different places. There should not be any clearly defined worldwide patterns in their distribution.

The great majority of textbooks and scientists present students with only the latter. Since their belief in uniformitarianism and long ages is foundational to evolution, if there really was a worldwide flood they are wrong.

C. EXPLANATIONS FOR LOWER PRIMATE FOSSIL RECORD.

We saw in the last chapter that the origin of lower primates and monkeys is poorly documented by fossils. Initial Disorganization and Initial Complexity offer opposing explanations for the lack of transitional fossils.

1. INITIAL COMPLEXITY - CATASTROPHIC FOSSILIZATION.

Visual # 10-9

Each type of animal was brought into existence in a complex, fully functional condition. The vast majority of fossils were produced in the aftermath of catastrophic flooding, when they were buried in water deposited sediment.

Suites of fossils are interpreted to represent ecological communities that were buried together. The communities that were already under water would be expected to leave the most complete fossil record. Members of communities that were on land, especially the most mobile and intelligent, would be able to escape burial longer and thus would be less likely to leave an abundant fossil record. Their carcasses would likely be ripped apart in the cataclysmic circumstances surrounding their burial.

2. INITIAL DISORGANIZATION - GRADUAL FOSSILIZATION.

Various types of animals developed gradually over millions of years. Individuals that happened to die by a body of water may have fallen in and been covered by sediment. The sediment hardened over millions of years, turning them into fossils. They were then exposed after millions of years of erosion. There are few fossils because the process is very haphazard.

Suites of fossils represent time periods lasting millions of years.

II. EOCENE AND OLIGOCENE HIGHER PRIMATES.

Moving from the fossil record of lower primates (lemurs, lorises, tarsiers, omomyids, adapids) and monkeys toward ourselves, apes and humans are either supposed to have evolved from Old World monkeys or from some last common ancestor (LCA) shared with them.

Visual # 10-10

A few of the differences between monkeys and apes:

- Monkeys have no appendix, apes do.
- Monkeys have tails, apes do not. (The Barbary "apes" of Gibraltar are macaques and actually have tails, though very short ones.)
- Monkeys are smaller than apes. Monkeys have a narrow and deep thorax (chest area), whereas that of apes is broad and shallow. The attachment of ribs to lumbar vertebrae is more curved in apes than in monkeys (Moyà-Solà et al, 2004, 1340-1).
- Apes are geared more toward an upright posture (orthograde) than monkeys (pronograde).
- Monkeys are better suited for running on tree branches, whereas apes are better suited for swinging because of their strong arms.
- Ape elbows can completely straighten, but those of monkeys cannot.
- The forelimbs of apes are proportionally longer compared to hind limbs than those of monkeys.
- One group of Old World monkeys, the colobine "leaf monkeys" (including multiple genera and species), have a digestive system that functions somewhat like that of cows and other ruminants. Their stomachs have chambers that allow plant foods indigestible to apes and other monkeys to ferment and thereby become digestible. Because of the

Visual # 10-11

more efficient digestive system, some of them obtain most of their water from their food rather than having to drink it in liquid form (Jablonski et al., 2020, 26).

Colobines and ruminants are not considered closely related. If they evolved from lower life forms, the digestive systems of these two disconnected groups would have had to evolve independently as a result of random mutations in the DNA of both ancestral lines.

It is easy to tell whether a living animal is a monkey or an ape. However, researchers working with only a tiny bit of fossil evidence cannot always state with certainty which kind of animal it was.

Visual # 10-12

Note: use of standard terminology of Ma (millions of years ago) in the following does not imply acceptance of multimillion year ages.

Visual # 10-13

In the last chapter we saw that there is no widely accepted candidate for any type of Paleocene "pre-primate" that might have evolved into any type of Eocene lower primate such as omomyids, adapids, prosimians, or tarsiers. We also saw that there is no widely accepted candidate proposed as the last common ancestor (LCA) of platyrrhines and catarrhines. In fact, there should be many last common ancestors. Catarrhines and apes should have an LCA as should lesser and great apes, gorillas, chimpanzees, orangutans, and so on.

This chapter will deal with the question of whether there are any widely accepted candidates representing transitions or LCAs from Old World monkeys to apes, then will deal with proposed transitional forms bridging the gap from lower to higher apes.

A. LACK OF EOCENE APES.

Visual # 10-14

Apes are part of the group of primates known as haplorrhines ("dry noses"). No apes are known from the Eocene. Those who believe that the apes in the higher strata evolved from lower forms would place the ancestor either as some type of catarrhine or as a common ancestor shared with the catarrhines such as some sort of omomyid.

- According to Initial Disorganization, the reason there are no fossil Eocene apes is that they had not evolved yet.
- According to Initial Complexity, all the major types of primates were present from the beginning, though they might have diversified somewhat due to original genetic variability. However, the different types probably lived in different environments, somewhat like the situation in the modern world where apes do not live in the same areas as prosimians or arboreal monkeys. The most mobile and intelligent types of primates would have been able to delay being buried in a catastrophic flood the longest and would thus be less likely to be fossilized.

B. OLIGOCENE APES.

Visual # 10-15

Old World monkeys and apes are supposed to have split from their LCA about 25-30 Ma, during the late Oligocene (Palmer, 2013). However, this is the least sampled time in primate evolution (Stevens et al., 2013, 611). Thus, it is difficult to draw firm conclusions based on fossils.

There is no fossil record of higher Oligocene primates throughout Eurasia, only Africa (Ciochon & Etler, 1994, 48, 50). Even on that continent there are no undisputed fossil apes before about 20 Ma (Stewart & Disotell, 1998, R587), though several of the Oligocene Fayum primates such as *Aegyptopithecus* and *Propliopithecus* are sometimes called apes. Both are considered to be among the earliest catarrhines. Their skeletons are said to be more similar to apes than to monkeys (Simons, 1995, 227). They are considered to be sister taxa or possible ape ancestors rather than being apes themselves. In particular, *Aegyptopithecus* is not considered to be near the LCA of Old World monkeys and apes (Simons, 1995, 222).

Farther south in Africa, the Tanzanian fossils *Rukwapithecus fleaglei* (est. 25.2 Ma) and *Nsungwepithecus gunnelli*, which comprise 40% of late Oligocene anthropoid taxa, are also considered to be sister taxa or possible ancestors rather than apes. As of this writing, the total evidence for *Nsungwepithecus* is a partial left partial mandible with a single lower molar M_3 (Rasmussen et al., 2019, 6053). Similarly, the total evidence for *Rukwapithecus* is a single right mandible with P_4 and M_1-M_3 (McNulty et al., 2015, 46). *Rukwapithecus* was assigned to a new genus because its teeth have several features found in supposedly later Miocene apes such as *Rangwapithecus* and living hominoids, but not in cercopithecoids or Fayum catarrhines. The only proposed ancestors are the Oligocene catarrhines *Kamoyapithecus* and *Saadanius.* (Stevens et al., 2013, 612-14; Palmer, 2013). However, the fossil evidence for *Rukwapithecus* and *Nsungwepithecus* is so scanty that it is not possible to identify potential intermediate stages.

At any rate, no specific transitions have been proposed showing any of the Oligocene apes or monkeys evolving into those of the Miocene. Each type of the Oligocene forms disappears from the fossil record and each Miocene type appears without known ancestry.

III. MIOCENE HIGHER PRIMATES.

Common terminology in the study of fossil primates: “Pro” means before, “anthro” means “man,” “pithec” means “ape,” “homo” means “human,” and “australo” means “southern.” The name sometimes includes a mention of where the fossil was discovered or hints at some characteristic (e.g., ”giganto”).

Visual # 10-16

In contrast to the small number of genera named in the Oligocene, at least 50 genus and species names have been assigned to Miocene fossils identified as apes or monkeys (Almécija et al., 2021, 5). Some of the names are: *Afropithecus, Alophia, Ankarapithecus, Ardipithecus kadabba, Ar. ramidus, Chororapithecus, Danuvius, Dendropithecus, Dryopithecus guggenmosi, Ekembo (Proconsul heseloni), Equatorius, Gigantopithecus (aka Indopithecus) bilaspurensis, G. blacki, Graecopithecus, Griphopithecus, Hispanopithecus, Kenyapithecus, Kapi ramnagarensis, Khoratpithecus piriyai, Limnopithecus, Lufengpithecus, Morotopithecus bishopi, Nacholapithecus, Nakalipithecus, Oreopithecus, Orrorin tuginensis, Ouranopithecus, Pierolapithecus catalaunicus, Pliobates cataloniae, Proconsul, Ramapithecus brevirostris (junior synonym of Sivapithecus), Rangwapithecus, Rudapithecus, Sahelanthropus tchadensis, Samburupithecus, Simiolus, Sivapithecus (Siv. indicus, Siv. parvada, Siv. sivalensis), and Victoriapithecus*.

Despite the large number of names, it is difficult to identify the exact number of genera and species of Miocene apes and monkeys.

Visual # 10-17

- Species are defined by the ability to breed. It is impossible to do breeding experiments on fossils.
- Because of the limited evidence, researchers who disagree with existing classification sometimes transfer fossils from one classification to another (McNulty et al., 2015, 57). They may split groups and “erect” new species or genera, or they may “sink” one group into another by combining two or more species or genera. However, such reclassifications are a matter of opinion and are not always universally agreed upon. Different authorities group fossils differently (Alba & Moyà-Solà, 2009, 80).
- Since the bodies of modern apes contain over 200 bones, it seems likely that Miocene would have had a similar number. However, not a single one of the Miocene primates is known from a 100% complete skeleton. (The oldest fossil for which we have a complete skeleton is Neanderthal.) The great majority of their fossils consist of isolated teeth or fragments of upper or lower jaws (Ciochon & Etler, 1994, 37).

It is extremely rare for a Miocene ape genus to be named and described based on more than a few dozen bones. Even in the cases where they are, the fragments are often believed to come from only one or two individuals. Researchers must assume that the bones they are working from represent the characteristics of all the members of the genus or species. Since there is a great deal of variation within the human species, it is reasonable to be skeptical about whether the bones of one or two fossil apes truly represent every member of their type.

