

Subject: Science

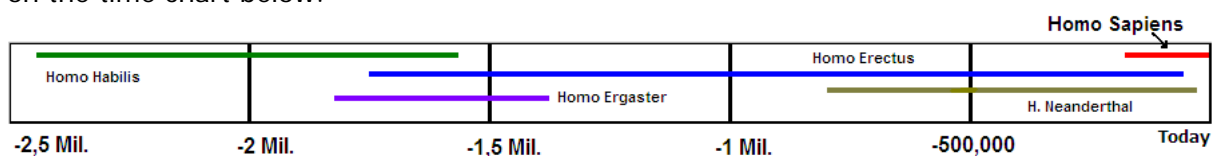
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Human Evolution

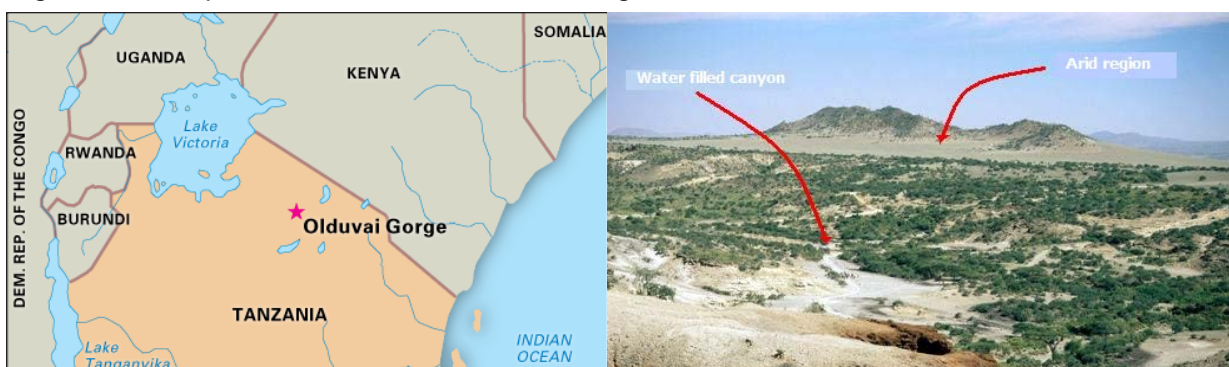
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The theory of evolution was first formulated by **Charles Darwin** (1809 – 1882) in his two books entitled **On the Origin of Species** and **The Descent of Man**. The theory of evolution is based on the principles of natural selection and genetic mutation. It is claimed that organisms are descended from one or several common ancestors and have diversified from this original stock. Thus, all living beings have adapted in time to their environment as the result of these two principles and have increased their probability of survival.

The theory of evolution created a strong reaction mainly because it claimed that human beings evolved from hominoid apes, which are tailless monkeys. It is just because of this claim that Darwin's theory is still debated today; although many clues supporting the theory have been discovered since its publication 155 years ago. We now know that there were several hominoid species before the appearance of the **Homo sapiens**, or the modern human species. **Homo** is the human genus which includes several extinct species as shown on the time chart below.

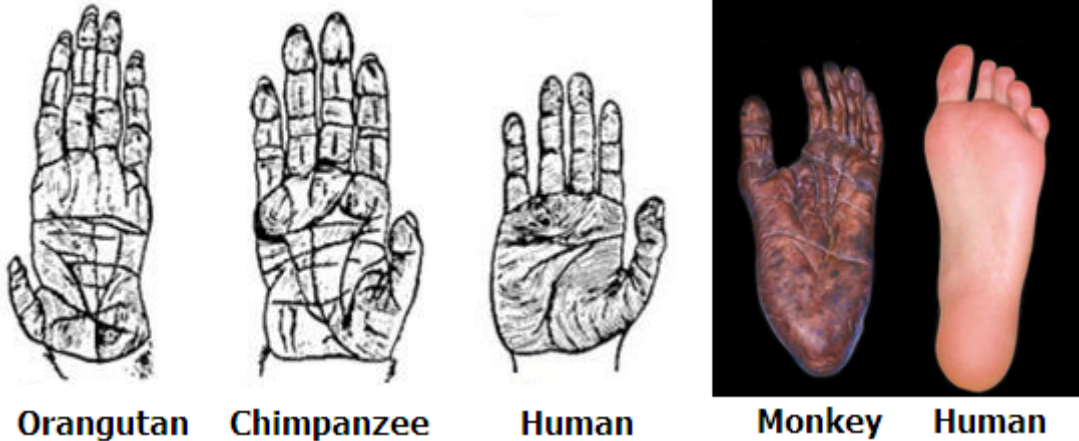


Homo sapiens started its existence some 200,000 years ago in the eastern regions of Africa. This region is located in Tanzania and is populated by many lakes and shallow canyons. Today most of these water filled canyons have dried up, due to the arid climate that transformed the region. It is in this region and especially in the **Olduvai Gorge** that many ancient skeletons and skulls have been discovered. Below we see the map of the region and the present view of the Olduvai Gorge.