A. HOMINOIDS, CERCOPITHECOIDS, AND HOMINIDS (HOMININS).

All living apes (not monkeys) are considered members of the superfamily Hominoidea. Hominoids are believed to have diverged from Old World monkeys (cercopithecoids) by about 30 - 25 Ma (Stewart & Disotell, 1998, R583), in the Oligocene.

Hominoids include lesser apes (gibbons and siamangs, part of the family Hylobatidae), great apes (gorillas, chimpanzees, orangutans), humans, and the supposed closely connected ancestors of these groups. By comparison, hominids exclude the lesser apes but include humans, greater apes, and our supposed immediate ancestors. Hominins refers specifically to the supposed human lineage (e.g., *Australopithecus* and *Ardipithecus*) but does not include living apes.

Visual
10-18

- Initial Disorganization (evolution) says there had to be a LCA for every two types of monkeys and apes. Though none of them have been found, they must be buried in the ground somewhere.
- Initial Complexity (creation) says that the LCAs have not been found because they never existed.

Despite the fact that there is no known LCA, the lesser apes and great apes are commonly believed to have split by 17 Ma (middle Miocene). At least one type of *lesser* ape (*Pliobates*) appears in the Miocene, but no universally accepted *great* ape fossils have been found in that stratum. However, some of the genera on the following pages have been proposed as possible relatives of the great apes.

Other researchers are skeptical. As Almécija et al. (2021, 587) put it, "There is no consensus on the phylogenetic positions of the diverse and widely distributed Miocene apes." The hypothetical hominoid (ape) stem lineage seems to have left no trace in the fossil record (Stewart & Disotell,1998, R586). There is nothing linking Miocene apes with either human ancestry or African ape ancestry (Andrews & Harrison, 2005, 109).

There is very little fossil evidence of African apes in the Miocene, though there is a bit more in Europe and Asia (Alba & Moyà-Solà, 2009, 77).

B. MIOCENE MONKEYS AND POSSIBLE LESSER APES.

Several Miocene monkeys such as *Microcolobus* and *Parapapio* are known only from one or two teeth and are not included herein.

Out of all the Miocene apes or monkeys listed below, the only one proposed to have a strong link to any of the Oligocene forms is *Afropithecus*. It has several features in common with *Aegyptopithecus* from the Oligocene, though it is more than twice the size of *Aegyptopithecus* (Simons, 1995, 232).

1. ***ALOPHIA METIOS*** (21.9 Ma, early Miocene monkey)

Visual
10-19

Old World monkeys are believed to have diverged from apes about 30 Ma. However, for many years Miocene monkey evolution from 30 Ma to 18 Ma was documented by only a single tooth from Uganda and one from Tanzania (Rasmussen et al., 2019,6051).

In 2019 Rasmussen et al. reported the discovery of a Kenyan Miocene monkey dated in the middle of that period at 22 Ma. *Alophia metios* was described based on a partial right mandible containing four lower teeth P_4 - M_3, and a partial left mandible from a different individual containing two lower molars M_2 - M_3. The rest of the skeleton is unknown. The teeth were considered morphologically more primitive than any previously known cercopithecoid such as the victoriapithecids from later Miocene deposits (Rasmussen et al., 2019, 6052-4). However, the fossil evidence is so limited that some consider it a sister group to the victoriapithecids rather than an ancestor. Until more fossils are discovered, it will be difficult to be certain. At any rate, it occurs later in the fossil record than several named types of apes and so is not likely to be their ancestor.

2. *DIONYSOPITHECUS* (Early Miocene, possible monkey)

Dionysopithecus is a Miocene primate found in East China, known only from a partial upper jaw with 3 teeth (Bernor et al., 1988, 339; Ciochon & Etler, 1994, 48). The known parts are similar to *Micropithecus* of Uganda. Several isolated teeth found in Pakistan were first believed to be from *Dionysopithecus* but were later eliminated as too dissimilar (Harrison, 2016, 98-99).

3. *PLIOPITHECUS/EPIPLIOPITHECUS*. (Early - Middle Miocene.)

Corruccini et al. (1976, 206) have proposed the Miocene *Pliopithecus (Epipliopithecus) vindobonensis* as a possible ancestor of the hylobatids such as gibbons, though it has no known connection to any living descendants.

At least four species of *Pliopithecus* have been named. They are known from fragments of several individuals including jaws, isolated teeth, a single partial skull, fragments of limbs, vertebrae, scapulae, and an ilium (hip bone). The skull had a wide ring-like external ear opening similar to that found in New World monkeys. There was a hole in the elbows for passage of nerves to the inside of the joint. Neither of these features is found in Old World monkeys or apes. One example is the Miocene *Pliobates cataloniae*, which is believed to be a lesser ape but does not have the hole in the elbow (Benefit & McCrossin, 2015, 515).

- The foot of *Pliopithecus* is significantly different from that of gibbons (Corruccini et al., 1976, 213).
- Its shoulder girdles are well preserved, showing no indication of the initial development of hominoid features.
- It is believed to have had a tail. (Corruccini et al., 1976, 211)
- The skull has a mosaic of features. For instance, the brain is twice as large relative to estimated body mass as the later *Victoriapithecus* and is most nearly like modern Old World monkeys.
- The Oligocene monkey *Saadanius* is dated 28 Ma, but *Pliopithecus,* dated millions of years later, has an external ear considered more primitive.

  Proconsul (18Ma), *Victoriapithecus* (15Ma), and living Old World monkeys and apes also have an ear structure similar to *Saadanius*. If the ears are the result of evolution rather than design, the constricted bony ear tube would have had to evolve independently multiple times in Old World monkeys and apes by parallel random mutations.

As a result of such features, many believe Pliopithecus was a basal catarrhine not connected to gibbons.

4. DENDROPITHACOIDEA: *DENDROPITHECUS / SIMIOLUS / MICROPITHECUS* (Early - Middle Miocene)

Visual # 10-20

A common grouping scheme places the Miocene forms believed to be apes or ape ancestors into three superfamilies: Dendropithecoidea, Proconsuloidea, and Hominoidea

(Harrison, 2002, 315). Dendropithecoids are a distinct group consisting of three genera considered close relatives: *Micropithecus*, *Dendropithecus*, and *Simiolus*. All were small catarrhines with body mass averaging between 4–8 kg. They are regarded as a sister taxon to proconsuloids, hominoids, and cercopithecoids (Harrison, 2013, 388). From largest to smallest, they were *Dendropithecus*, *Simiolus*, and *Micropithecus*.

Three species of *Simiolus* have been named. They are comparable to *Dendropithecus*, though a bit smaller (Harrison, 2013, 390).

Simiolus is believed to have been an agile tree dweller, with movement similar to platyrrhines (New World monkeys) (Miller & Rossie, 2018, 8; Harrison, 2013, 390).

The *cranium* means the skull. *Postcranial* indicates other parts of the skeleton not associated with the head.

Its postcranial fossils are so similar to platyrrhines and propliopithecids that is questionable whether it could have been associated with hominoids (Benefit, 1999, 168).

5. *VICTORIAPITHECUS / PROHYLOBATES* (Middle Miocene monkey, 19-15 Ma)

As noted in Chapter 9, *Victoriapithecus* has long been considered one of the older known monkeys (Andrews & Harrison, 2005, 105). It is not a cercopithecoid (Old World monkey) itself, but has been proposed as a transitional form close to the last common ancestor (LCA) of apes and cercopithecoids.

The hypothetical LCA is supposed to have lived some time during the Oligocene. The *Victoriapithecus* fossils found at Maboko Island are in sediments dated about 19 Ma (Pozzi, 2011, 209), an estimated 10 million years after the unknown LCA. The Maboko fossils are said to have features that are “clearly intermediate” between those of the LCA and the modern Old World monkeys. However, there are enough differences (e.g., skulls) that it is placed into its own family, Victoriapithecidae. This is considered a sister taxon of the cercopithecoids rather than an ancestor (Benefit, 1999, 155-9).

Victoriapithecus is dated about 10 million years after another Miocene primate supposed to be a stem catarrhine, the Oligocene *Saadanius* (dated about 28 Ma) (Pozzi et al., 2011). Since *Victoriapithecus* is much different but is also supposed to be a stem catarrhine, it would have had to stop evolving for millions of years while other monkeys evolved all around it. Or, another alternative is that it is not the ancestor of catarrhines.

Prohylobates means “pre-gibbon.” *P. simonsi* is known only from a single partial mandible containing two teeth (Benefit, 2008, 247) It is similar enough to *Victoriapithecus* that some say the two names may represent the same genus. However, several features are different between the two genera. The two are at least considered to belong to the same family (Benefit, 2008, 248-9).

There are no proposed transitional forms connecting this family to later apes or monkeys. Belief that the victoriapithecids are their ancestor is based entirely on the belief that evolution *must have* happened.

6. *AFROPITHECUS TURKANENSIS* (18-16 Ma, Middle Miocene)

Visual
10-21

Afropithecus was first identified from 46 fossil fragments from the Miocene of north Kenya, (Benefit & McCrossin, 1995, 239) in the Lake Turkana region. It is considered a primitive monkeylike hominoid, with an orientation that follows a typical monkey-like pronograde pattern (Moyà-Solà et al., 2004, 1342). It has a complex of primitive facial features similar to *Aegyptopithecus*, indicating that the face remained unchanged for 17 million years (Simons, 1995, 222).

Because *Afropithecus* does not share many postcranial characteristics with living hominoids, it is believed to represent a different radiation than the one which gave rise to them (MacLatchy et al., 2000, 160). That is, it is considered an evolutionary side branch leading to a dead end.

7. LESSER APES: *PLIOBATES / HYLOBATES* (Gibbons) 13 Ma - present

Visual
10-22

Modern gibbons and siamangs (*Hylobates*) first appear in the Pleistocene (Ciochon & Etler, 1994, 51). They are supposed to have branched off from a LCA shared with African apes about 18 Ma, but Miocene fossil evidence on their origin is extremely rare (Alba & Moyà-Solà, 2009, 77, 81).

The first known lesser ape fossil, *Pliobates cataloniae*, is a small-bodied Miocene ape discovered near Barcelona in 2011. It is unmistakably gibbon–like (Alba et al., 2015). It was described from a single partial specimen designated IPS58443. There were a total of 70 fragments from the whole body. Parts of the head include most of the cranium with parts of a neurocranium, basicranium, muzzle, and right maxilla. Other smaller fragments were found nearby, including a very small fragment of a mandible with upper cheek teeth similar to those of other Miocene catarrhines. The muzzle is fairly well defined, but because the skull was fragmented the cranial capacity is not measurable. It is estimated between 60-75 cc. Depending on which body parts are used, the animal's mass is estimated anywhere between 2.5 and 6.3 kg, or about 6 to 14 lbs.

There is no known LCA for the lesser and great apes, leading those who believe they evolved to disagree about which appeared first. Alba et al. believe *Pliobates* is closer to crown (highest evolved) hominoids than other Miocene small bodied catarrhines, but others believe *Pliobates* is closely related to the stem (ancestral) catarrhines. That is, rather than the great apes being descended from the lesser, the lesser evolved from the great. (Alba et al., 2015, aab2625-1-9). Young and MacLatchy believe that rather than being a descendant, living gibbons (*Hylobates*) are a sister taxon to the African apes (Young & MacLatchy, 2004, 163). Some consider *Pliobates* the ancestor of nothing else but gibbons (Benefit & McCrossin, 2015, 516).

Gibbons orangs, gorillas, chimps, and humans are all supposed to have branched off from the same LCA. However, there is a problem with the rates at which they are supposed to have evolved. Chimps and humans are supposed to have evolved at roughly the same rate as each other. We would expect gibbons to also evolve at a similar rate. According to the commonly accepted dating scheme, though, the gibbon-like *Pliobates* appears in rocks (Miocene) dated more than seven million years before the chimp-like *Australopithecus* (Pliocene), supposed to be a human ancestor. Thus, *Pliobates* would have had to evolve in a sudden leap while the unknown line leading to *Australopithecus* took about seven million years to make the same amount of progress.

While this could be true, it is not testable. Believing in stagnation among gibbons while human ancestors went through extreme evolutionary change is faith, not science.

8. *MESOPITHECUS*. (Late Miocene)

Mesopithecus is known from cranial fragments and partial skeletons found in Europe, and also from jaw fragments, teeth, and part of an upper femur in the Pakistani Siwaliks. The femur is assumed to be associated with the other parts.

Mesopithecus has a number of similarities to some modern monkeys such as *Simias*, *Papio*, *Theropithecus*, and *Macaca* (Jablonski et al., 2020). However, it appears too late to be considered ancestral to any of the other Miocene monkeys. The models assembled in museums could represent an extinct monkey, or they could simply be from fossilized fragments of modern monkeys.

C. MIOCENE APES COMMONLY CONSIDERED HOMINIDS OR ANCESTORS.

Visual # 10-23

Few authors allow for the possibility that multiple types of hominoids (apes) or hominids (considered ancestors or close relatives of humans) could have been directly created. Instead, most believe that humans share a LCA with chimps (CLCA) and farther back with gorillas (GLCA) and orangs, and even farther back, with the lesser apes.

No specific fossil type has been proposed as a transition leading to any of the LCAs, nor has any specific type been proposed as a transition leading to the first humans, chimpanzees, gorillas, and orangutans. However, since those four types are first found in the Pleistocene, most authors would say that the LCAs should be sought among the Miocene apes, which are commonly grouped into the superfamilies Dendropithecoidea (previously mentioned), Proconsuloidea, and Hominoidea (Harrison, 2002, 315).

A recent grouping of proconsulids includes *Dendropithecus*, *Micropithecus*, and *Simiolus* (the three genera usually classified as dendropithecines) as well as four species of *Proconsul*, one of *Afropithecus*, one of *Heliopithecus*, three of *Nyanzapithecus*, one of *Mabokopithecus*, one of *Rangwapithecus*, one of *Turkanapithecus*, one of *Morotopithecus*, two of *Limnopithecus*, one of *Kalepithecus*, and one of *Kamoyapithecus*. Others may be added or removed according to the opinions of later authors.

Some authors do not place proconsulids at the superfamily level but instead include them in a larger group known as the dryopithecenes. That practice will be followed herein. Some of the genera sometimes classified as dryopithecines include *Anoiapithecus*, *Danuvius*, *Graecopithecus*, *Hispanopithecus*, *Limnopithecus*, *Otavipithecus*, *Oreopithecus*, *Ouranopithecus*, *Nakalipithecus*, *Neopithecus*, *Pierolapithecus*, *Proconsul*, *Rudapithecus*, *Samburupithecus*, *Udabnopithecus*, and possibly *Griphopithecus* and *Kenyapithecus*. They are all grouped together because they have the same dental pattern.

1. DRYOPITHECINES. (12 - 9 Ma, Middle to Late Miocene)

Visual # 10-24

The best known proposed LCAs for hominoids (and later, the hominids) are the dryopithecines, named from the Greek word for "forest ape." (Some, though, view them as an evolutionary dead end.) Though dryopiths ranged from the size of gibbons to small gorillas, they are classified as members of the same tribe (a category higher than a genus but lower than a family) because they were all alike in dental pattern.

Different authorities have placed a number of genera besides *Dryopithecus* into Tribe Dryopithecinae. They include but are not limited to the well-known *Proconsul*, *Danuvius*, *Graecopithecus/Ouranopithecus* (discovered in Greece and Turkey, may be different names for the same genus – Ciochon & Etler, 1994, 55-57), *Hispanopithecus*, *Limnopithecus/Dendropithecus*, *Oreopithecus* (found in Italy), *Pierolapithecus* (based on a single cranium and parts of a skeleton from Spain), *Rudapithecus* (found in Rudabánya, Hungary), and possibly *Griphopithecus* and *Kenyapithecus* (Almécija et al., 2021, 6).

Most of the dryopithecines are known from Europe and Asia, though a smaller group known as sivapithecines (*Sivapithecus*, *Ramapithecus*, *Gigantopithecus*) most commonly found in Asia are usually included.

- Creationists believe that the dryopithecines lived around the world in similar environments until they were buried in a global flood. Since they were mobile and intelligent, they would have been able to avoid burial longer than many other types of animal and thus left a poor fossil record.
- Evolutionists, on the other hand, believe that they were evolving during the Miocene. Since they are known from Africa, Europe, and Asia, the ancestors in one of those

areas one of them would have had to leave the forested ("dryopithecus" means "forest ape") area where they evolved, traveled across the arid Arabian region, and settled into a different forested area thousands of miles away to give rise to the other group.

Sivapithecines had some differences from the rest of the dryopithecines. They had thick enamel on their teeth. thick jaw bones, and are believed to have had baboon-like forelimbs. They are generally accepted as a sister taxon to orangutans. In contrast, dryopithecines had thin molar enamel and jaw bones and are believed to have had forelimbs suitable for hanging from tree limbs (Begun, 2005).

Since all the dryopithecines had the same dental pattern, Yale's McAlester (1968, 136) believes the different sizes may have represented individual variation within a single genus. Eckhardt of Penn State (Eckhardt, 1971, 94-101) goes beyond this conclusion. Based on his extensive studies of teeth, he believes that several dryopithecines identified as separate genera were not only members of the same genus, but may have belonged to the same species.

Eckhardt's studies involved 24 different measurements on fossil teeth from one species of *Ramapithecus, R. Punjabicus*. and two species that were at the time classified *Dryopithecus* (*D. Sivalensis* and *D. Indicus)* but are now classified *Sivapithecus.* He then made the same 24 measurements on chimpanzees at the Yerkes Research Center and in the wild in Liberia. He found that the range of variation between the three fossil species was less than that in the chimpanzees in 14 measurements, the same in one, and more for nine. The differences in those nine points were very small. Thus, the three fossil species actually showed less overall variation than the one living species. He then compared the teeth of 5 other species of *Dryopithecus* and of *Kenyapithecus.* On the basis of his calculations relating to the teeth, he says that there is little reason to classify the dryopithecines as more than a single phyletic line. He believes that the variations within the teeth are probably due to genetic variability within a genus or species rather than to the development of separate species. He also reports that European and African fossils of *D. fontani*, *D. laietanus*, *D. africanus*, *D. nyanzae*, *D. major*, *Oreopithecus*, *Kenyapithecus* as well as other *Dryopithecus* and *Ramapithecus* fossils from Asia did not have a range of variation significantly greater than the of the modern chimpanzee. As he puts it, "On the basis of these tooth-size calculations, at least, there would appear to be little evidence to suggest that several different hominoid species are represented among the Old World dryopithecine fossils of late Miocene and early Pliocene times." (Eckhardt, 1972, 101).

Harvard's Pilbeam used to believe that the dryopithecines were the ancestors of hominids (Pilbeam, 1968, 1335). However, he later changed his opinion and said that the dryopithecines were already too apelike to produce the hominids. Teilhard agrees that *Dryopithecus* was too far committed toward "to have been able to produce hominians without first 'retreating' some degrees toward a type more 'generalised' than theirs" (Teilhard, 1965, 45). That is, *Dryopithecus* was too apelike to be a human ancestor either.

a. Dryopithecus / Rudapithecus.

Visual
10-25

Three species of *Dryopithecus* have been named in Europe, though there is no known ancestor for any of them.

- *D. fontani* from France was described based on fragmentary mandibles, isolated teeth, and part of the shaft of a humerus. A specimen from Catalonia, Spain was described based on only a lower face and partial femur. It was a bit larger than *Pierolapithecus* (Alba & Moyà-Solà, 2009, 79). A few teeth have also been found in Czechoslovakia (Pilbeam, 1969, 127).