Homo sapiens thrived on the shores of these shallow lakes and subsisted with clams, oysters and fish that could be caught with bare hands. In order to compensate for the

bending of light underwater these creatures needed agile hands that could grab and a good coordination between the eyes, the hand and the brain. Their hands had to transform from monkey hands that held branches to hands that could snatch and tear away. They also had to stand on two feet inside the water for a very long time, in order to observe the edible creatures that lived underwater. As the result of walking and standing in water, after many generations, their feet anatomy changed and the fur on their body gradually disappeared. Below we see the difference between the monkey and the human hand and foot.



Orangutan

Chimpanzee

Human

Monkey

Human

The four fingers of the monkeys are longer than the human fingers. They are better adapted for holding and hanging from a tree branch. But the human hand, with a longer thumb is better adapted for grabbing and snatching. The monkey foot with its separation of one toe from the others is better adapted for climbing a tree, while the human foot is better adapted for walking and jumping. Early humans developed bipedalism in water because it gave the advantage of standing upright and using the arms and hands for gathering and hunting underwater animals.

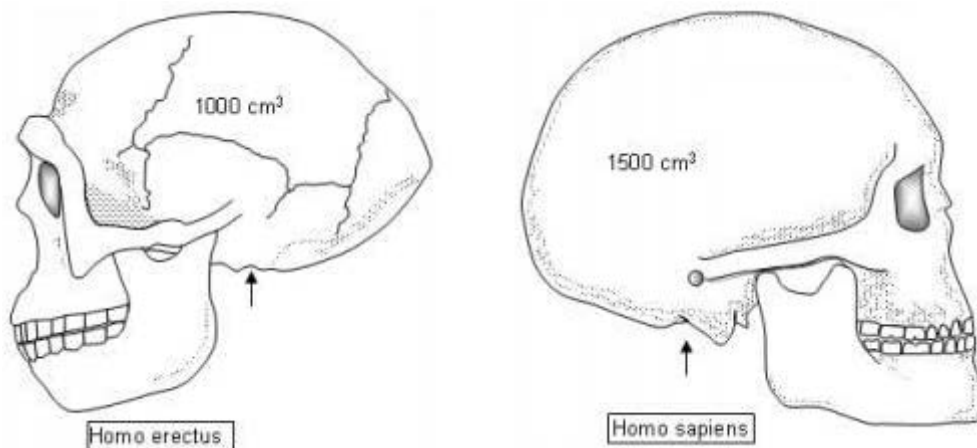


Their first weapon was a simple stick that could be used for piercing shellfish and small fish. This method is still used today as can be seen on the left. This stick became an important tool in the life and development of the early humans. It served not only for hunting small sea and terrestrial animals, but also for keeping the carnivorous predators at a distance. This stick was the first and most important invention of the Homo sapiens that allowed them to survive when the climate and the living conditions changed in the region.



About 120,000 years ago that the climate around the lakes of Tanzania changed drastically and the small lakes as well the canyons started to dry up. Lake animals became scarce and the small amount of remaining shellfish did not suffice to feed the entire group of lake-dwelling Homo sapiens. On the left we see such an early human holding his most important weapon, which gave him the self confidence and courage to leave the region and travel long distances.

Living on land is much more dangerous than living near a lake. If a predator approaches the lake, the human can swim away and avoid the mortal attack. But on the land predators can run much faster than humans and the chance of survival diminishes drastically. So, the early humans had to use their brain and their capacity of evaluating the external conditions which lead to an increase of their brain size. If the human species is the only sovereign group of mammal existing on every part of the earth, -under very different weather conditions and very different climates- it is because of its brain capacity and not because of its body structure. Early humans were rather small in size but were very agile in running and also in climbing trees. Below we see the comparison between the braincases of the **Homo Erectus** and of the **Homo sapiens**.



The braincase of the modern human is 50 % larger than the braincase of the Homo erectus. This large difference happened rather fast, most probably in that last 100,000 years. Homo sapiens's brain expansion tracks closely with refinements in tool technology and is the main factor in the survival of the human race. Not only the brain size of the modern human increased, but also the thick bone above its eyebrows disappeared. What could be the reason for this change?

This transformation can be explained in the change of the lifestyle that occurred during the land dwelling period of the human species. The bone that protruded above the eye prevented the water from covering the eyes once the head was lifted above water. Because wiping off the water from the eyes would require some important seconds before hurling the stick towards the fish. During these precious seconds the fish may change place underwater and escape the attack. But as the early humans started to hunt on land, the thick bone over the eyes became useless and disappeared as time went by.

Hunting and living on land required not only an agile body but also a flexible head that could turn quickly over the neck in order to spot any existing prey or predator in the near vicinity. This requirement changed the base bone of the skull in modern humans as can be seen in the braincases pictured above. The vertical arrows indicate the location where the change occurred.

Apes and monkeys do not and cannot turn their heads as much as humans do. This is because their heavy and strong shoulder muscles have developed for holding and swinging their body on tree branches. Such developed shoulder muscles prevents the monkeys and the apes from turning their head as quickly and as much as humans can.