- *D. brancoi* from Rudabanya, Hungary was described based on a left lower molar M_3, a partial cranium RUD 77, mandibles and maxillae with several teeth, and isolated teeth. For a while it was designated *Rudapithecus hungaricus*, but that name is now considered to be as junior synonym for *Dryopithecus brancoi* (Kordos & Szeged, 2000, 71).
- *D. crusafonti* from Spain was described based on one badly preserved left maxilla and a separate left canine fragment, along with 15 isolated teeth and a mandible (Grehan & Schwartz, 2009, 1827).

A small number of very fragmentary vertebrae have been used to link *Dryopithecus* to living apes (MacLatchy et al., 2000, 177; Moyà-Solà et al., 2004, 1342). It seems to have had hands and wrists resembling those of modern apes (Miller & Rossie, 2018, 9), and may have been suited for climbing & suspensory (tree-hanging) locomotion (Andrews & Harrison, 2005, 109).

Some consider *Dryopithecus* to be an ancestor to chimpanzees but not gorillas. If this were the case, the gorillas would have had to independently evolve arm and shoulder structures that would allow suspensory motion as well as independently evolving similar wrist structures. Their putative ancestors *Dryopithecus* and *Pliopithecus* show no indication of the beginning of such adaptations (Corruccini et al., 1976, 208). As a result, some consider them as sister taxa of australopithecines and African apes. (Grehan & Schwartz, 2009, 1827) Almécija et al. (2021, 7) believe the dryopiths could either be stem hominids or evolutionary dead ends. Without more fossil evidence, there is no way to be sure.

b. Proconsul/Ekembo/Ugandapithecus. (23-14 Ma, early to middle Miocene)

Visual
10-26

Consul was a famous chimpanzee on display in London in 1909, known for smoking cigarettes and riding a bicycle. When a fossil believed by some to be the ancestor of chimpanzees was discovered, it was given the name *Proconsul*, which means "before consul."

The African Miocene genus *Proconsul* is considered a member of Tribe Dryopithecinae. It is dated by different writers between 23 to 14 Ma (Benefit & McCrossin, 2015, 516; McNulty et al., 2015, 44). Depending on whose classification we follow, it includes up to 6 species, ranging in size from macaques (10 kg) to small gorillas (50 kg). The uncertainty in the number of species included is because it is impossible to do breeding experiments on fossils. Some (e.g., Almécija et al., 2021, 6) believe *Ekembo* is an alternate name for *Proconsul*. The two types are very similar, but some place *Ekembo* (formerly known as *P. heseloni*) in a different clade because of differences such as teeth. Some researchers classify a number of the specimens as a different genus, *Ugandapithecus* (McNulty et al., 2015, 47-48).

Proconsul is presently believed to have included multiple species including *P. africanus, P. meswae*, and *P. major*.

- The type specimen of *P. africanus* is a fossil known as M 14084. It was originally called *Dryopithecus africanus*, based on a skull numbered KNM-RU 7290, dated at 18 Ma by discoverer Mary Leakey. It had a smaller snout than its supposed ancestor, the Oligocene *Aegyptopithecus*. Its brain size was estimated at 167.3 cc, larger than monkeys of similar size but much smaller than chimps

(400cc) or gorillas (500cc).

P. africanus is believed to have possessed characteristics of both apes and monkeys. It had a shorter forearm relative to upper arm than a chimp, with limb proportions similar to modern quadruped monkeys. Its forelimbs would have been able to rotate more than living monkeys. It had grasping hands and feet, apelike shoulder and elbow, and monkey-like wrists. Its lumbar vertebrae were gibbon-like but its spine and ilium were more monkey-like than apelike. Its anatomy would have allowed it to walk on top of branches, but would have made it difficult to swing or hang (suspensory locomotion) (Miller & Rossie, 2018, 8). It did not show the gradual loss of a tail, but had clearly defined sacral vertebrae indicating no tail at all (Alba & Moyà-Solà, 2009, 79). Since one of the main distinctions between monkeys and apes is the presence or absence of a tail, we can be confident that it was fully ape, though displaying a mosaic mixture of characters of living apes (Murdock, 2003) However, it did not exhibit the peculiar characteristics of humans.

- *P. major* is known from the specimens M14331, KNM-CA 2127, KNM-SO 584, KNM-SO 396, KNM-SO 404, and KNM-LG 452. *P. major* estimated to have been almost the size of female gorilla, about 50 kg (110 lb) (Miller & Rossie, 2018, 8).

In general, *Proconsul* seems to have had modern hominoid features but a pronograde (more or less forward leaning) monkey-like body plan. (Moyà-Solà et al., 2004, 1342; Almécija et al., 2021, 6) The vertebrae are similar to those of Old World monkeys (MacLatchy et al., 2000, 176). However, the feet and hind limbs resemble those of *Pan*, the chimpanzee (Simons, 1995, 224).

In several of the proposed genera and species, the fossil evidence is limited enough that some of the proconsulids are classified differently by different paleontologists. They are often assigned to different genera or even families.

- *P. heseloni* and *P. nyanzae* are alternately classified *Ekembo heseloni* and *E. nyanzae* (McNulty et al., 2015).

  P. heseloni is known from fossils designated KNM-RU 7290 and KNM-RU 2036. Rib fragments (KNM-RU 2036) are monkeylike (Moyà-Solà et al., 2004, 1340).

  P. nyanzae is known from KNM-RU 1676-77, as well as the type specimen of M 16647, a crushed palate containing most of the teeth as well as a lower face and a partially complete skeleton designated KNM-MW 13142 (Hammond & Almécija, 2017, 829). At first *P. nyanzae* was assigned to *P. africanus* but was reclassified because of its larger size. (Whybrow & Andrews, 1978, 115-6)
- Some consider *P. gitongai* as a different genus, *Ugandapithecus gitongai*, though this is disputed.

Because of the variation in fossils and in the number of proposed genera, there is still debate about whether *Proconsul* is hominoid (ape) or stem catarrhine (McNulty et al., 2015, 42; Andrews & Harrison, 2005, 105). Those who take simple-to-complex evolution for granted believe that the proconsulids must have shared a LCA with other Miocene apes. However, no specific earlier genus has been proposed as the LCA. Nor are the proconsulids considered a direct ancestor of the living apes or humans, but rather, a sister taxon..

Since the fossil evidence seldom contains postcranial fragments, comparisons between *Ekembo* and *Afropithecus*, *Heliopithecus*, *Equatorius*, *Nacholapithecus*, *Nyanzapithecus*, *Rangwapithecus*, *Turkanapithecus*, *Mabokopithecus*, *Xenopithecus* are usually based on teeth, jaw fragments, and occasionally skull fragments. *Morotopithecus* has a greater amount of fossil evidence, allowing for comparisons of the skull, vertebrae, and femur (McNulty et al., 2015, 46).

c. Danuvius. (11.6 Ma, Middle to late Miocene)

Visual
10-27

The majority of Miocene apes have been discovered in Asia and Africa. However, *Danuvius guggenmosi* is a European discovery from near the Danube River in Bavaria.

Danuvius is known from 38 fragments believed to come from four individuals. Twenty-one of these – about 15% of a skeleton (Böhme et al., 2019, 6) – are attributed to a single male. The bones include not only jaws and teeth, but also a complete ulna (lower arm bone) and a mostly complete tibia (shin bone) from the male and a partial femur (upper leg bone) from a female (Böhme et al., 2019, 2). The other parts are believed to be from at least two other individuals. Based on the teeth and jaw fragments, *Danuvius* is considered dryopithecine.

- Size estimates for *Danuvius* range from 17 to 31 kg, between siamangs and bonobos.
- Several features such as the hand are believed to show the ability for suspensory (limb hanging) behavior, but some think it could also walk bipedally (Böhme et al.. 2019, 2-5).
- The ulna of *Danuvius* is comparable to that of *Pan paniscus*, the bonobo (Böhme et al.. 2019, 3).
- The limb measurements of *Danuvius* are not unique Based on reconstructed bone lengths, two other Miocene apes, *Oreopithecus* and *Hispanopithecus,* are believed to have a tibia-to-ulna ratio comparable to *Danuvius* (Böhme et al.. 2019, 3).

One of the most interesting claims about *Danuvius* is that unlike living apes, it had arms and legs of similar length. However, this claim is based on a single lower arm bone (ulna) and leg bone (tibia) believed to be from one male, and a partial upper leg bone (femur) from a single different individual, a female. One might question the validity of assuming that these two individuals, whose age we do not know, represent every male and female member of the species.

Whereas the idea of complex-to-simple allows for the possibility that the dryopithecines (perhaps *Danuvius*) were separate created types, those who believe in simple-to-complex evolution require transitions leading to and from each type. Before we can draw firm conclusions about the possible transitional status of *Danuvius*, we need many more fossils than just these few.

d. Ouranopithecus/Graecopithecus (9.6-7.4 Ma, late Miocene)

Fossils of *Ouranopithecus* have been found in Greece and Turkey. The original description was based only on cranial and dental remains (Miller & Rossie, 2018, 9), though *O. macedoniensis*, found in Greece, is based on a partial skull, several mandibles, isolated teeth, and two finger bones. *O. turkae* from Turkey is based only on maxilla and several partial mandibles (Grehan & Schwartz, 2009, 1829).

As noted previously, *Graecopithecus* and *Ouranopithecus* may be different names for the same genus. Only one nearly complete face is known for the latter (Ciochon & Etler, 1994, 55-57). It is difficult to be certain about the phyletic position of these fossils based on such scanty evidence.

e. Hispanopithecus (10-9.5 Ma, Middle Miocene)

Visual # 10-28

Hispanopithecus laeietanus was identified based on fragments of a skull, upper and lower jaw, isolated teeth, and a partial skeleton including several limb fragments, found in northeastern Spain. Some consider it a junior synonym of *Dryopithecus* (Grehan & Schwartz, 2009, 1828). As noted previously, it is believed to have a tibia-to-ulna ratio comparable to *Oreopithecus* and *Danuvius* (Böhme et al.. 2019, 3).Whether it is the same genus as *Dryopithecus* or is a valid taxonomic group, it is assigned to Tribe Dryopithecinae (Almécija et al., 2021, 6).

f. Limnopithecus/Dendropithecus (Early Miocene, small bodied apes)

The species *Limnopithecus legetet* was named in 1933 based on two fragments found at the Legetet Formation in Kenya, an adult mandible containing two teeth and a juvenile mandible fragment containing a canine and several premolar teeth. In 1943 several more fragments were included and a second species (*L. evansi*) was named. The two were later reclassified into a single species and then separated again. Other fragments have been identified at several locations in Kenya and Uganda (Cote et al., 2016, 3-7).

In the 1950's the fragments of *Limnopithecus* were interpreted by some as gibbonlike, resulting in it being regarded as a potential gibbon ancestor (Tuttle, 2006, 16). Others believed the remains represented a stem hominoid or primitive catarrhine. Later in the 1950's, several postcranial and craniodental remains attributed to at least four individuals were added to the genus. These included fragments of two ribs, a scapula, and a humerus (Tuttle, 2006, 16-17). However, in the 1970's some began to interpret the new fossils as closer to *Dryopithecus (Proconsul)* (Cote et al., 2016, 4). The fossils of *L. macinnesi* were transferred to a new genus and species, *Dendropithecus macinnesi* (Harrison, 2002, 312; Tuttle, 2006, 18), previously mentioned as one of the dendropithecoids.

Limnopithecus is known almost entirely from jaw fragments and teeth. It has been subdivided, combined with other genera, and re-elevated to its own genus several times. Some have considered it to have affinities with *Proconsul*, others with other hominoids, and others with hylobatids. Its postcrania are more similar to platyrrhines (New World monkeys) than catarrhines, leading some to doubt its status as a hominoid at all (Benefit, 1999, 168). In short, very little is known about it with certainty.

g. Oreopithecus (9-7 Ma, Miocene)

Visual # 10-29

Oreopithecus bambolii is found only in two areas of Italy, Tuscany and Sardinia, in an area believed to once have been an isolated island in the Mediterranean (Andrews & Harrison, 2005, 110).

Though there are reported fossils of several dozen individuals in the area, only one consists of more than a few fragments. IGF11778, the fossil referred to when *Oreopithecus* is described in the literature, is one of the few relatively complete postcranial skeletons of any fossil primate anywhere (Rook et al., 2004, 348). Despite the relative completeness, the fossil is embedded in a lignite (coal) slab and is very badly deformed, almost completely flattened (Hammond et al., 2017, 830-1).

- Micro CT scans show that the labyrinth (inner ear) of *Oreopithecus* is close to that of the great apes, especially chimpanzees, but is regarded as lower than that of humans (Rook et al., 2004, 351-2).
- *Oreopithecus* was one of the only apes (the other is possibly *Dryopithecus*) with lumbar vertebrae like those of living hominoids. (MacLatchy et al., 2000, 177; Moyà-Solà et al., 2004, 1342)
- *Oreopithecus* teeth are unlike those of any other fossil ape (Andrews & Harrison, 2005, 109).
- Because the skeleton is so badly crushed, scientists cannot be certain whether *Oreopithecus* was a cercopithecoid (Old World monkey), stem hominoid, or hominid (Almécija et al., 2021, 8).
- Based on the single deformed skeleton, *Oreopithecus* is believed to have had an orthograde (upright) orientation.

  There are four opposing hypotheses as to why it had this posture.

  1. It acquired its posture by adaptation to climbing and below-branch movement
  2. It became upright as it adapted to bipedal locomotion.
  3. It acquired its features through convergent evolution in which both *Oreopithecus* and similar types happened to acquire corresponding features through random mutations (Rook, 2009, 69).
  4. It was designed that way.

Many of the dryopithecines were described based on teeth and jaw fragments. Only a few are known from cranial fragments. Postcranial fragments such as ribs, vertebrae, or limb bones are extremely rare. *Oreopithecus* is the only one known from a fairly complete skeleton.

Due to the lack of fossils other than the single skeleton, *Oreopithecus* remains a puzzle. Some believe it is somehow related to the dryopithecines, while others believe it is a sister taxon.

h. Pierolapithecus**.** (13 Ma, Middle Miocene)

Visual # 10-30

The great and lesser apes are commonly believed to have diverged around the Middle Miocene, but the LCA is unknown. The relationship between Miocene and extant apes is debated (Moyà-Solà et al., 2004, 1339).

One proposed ancestor is *Pierolapithecus catalaunicus*, considered one of the dryopiths (Almécija et al., 2021, 6). It is known from a face and partial skeleton including 83 bone fragments (Moyà-Solà et al., 2004, 1339) found in Catalonia, Spain, believed to be from a single individual. The skeleton is interpreted as indicating orthogrady (upright posture), and the broad and shallow thorax is more characteristic of apes than monkeys (Alba & Moyà-Solà, 2009, 78). Though the hands and wrists resemble those of modern apes (Miller & Rossie, 2018, 9), the hand does not indicate suspensory behavior, unlike the modern apes (Moyà-Solà et al., 2004, 1343).

Many features of the head of *Pierolapithecus* are different from all other known Miocene Eurasian hominoids including *Dryopithecus* (Moyà-Solà et al., 2004, 1339-40). However, it has other features shared with extant great apes, *Dryopithecus*, *Sivapithecus*, *Ankarapithecus*, and *Ouranopithecus,* but not with *Proconsul*, *Afropithecus*, or *Morotopithecus* (Moyà-Solà et al., 2004, 1340).

Since the fragments are attributed to a single individual, it is difficult to draw firm conclusions about the genus. The uncertain evidence leads to contradictory hypotheses about its correct taxonomic position (Moyà-Solà et al., 2004, 1343).

i. Griphopithecus. (14-15 Ma, Miocene)

Fossils identified as *Griphopithecus* have found in the middle Miocene of Turkey and Eastern Europe, as well as Kenya in Africa (Alba & Moyà-Solà, 2009, 80-81). However, it is known only from teeth and jaws (Andrews & Harrison, 2005, 107); Kelly et al., 2007). Because the evidence is so fragmentary, there is no consensus on its relationships with other fossil primates (Almécija et al., 2021, 7). However, it is often grouped with the kenyapiths (Alba & Moyà-Solà, 2009).

j. Kenyapithecus. (14-15 Ma, Miocene)

Visual
10-31

There has been a great deal of uncertainty regarding *Kenyapithecus* fossils. As the name implies, the first ones were found in Kenya. *K. wickeri* was first identified at Fort Ternan in that country in 1962. However, shortly thereafter a fossil maxilla previously identified as the type specimen of *Sivapithecus africanus* (BMNH 16649) was transferred to *Kenyapithecus*. Some authorities are not convinced that the transfer was correct and believe that it should either be transferred back to *Sivapithecus* or else should be considered *Proconsul nyanzae.* Excavations at Maboko Island in Kenya in the early 1980's later unearthed 34 teeth, a fragment of an ulna, and a fairly complete but deformed mandible attributed to a different species, *K. africanus*. More excavation in 1987-89 yielded 32 more specimens including another deformed mandible and multiple teeth (Benefit & McCrossin, 1992, 11).

In addition to the teeth and maxillae, a humerus (arm bone) was found at Fort Ternan (McCrossin & Benefit, 1997, 242). Based on this fossil and the aforementioned fragment of an ulna, *Kenyapithecus* is said to have had modern hominoid features but the pronograde (forward leaning) body plan typical of monkeys rather than the orthograde (upright) body plan of apes (Almécija et al., 2021, 6; Alba & Moyà-Solà, 2009, 80).

Yet another different species has been named in Turkey and Eastern Europe (Alba & Moyà-Solà, 2009, 80-81). *Kenyapithecus kizili* from Paşalar, Turkey is based on a partial left maxilla and several dozen isolated teeth. It is difficult to be certain about its overall body shape because little is known about it besides its dentition (Kelley et al., 2008, 469-470).

The transfers between genera underscore the fact that though there are a significant number of fossils attributed to *Kenyapithecus*, there is disagreement among authorities on how they fit into the ancestry of apes.

***k. Equatorius*.**

Visual
10-32

Between 1990 and 1992, researchers found 41 teeth believed to come from at least five individuals at the Kipsaramon site in Kenya. 38 of the teeth were first attributed to *Kenyapithecus* but were later transferred to a newly created genus, *Equatorius*. The reclassification greatly reduced the number of samples supporting previous descriptions of *Kenyapithecus africanus* (Kelley et al., 2008, 471).

Besides the teeth at Kipsaramon, other fossils were later found at a higher location (BPRP #122). These included a mandible fragment containing several teeth and a partial skeleton (Kelley et al., 2002; Sherwood et al., 2002, 63-64). Unlike many other primate fossil finds that consist only of teeth, this one included over 20 fragments of the postcranial skeleton. Among these were parts of several arm and leg bones, parts of the upper skeleton, a vertebra, several finger and toe bones, and a number of rib fragments (Sherwood et al., 2002, 64-70). Study of the fossils led to the conclusion that *Equatorius* was fairly large, at least as large as *Nacholapithecus* (Takano et al., 2020, 146).

Though the bones comprised a fairly small percentage of a complete skeleton, they did allow researchers to conclude that *Equatorius* was monkey-like rather than apelike..

- Extant apes have an orthograde (upright) posture. However, *Equatorius* had a typical monkey-like pronograde pattern (Moyà-Solà et al., 2004, 1342; Almécija et al., 2021, 6).
- The ribs of apes are more curved than those of monkeys, but the fragments of the first rib of *E. africanus* are monkeylike (Moyà-Solà et al., 2004, 1340).

Equatorius is considered more derived, i.e., more evolved, than *Proconsul* (Andrews & Harrison, 2005, 106). Whatever it was, it was more monkeylike than *Proconsul*. It is not believed to be on the line of human descent.

One might be skeptical of the conclusions about the overall body characteristics of the kenyapithecines due to the limited number of postcranial fossils. At any rate, there is no clear affinity with either modern apes or monkeys.

2. SIVAPITHECINES.

Though sivapithecines are usually considered part of the dryopithecine group, they are associated more with Asia than with Europe and Africa.

a. Ramapithecus. (13.5-6.3 Ma, Middle to Late Miocene ape)

Visual
10-33

The first *Ramapithecus* fossils were found in India in 1932. For years, its total fossil evidence consisted of several teeth and jaw fragments, with incisors smaller than those of apes (Morris, 1974, 172).

The discovery of *R. brevirostris* in India in 1967-69 changed the interpretation of *Ramapithecus*. Until that time, no bones of the face, skull, or any other part of the body had been recovered (Simons, 1964, 50; Simons, 1969, 319; Simons & Pilbeam, 1971, 23). However, more complete samples showed that it did not have the parabolic dental arcade which had been assumed on the basis of the previous limited samples (Walker & Andrews, 1973, 313), but instead had the typical U-shaped jaw of an ape. Its jaws were shaped wrong for a human ancestor.

As a result of the later discoveries *Ramapithecus* was subsumed into the genus *Sivapithecus* (Patnaik, 2008, 197), and is now accepted as a junior synonym of *Sivapithecus* (Almécija et al., 2021, 6; Grehan & Schwartz, 2009, 1829; Andrews & Harrison, 2005, 107), perhaps the female form (*Encyclopedia Britannica*, 2015; Andrews & Cronin, 1982).

b. Sivapithecus (12.2 Ma, Middle to Late Miocene)

The first definite orangutan (*Pongo*) fossils occur in the Pleistocene. However, several Miocene fossils are considered pongine.

Sivapithecus is one of the best known of these. Its skull is similar enough to the orang that it is considered a member of the same family tree (Miller & Rossie, 2018, 9). However, the lower jaw of *Sivapithecus* has several dissimilarities to the *Pongo* mandible (Chaimanee et al., 2004, 440-1). It is not considered an ancestor to *Pongo*, but instead a sister (Andrews & Harrison, 2005, 107).

Sivapithecus fossils were first discovered in the Siwaliks deposits of India and Pakistan. Three species names have been given. *S. indicus* is known from a single cranium and lower jaw (Ciochon & Etler, 1994, 52-3) and a partial innominate (hip) bone (Morgan et al., 2015). *S. sivalensis* is known from a first upper incisor, right second lower molar, and third upper premolar (Patnaik, 2008, 200) and a partial femoral head (Morgan et al., 2015, 85). *S. parvada* is known from even fewer cranial and postcranial remains, plus several molars (Grehan & Schwartz, 2009, 1829).

In general, the difference between the three named species has to do with size. *S. sivalensis* is slightly smaller than *S. indicus*, and *S. parvada* is the largest (Kelley, 1988).

Some believe there is no compelling reason to separate *indicus* from *sivalensis* (Bhandari et al., 2018, 13-14). Many museums display a cast of the *S. indicus* skull reconstruction designated GSP 15000 (Geological Survey of Pakistan), first described in 1982 by Pilbeam (Pilbeam, 1982). Recently, a number of museums have begun to display a slightly different looking cast labeled *S. sivalensis*. This is not based on any new fossil material, but is simply a different arrangement of the fragments of GSP 15000 relabeled *sivalensis* rather than *indicus*.

Early paleomagnetic data had *S. indicus* dated 12.5-9.3 Ma, *sivalensis* 8.8 - 7.4 Ma, and *parvada* 9 Ma. However, these ages have been revised upward due to stratigraphic positions. Latest age estimates for *Sivapithecus* range vary from 13.5 ma to 7.5 ma (Patnaik, 2008, 202).

c. ***Gigantopithecus*** (8.85-6.3 Ma, Miocene to Pleistocene)

Visual
10-34

A fossil believed to be pongine (McMenamin, 2015, 4) known as *Gigantopithecus blacki* or *Indopithecus gigantaeus* (Patnaik, 2008, 198; Almécija et al., 2021, 9) is often grouped with *Sivapithecus*. Three species of *Gigantopithecus* have been named, two from the Late Miocene (*G. giganteus* and *G. bilaspurensis*) and one (*G. blacki*) from the Pleistocene.

We know almost nothing about *Gigantopithecus* except the size and shape of the teeth and lower jaw (Patnaik, 2008, 206). The teeth are isolated and highly worn (Grehan & Schwartz, 2009, 1827).

- *Siwalik specimens from Pakistan/India.*
  Sivapithecus giganteus is the oldest name attributed to Late Miocene fossils related to *Gigantopithecus*. The fossil was described based on a single lower molar M3 from the Late Miocene of the Siwaliks, differing from *Sivapithecus* mainly in size. Later, a mandible with similar sized teeth was discovered and given a new species name, *Gigantopithecus bilaspurensis*. However, many researchers later combined the mandible with the lower molar previously used to identify *Sivapithecus giganteus*. *G. bilaspurensis* and *S. giganteus* are now commonly considered together under the species name *Gigantopithecus giganteus* (Begun, 2007, 1298; Kelley, 1998, 305-6; Patnaik, 2008, 202; Bhandari et al., 2018, 2).

  G. bilaspurensis, also known as *I. giganteus*, is known from the partial lower jaw fossil CYP359/68, found in the Siwaliks of India and Pakistan. It is dated anywhere between 9.23 - 5.5 Ma (Patnaik, 2008, 199-202; Grehan & Schwartz, 2009, 1827). *G. giganteus*, dated 7.8 - 7.5 Ma, is based on a right lower second or third molar (Grehan & Schwartz, 2009, 1827). As of 2008, there was no known cranium nor any parts of the skeleton that might tell us how it moved (Patnaik, 2008, 206).

- *G. blacki specimens from China.*
  A different species attributed to *Gigantopithecus*, *G. blacki,* was identified in rocks dated much later, the early and middle Pleistocene of China (Patnaik, 2008, 197-8; Zhang & Harrison, 2017, 157).

  G. blacki is believed to be the largest hominoid that ever lived. It was first identified based on a right lower third molar and a partial mandible (Grehan & Schwartz, 2009, 1827; McMenamin 2015, 4). Since then perhaps two thousand teeth but only four partial mandibles have been discovered. Not a single bone is known from the rest of the body (Zhang & Harrison, 2017, 153-9). Zhang and Harrison note that the teeth seem to have been gnawed by something. They speculate that porcupines (which need calcium for their quills) may have eaten all the rest of the bones.

The Pakistani and Indian *G. giganteus* fossils are dated millions of years before the Chinese *G. blacki* fossils, dated 2.0 - 0.3 Ma, with no known transitions documenting movement of *G. giganteus* to China and subsequent evolution to the much larger *G. blacki*.

The date assigned to *G. blacki* would make it contemporary with orangs and *H. erectus* (Ciochon & Etler, 1994, 58), ruling out *blacki*, at least, as their ancestor. It is considered a sister taxon to the orangs.

Movie trivia: Rudyard Kipling's novel *The Jungle Book* did not have the giant orangutan-like character King Louie, the king of the apes. He was added in the 1967 Disney movie of the same title and was based on *Gigantopithecus blacki* (Dove, 2008).

D. MIOCENE FOSSILS OF LESS CERTAIN AFFINITY.

It is not always clear whether the following types should be grouped with the lesser apes, great apes, dryopithecines, sivapithecines, or something else.

1. *MOROTOPITHECUS.* (20.6 Ma, early Miocene ape)

Visual
10-35

M. bishopi was originally attributed to *P. major* but is now considered more derived (evolved) than *Proconsul* (Andrews & Harrison, 2005, 106) The first *Morotopithecus* fossils consisted of facial and dental fragments found between 1961-1965 at Moroto, Uganda, including one definite mandible with several teeth and a second possibly belong to same type. These were combined with later discoveries such as a single lumbar vertebra designated UMP 67.28 resembling those of extant hominoids, into *M. bishopi* (Young & MacLatchy, 2004, 172).

The vertebrae were found in water deposited sediment, some overlain by basalt. (Gebo et al., 1997, 401; Young & MacLatchy, 2004, 172) A 1994 discovery designated MUZM 60 included a fragment of a scapula (shoulder blade). MUZM 80 consisted of six fragments of the left & right femora. The orientation of the head of the femur was not like living Old World monkeys, but instead like some Miocene and extant hominoids, and also like the New World spider monkey *Ateles* (MacLatchy et al., 2000, 162-9). Depending on which bones are used in analysis, body mass estimates range from 20 to 54 kg, or about 44 to 118 lbs. (MacLatchy et al., 2000, 169).

There are not enough *Morotopithecus* fossils to lead to unanimous agreement as to whether it was closer to the great or lesser apes (Young & MacLatchy, 2004, 164). Some (e.g., Gebo et al., 1997) believe it is a primitive member of the line leading to great apes. However, since it is dated about 9 million years earlier than the lesser ape *Hylobates*, others consider it a lesser ape (MacLatchy et al., 2000, 180).

Young and MacLatchy analyzed data for over a dozen extinct and extant ape species and came up with 15 equally parsimonious (i.e., equally likely) cladograms. Most of these suggest that *Morotopithecus* was a primitive member of the great ape clade, but that it lived 6.3 million years before the split of great and lesser apes. (If this were the case, *Morotopithecus* would have had to remain unchanged for over 6 million years while many other apes were undergoing drastic changes all around it.) Young and MacLatchy's work shows that the fossil characters researchers choose as more important can lead to very different conclusions about phylogenetic positions (Young & MacLatchy, 2004, 168-178). Its true phylogeny cannot be known for certain.

Morotopithecus seems to have had hominoid (ape) features but a pronograde monkey-like body plan (Almécija et al., 2021, 6; Moya-Sola et al., 2004, 1342). Nevertheless, it is considered the oldest hominoid to share several features with the living apes. However, because of differences with the Miocene apes such as *Sivapithecus* (12.5-8.5 Ma), *Proconsul/Ekembo* (21-11 Ma), from which it differs in the skull, vertebrae, and femur (McNulty et al., 2015, 46), *Afropithecus* (18-16 Ma), and *Equatorius* (15.6 - 15.4 Ma), MacLatchy et al. believe that Miocene apes may belong to a different radiation than the one that led to the living hominoids. Both Gebo et al., MacLatchy et al., and Moyà-Solà et al. believe *Morotopithecus* is not the ancestor of all living hominoids but instead a sister taxon (Gebo et al., 1997, 403; MacLatchy et al., 2000, 180; Moyà-Solà et al., 2004, 1342)

2. ***NACHOLAPITHECUS*** (15 Ma, Middle Miocene)

Visual # 10-36

Nacholapithecus kerioi, named for the Nachola Formation of Kenya, is represented by one of the most complete primate skeletons, KNM-BG 35250. (Unfortunately, the skeleton is deformed.) Other than the single skeleton, the only other fossils known are several isolated postcranial fragments, jaw fragments, and teeth (Harrison, 2010, 445). These include fragments identified as BG-14708, BG-17835, BG-14700, and BG-17840 (Kelley et al, 2008, 472) and lower spine fragments KNM-BG 42753I and KNM-BG 47687A (Kikuchi et al., 2016, 117). Based on these parts, the body mass was estimated at about 22 kg (Takano et al., 2020, 135). However, the ischium of the skeleton is fragmentary so it is not very useful in determining the anatomy of the torso (Morgan et al., 2015, 86).

Nacholapithecus is considered more derived (evolved) than *Proconsul* (Andrews & Harrison, 2005, 106). Based on the single skeleton and the scattered parts, researchers have concluded that:

- It had a longer premaxilla than *Proconsul* (Begun, 2007, 1275).
- Compared to *Proconsul*, it had "relatively larger forelimb bones, longer clavicle and scapular spine, and longer pedal rays"(Harrison, 2010, 447).
- It had several features found in hominoids such as the lack of a tail (Alba & Moyà-Solà, 2009, 79), but it had a pronograde monkey-like body plan (Almécija et al., 2021, 6; Moyà-Solà et al., 2004, 1342).
- Its elbow seems intermediate between that of early catarrhines and that of apes. If it was not created that way, there are two possibilities: (1) It represented a transitional stage from primitive catarrhines toward living apes, or (2) it acquired the elbow structure through random mutations that produced parallel evolution (Takano et al., 2020, 147).
- It did not have the "full suite of suspensory features predicted to characterize fossil crown hominoids." In particular, its shoulders do not seem to have been capable

of the full circular motion needed for ape brachiation through the trees (Patel et al. 2009, 770).

- The joints on its forelimbs are the size of the corresponding joints of chimpanzees, but the joints on its hind limbs are much smaller, closer to those of baboons.
- Its anterior palate was unlike those of hominids (Begun, 2007, 1286).

Its affinity to hominoids and catarrhines is somewhat contentious (Takano et al., 2020, 146). Some authors have classified it as a proconsuloid (subfamily Afropithecinae), while others place it alongside *Equatorius*, *Kenyapithecus*, and *Griphopithecus* in the griphopithecines or kenyapithecines (Takano et al., 2020, 146; Begun 2005, 2). It is unclear if it is closer to stem catarrhines, stem hominoids, or hominids (Harrison, 2010, 447). Because it had monkey-like pronograde orientation and "primitive" facial anatomy, some believe it is not a member of the great ape/human clade but is instead a stem hominoid (Moya-Sola et al., 2004, 1343). There is not sufficient fossil evidence to draw firm conclusions (Takano et al., 2020, 147).

Because of all its oddities, Begun (2007, 1285) describes *Nacholapithecus* as a "weird, unique fossil ape without a modern counterpart."

3. ***KAPI ramnagarensis*** (13.8–12.5 Ma, middle Miocene ape)

Visual
10-37

Kapi ramnagarensis has been identified as a small-bodied Miocene ape based on a single molar found in an area of river and stream deposits known as the Lower Siwaliks of Ramnagar, India (Gilbert et al., 2020). The tooth is gibbon-like, but as in other cases, it is impossible to draw firm conclusions about the entire species based on a single fragment.

4. ***KHORATPITHECUS*** (13 - 10 Ma, Middle Miocene)

The Thai fossil *Khoratpithecus* (also reported to have occurred in Myanmar - Jaeger et al., 2011) is considered pongine. It is considered different enough from other Miocene hominoids to be classified as a unique type (Chaimanee et al., 2004, 441).

Khoratpithecus is known only from cranial and dental remains (Miller & Rossie, 2018, 9). Three species have been named.

- *K. chiangmuanensis* is based on isolated teeth.
- *K. piriyai* is based on a single partial mandible (lower jaw) containing several teeth (Chaimanee et al., 2006; Grehan & Schwartz, 2009, 1828). It had a U-shaped dental arcade (Chaimanee et al., 2004, 439).
- *K. ayeyarwadyensis* is based only on a partial left mandible containing lower teeth P_3 - M_2 (Jaeger et al., 2011, 2).

Until more fossils have been recovered, it will be difficult to be sure about the rest of the anatomy.

5. ***ANOIAPITHECUS - possible afropithecid*** (10.9 Ma, Middle Miocene)

Visual
10-38

Anoiapithecus brevirostris was discovered in Catalonia, Spain. It is known from a single adult skull IPS43000 preserving the face, partial mandible, and several teeth. The rear of the skull is missing. There are no postcranial fragments.

The muzzle is unusually short for Miocene hominoids or living apes (Moyà-Solà et al., 2009, 9601-6). Of course, since we only have one partial skull to work form, we cannot tell if this was characteristic of all the members of the species.

Some believe *Anoiapithecus* belongs to the same genus as the previously mentioned *Pierolapithecus* (Alba et al., 2013, 574).

6. ***ANKARAPITHECUS*** (10.7 - 10.6 Ma, Middle Miocene)

The genus *Ankarapithecus* from central Turkey contains only a single species, previously known as *Sivapithecus meteai*. It is generally considered pongine, but is based on mandible and skull fragments only. The features suggest affinity with the great apes (Moyà-Solà et al., 2004, 1340), specifically with with orangs (Grehan & Schwartz, 2009, 1826).

7. CHORORAPITHECUS (10.5-10 Ma, Middle Miocene)

The East African genus *Chororapithecus abyssinicus* was found in the Chorora Formation of Ethiopia (once known as Abyssinia). It has been described as a large bodied ape, but the description is based on isolated teeth only. The fossils include one canine and eight partial molars from at least three individuals.

There is no fossil record for either gorillas or chimps (Miller & Rossie, 2018, 9), which appear suddenly in the Pleistocene. The teeth of *Chororapithecus* are similar to those of gorillas, but it is considered too specialized to be their direct ancestor. It is the first Miocene ape species considered a possible member of their clade, that is, a sister group of the gorillas rather than an ancestor (Suwa et al., 2007, 921-4).

Many evolutionists believe the LCA of the great apes and lesser apes lived about 15 Ma; the orangutan/African ape LCA about 12 Ma; the gorilla/chimp LCA 7.5 Ma; the chimp/human CLCA about 5 Ma, (Ciochon & Etler, 1994, 51). Creationists believe the major types of apes were created as separate kinds rather than evolving from a LCA. At any rate, *Chororapithecus* is considered too recent to be the common ancestor of the living apes.

8. ***LUFENGPITHECUS.*** (9-7 Ma, late Miocene)

Visual # 10-39

Though there are no known transitional fossils leading to orangutans from some ancestor, several types believed to be somewhat similar to orangs have been proposed. Besides the previously mentioned *Sivapithecus* (Indo-Pakistan Miocene) and *Khoratpithecus*, another candidate is *Lufengpithecus* (Chinese and Thai Middle Miocene) . Both are generally considered pongine, somewhat close to orangutans.

Several species of *Lufengpithecus* have been named in China, distinguished mostly by size and geography (Begun 2007, 1299). Two species are known from partial skulls and a number of teeth; the third also includes a few postcranial remains.

- *L. keiyuanensis* was named from isolated teeth and fragments of a mandible and maxilla (Grehan & Schwartz, 2009, 1828; Ji et al., 2013, 3776).
- *L. hudienensis* is represented by YV0999, a partial skull recovered at Shuitangba. It is believed to be from a younger individual than ZT 299 below (Ji et al., 2013, 3776). It contains only the front of the skull, including most of the face. (Image at Kelley & Gao, 2012, 6883.)
- *L. lufengensis* was discovered near Shihuiba, China. It was originally named based on a single mandible containing two incisors and a molar. There was a report in 1978 that said it also included some postcranial remains. These included a partial scapula, clavicle, radius, a metatarsal (foot) bone, and two toe bones (Begun, 2007, 1299). However, as of 2022 these fragments have not been described in the literature.

  Two *lufengensis* skulls were found later. Skull PA 644, believed to be from an adult, was at first attributed to *Sivapithecus* but later ascribed to *L. lufengensis* (Etler, 1984, 23; Ji et al., 2013, 3772-6). Though the face of PA 644 can be made out, it is badly damaged. (Image at Kelley, 2002, 380.) The partial cranium ZT 299 from Shuitangba, believed to be from a young juvenile, is also attributed to *L. lufengensis*. It preserves most of the facial skeleton (Ji et al., 2013, 3772-4) but none of the back of the skull. (Image at Ji et al., 2013, 2774.) It is considered possible that PA 644 and ZT 299 represent different species (Ji et al., 2013, 3778)

PA 644 is damaged enough to produce uncertainty about the appearance of adults. Skulls YV0999 and ZT 299 are believed to be from young juveniles. Since the shape of the face and head change so much between baby and adult primates, it is difficult to be certain from these two how adults would have looked.

Lufengpithecus had no special resemblance to any known Asian or African hominoids. In particular, despite the fact that its teeth are closer to *Pongo* than those of *Sivapithecus*, it is likely excluded from *Pongo* ancestry because of face & skull differences (Chaimanee et al., 2004, 441). Besides, it occurs too late in the fossil record to be the ancestor of orangs (Ciochon & Etler, 1994, 57). It is now considered a sister taxon to *Pongo* rather than an ancestor (Harrison et al., 2002, 220).

9. NAKALIPITHECUS (10 Ma, middle Miocene).

Visual # 10-40

The East African species *Nakalipithecus nakayamai* is known only from 11 isolated teeth and a right jaw fragment containing three molars. It is believed to have been about the size of a female gorilla (Miller & Rossie, 2018, 9).

Since the LCA of the living apes is estimated to have lived at least 12 Ma (Ciochon & Etler, 1994, 51), *Nakalipithecus* is considered too recent to be their ancestor.

10. *SAMBURUPITHECUS* (9.5 Ma, late Miocene)

Samburupithecus kiptalami is known only from a single fragment of a maxilla (upper jaw) from the Samburu Hills of Kenya, designated KNM-SH 8531. The tooth shape is considered to resemble that of gorillas. (Benefit & McCrossin, 1995, 241; Miller & Rossie, 2018, 9; Kunimatsu et al., 2016, 1-3).

Even those who believe apes and humans evolved from some ancient LCA consider *Samburupithecus* too recent to be ancestors of living apes (Miller & Rossie, 2018, 9). Some consider it likely a late-occurring stem hominoid (Almécija et al., 2021, 7). However, with only a single fossil to go on, it is difficult to draw any firm conclusions about the animal's anatomy.

11. *SAHELANTHROPUS.* (7 Ma, Late Miocene)

There are no universally accepted fossil ancestors of gorillas. However, one fossil that seems similar to them stands out. *Sahelanthropus tchadensis*, nicknamed Toumai ("hope of life") was discovered in the Late Upper Miocene of Chad in 2001 (Smithsonian Institute, 2015; Andrews & Harrison, 2005, 104). It was first identified from a single partially crushed skull, five jaw fragments, and a few teeth. The skull is very apelike, similar to a gorilla or chimpanzee and having a brain capacity of only about 350 cc. Later discoveries include two more partial lower jaws, 1 left lower canine, and a crown of the right P^3. (Brunet et al., 2005, 753; Grehan & Schwartz, 2009, 1829). The fossils are believed to come from at least 6 individuals. A partial femur TM 266-01-063 has also been attributed to *Sahelanthropus* (Macchiarelli, et al., 2020).

Based on the single crushed skull, the cranial capacity of *S. tchadensis* is estimated to be less than that of the proposed later human ancestor *Australopithecus* discussed in the next chapter. The neurocranium is long and low. The upper face is extended with a large supraorbital torus (eyebrow ridge). The jaws do not jut out as much as those of than gorillas or chimps (Suwa et al., 2009, 68e1). Also, based on this one skull, *Sahelanthropus* is believed to have been a bit larger than *Ardipithecus*. Both had a short but projecting muzzle. Their muzzles differ from *Australopithecus* and early *Homo* (Suwa et al., 2009, 68e5).

Several paleontologists (e.g., Wolpoff et al., 2006) have noted that the skull bears strong similarities to a female gorilla. If it were considered to belong to the line of human ancestry, it would rule out the well known "later" australopithecines as being on the path to humans because its brow ridge is much closer to that of humans than theirs.

Since *Sahelanthropus* was dated by its discoverers at about 7 million years ago, many say that it is a possible ancestor of the African great apes. Some consider it close to the LCA of humans, chimps, and gorillas (Brunet et al., 2005, 753-4). However, the fossil evidence is so limited that it is impossible to draw firm conclusions.

12. *LACCOPITHECUS* (7 Ma, late Miocene)

Visual # 10-41

Laccopithecus is also from Lufeng in China. It is based on fossil evidence consisting of a nearly complete face, 14 upper and lower jaw fragments, 14 tooth rows, 67 isolated teeth, and one finger bone (Ciochon & Etler, 1994, 52; Harrison, 2016, 97).

Laccopithecus has been proposed as a possible ancestor for the gibbon-like lesser apes. However, it has a number of characters considered primitive and not found in the catarrhines considered more evolved, but instead shared with other pliopithecoids. In particular, its cranium is similar to the only other known pliopithecoid cranial specimens, *Pliopithecus vindobonensis*, *Pliopithecus zhanxiangi*, and *Anapithecus hernyak*. Rather than a hylobatid, *Laccopithecus* is generally accepted as a late surviving pliopithecoid, i.e., a primitive catarrhine (Harrison, 2016, 97). It has no connection with any known later forms.

13. *ORRORIN tugensis* (6-0 - 5.7 Ma, late Miocene)

Only one species of *Orrorin* has been named, *O. tugenensis* from the late Miocene of Kenya (Andrews & Harrison, 2005, 104). The species was named based on two fragments of mandibles designated BAR 1000'00a & b, isolated teeth, and a fragment of a femur designated BAR 1002'00 (Grehan & Schwartz, 2009, 1828; Andrews & Harrison, 2005, 111).

Though *Orrorin* is often mentioned as the possible first hominin, there is so little evidence that it could be either an unknown hominoid with no living descendants, or a precursor of humans or chimps or gorillas (Haile-Selassie, 2001, 180).

14. *ARDIPITHECUS kadabba* (5.8-5.2 Ma, late Miocene). See also *Ar. ramidus* in the next chapter.

Ardipithecus is one of the extremely small number of primate genera found in more than one geologic stratum. Two species have been named: *Ar. kadabba* from the very late Miocene, and *Ar. ramidus* from the Pliocene. ("*Kadabba*" means "oldest ancestor" and "*ramidus*" means "root" in the Afar language used where the fossils were discovered.)

The first *Ardipithecus* fossils, found in the Middle Awash of Ethiopia, were given the species name *Ar. ramidus* and were dated 4.4 Ma in the Pliocene. More *Ardipithecus* fossils were found later in rocks dated hundreds of thousands of years older at 5.2-5.8 Ma (Miocene) and attributed to a second species, *Ar. kadabba*. *Ar. ramidus* will be dealt with more extensively in the next chapter, which deals with Pliocene and Pleistocene apes.

Ar. kadabba is believed by some to be close to the LCA of chimps and humans (Andrews & Harrison, 2005, 104). However, there is not much evidence for it. It is based primarily on teeth and jaw fragments, plus three partial finger phalanges (finger bones) and one from a toe (Semaw et al., 2005, 301-2). Its total fossil evidence consists of less than 3 dozen fragments (Haile-Selassie, 2001, 179-180). There are no skulls or vertebrae.

- Some believe *Ardipithecus* was too far committed in the direction of apes to be a

human ancestor, but too different from the living apes to be considered their possible ancestor (Gee, 1995).
- Some believe it is not a member of the chimp clade because it shares many characters with non-chimp hominids (Haile-Selassie, 2001, 180). Thus, it is considered by some to be an adaptive cul-de-sac.
- Some believe that rather than being an ancestor of *Pongo*, *Gorilla*, *Pan*, and *Homo*, it may be a sister group (Lovejoy et al., 2009a, 104).

Though most of the fossils considered best documented are listed above, paleontologists continue to discover new bones and name new genera and species. These include such names as *Platodontopithecus*, *Fanchangia*, *Barberapithecus*, *Crouzelia*, *Egarapithecus*, and others. Out of all the Miocene types, though, *Ardipithecus* is the only one commonly associated with the line supposed to lead to humans.

IV. CHAPTER SUMMARY.

A. Both creation and evolution are based on unprovable and untestable assumptions. Creation is based on the idea that the universe, earth, and life have shown an overall trend from simple to complex. Evolution is based on the idea that the universe, earth, and life have shown an overall trend from simple to complex.

1. Similar features.
    - Creation: similar features in creatures not considered to be close relatives are most likely due to common design.
    - Evolution: similar features in creatures not considered to be close relatives are most likely due to common ancestry or to convergent evolution by a series of parallel mutations in the two groups.
2. Meaning of fossil suites.
    - Creation: suites of fossils used to identify rock strata likely represent ecological communities.
    - Evolution: suites of fossils used to identify rock strata represent time periods.
3. General explanation of the fossil record.
    - Creation: the great majority of fossils were formed after being buried under under catastrophic condition such as widespread flooding, volcanic eruptions, and the like.
    - Evolution: most fossils form slowly, steadily, and gradually as animals and plants die and fall into bodies of water where they are gradually buried, mineralized, and re-exposed due to erosion.

B. Lack of pre-Eocene primate fossils.
There are no undisputed primate fossils in any geologic layer lower than the Eocene.

- Creation: this is because the fossils in the strata represent ecological communities. Because the Paleocene and lower layers would have had an environment inhospitable to primates, few if any of them would have been buried in those layers.
- Evolution: primates are not preserved below the Eocene because they had not evolved yet.

C. Lack of Eocene apes.
There are no undisputed ape fossils in any geologic layer lower than the Oligocene.

- As above, creation says this is because the suites of fossils represent ecological communities. The Eocene apparently had an environment inhospitable to apes.
- Evolution says that apes are not preserved in the Eocene because they had not evolved yet.

D. Miocene apes.

Dozens of genus and species names have been assigned to Miocene ape and monkey fossils. The number has changed repeatedly as different writers erect, combine, reclassify, and eliminate the names in their publications.

- There are relatively few types of Miocene apes from Africa. The majority of genera and species (not fossils) are from Asia and Europe.
- Miocene apes range in size from *Micropithecus*, smaller than any living ape, to *Proconsul major*, estimated to be almost the size of female gorilla.
- Not a single Miocene ape or monkey has been identified from a 100% complete skeleton.
- Only a handful are known from partial skeletons.
- The great majority were identified from teeth, jaw fragments, and occasionally other bone fragments.
- Out of all the Miocene primates, the only one proposed to have a strong link to any of the Oligocene forms is *Afropithecus*, which is twice the size of *Aegyptopithecus but* has several similarities. However, neither is considered closely connected to humans.
- Out of all the Miocene primates, only one genus is also found in the next higher stratum. The Miocene species *Ardipithecus kadabba* is based on less than three dozen fossil fragments, none of which are from the skull or vertebrae. It is not found in the Pliocene, though a different species attributed to the same genus is. *Ar. ramidus* will be dealt with in the next chapter. Many consider *Ardipithecus* an evolutionary dead end.

Visual # 10-42

In each case, a male and female of the evolving line of ancestors would have had to acquire a great many identical beneficial mutations so as to pass them on to the next generation, but would also have had to acquire a great many complementary beneficial mutations so that their reproductive systems could continue to work together.