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From Lucy to Me

This argumentative paper will discuss the human biological evolution from our ancestors the Australopithecus to the last branch of the human evolutionary tree, the Homo sapiens sapiens. Human evolution is the result of several interrelated processes such as adaptation, genetic variations, natural selection and speciation.

According to the definition provided in class, evolution is the observed change that species undergo over time. This change can be observed in the human species, from the Australopithecus to the Homo sapiens sapiens. All species, as the book "Our Kind" by Marvin Harris states, are descended from the some pre-existing form (Harris 6). Evidence that humans descend from a pre-existing form, as sited in the text, is that human beings shared common aspects in terms of behavior and physical appearance with apes. Another type of evolution seen in class, specifically in the film "In Search of Human Origin: The Creative Revolution" is a cultural evolution. The film narrates how the first modern humans developed a cultural take-off consisting of the expression of beliefs and feelings through language, painting and other art forms.

Another process of evolution is adaptation. Adaptation is a physical or behavioral change that occurs over many generations in a species. Adaptations usually, although not always, help improve the survival of a species in its environment. The example of adaptation discussed in class involved bacterial adaptation to antibiotics. After antibiotic

exposure, some bacteria may adapt to resist the medicine's effects by changing some aspect of their physical structure. Another example of adaptation that is found in the text is how the Homo erectus walked in a straight position to avoid the impact of the sun's rays. In four legged animals more body parts are exposed to the sun, while walking upright on two legs exposes only the top of the head to the sun. Exposing less surface area to the sun is an adaptation that allowed Homo erectus to withstand the heat of the midday sun of the savannah while other animals had to rest in the shade. In this way, walking upright gave the Homo erectus a predatory advantage due to its physical adaptation to the heat (55). Finally, the film discusses adaptation in the context of the Out of Africa theory. It states that several populations of Homo sapiens may have adapted to different environments all over the world around the same time, which may explain why there is such physical variation in human beings across the world.

Genetic variation is another process of evolution. As discussed in class, the forces that create genetic variations include gene mutations, gene flow, genetic drift and crossing over. Genes are encoded in the DNA molecule, which is made up of four building blocks that are the language of DNA. DNA provides the instructions for an individual's genotype, and mutations in the DNA can lead to changes in the genotype. The example mentioned earlier regarding bacterial adaptation to antibiotic presence also applies to genetic mutation. The mechanism by which bacteria adapt to antibiotics is through a process of random mutation at the gene level. Sometimes, these mutations make an organism more suited for its environment. Gene flow involves the mixing of different genes between two previously separate populations. Gene flow, therefore, adds variation to the existing gene pool. An example from class is the mixing of two

populations, one with light hair and the other with dark hair. The result of this mix is new variation of hair color. Genetic drift occurs in small populations and involves the over expression of genes by chance, leading to a predominance of a certain gene over others. The final force creating genetic variation is crossing over, which is the exchange of DNA from one chromosome to another during the process of meiosis. All of these processes lead to genetic variation within a species.

Natural selection is another key force in evolution. According to natural selection, animals better adapted to their environment will be more likely to reproduce and pass on their genes. One example discussed in class regards deer and their relation to lions. Imagine one individual deer has only three legs, while the others have four. Lions would quickly target the three legged deer because of its lack of speed. Therefore, the three legged gene variation in the deer species never will be passed on to the next generations, because having only three legs makes the deer less fit for its environment. In the book by Harris, an example of natural selection is how birds came to have wings. According to Harris, birds' wings evolved from reptiles using their front legs for grasping (59). This illustrates how the selection and adaptation of one structure, in this case reptile legs, evolves to a new structure with a new function (birds' wings for flying).

Finally, speciation is the result of the various forces of evolution, from mutation through natural selection, which leads to the development of one species splitting into two separate species.

These evolutionary forces are clearly seen in the study of the human evolution from the hominids. This evolution can be observed, from the *Australopithecus afarensis*

to the *Homo sapiens sapiens*. Almost four millions years ago the branch of human evolutionary tree took a different direction from other primates. The species *Australopithecus afarensis*, also known as Lucy, is at the beginning of this new branch (Harris 15). The physical characteristics of this species and the capacity to use tools show evidence of their evolutionary split from other primates. According to the remains that were found in the Afar region in Ethiopia, the *Australopithecus afarensis* was less than four feet tall and their upper arm was 95 percent of the length of their upper leg (Harris 16). These physical characteristics are not so different from a chimpanzee. What distinguishes *Australopithecus* from other primates was their ability to walk on two feet. The footprints found near Laetoli (Tanzania) prove that this species was able to walk on two feet. The position of the big toe, parallel to the other toes resembles the shape of the *Homo sapiens* feet. With this ability to walk in an upright posture, the *Australopithecus* had the capability to carry and use tools to survive. According to lecture, the tools utilized included “geofacts” such as rocks used in the manner of a hammer. Rocks were employed to open nuts, and crush bones. Twigs and sticks were also used to collect food (Harris 27). The ability of this species to walk upright and therefore utilize tools represents important adaptations along the way to the biological evolution of modern humans.

The next species in the human evolutionary tree is the *Homo habilis*. This hominid is considered the link between the *Australopithecus afarensis* and the *Homo erectus* (48). Evidence supporting this theory is their physical appearance, brain size and the tools found near some of their archeological remains. The physical appearance of this hominid is practically the same as that of *Australopithecus afarensis*. According to the

remains found in Olduvai, Tanzania, *Australopithecus afarensis* and *Homo habilis* share the same height, and same body structure. The only difference is the volume of their brain. The *Homo habilis* had a brain approximately 650 and 775 cubic centimeters in size, in contrast to the 450 and 500 cubic centimeters sized brain of the *Australopithecines* and the 900 and 1000 cubic centimeters of the *Homo erectus* (Harris 22). The Oldwan tools are considered the first tools made of stones. According to researchers, the way they were developed was hitting one stone against another making their edges perfect for chopping or slicing meat (Harris 23). Despite the physical similarity between the two species, there is evidence of evolution in the tool making capability starting with *Homo habilis*. This tool making capability likely stems from the increased brain size of *Homo habilis*, which is an example of a physical adaptation leading to evolutionary change.

Around 1.8 million years ago the *Homo erectus* walked the African savanna. According to the remains found in Kobbí Fora, Kenya, this hominid was taller than the other two species mentioned previously, about six feet tall. Their body structure was tall and thin, which allowed them withstand high temperatures according to Bergman's rule (Harris 55). Bergman's rule states that body shapes are selected for according to the climate, with shorter, thicker body structures being well suited to colder climates. Taller body shapes dissipate heat better due to their large surface area of skin compared to body mass. Another characteristic found in the *Homo erectus* is their brain size, about 33 percent larger than the *Homo habilis*. According to Fialkowski's theory, bigger brain size improved *Homo erectus*' ability to chase prey due to increased physical resistance to the heat (Harris 53). A bigger brain signifies more brain cells; a redundancy in brain cells

therefore allowed *Homo erectus* to withstand the stress of exercise, with many brain cells in reserve. This allowed the cognitive functioning of *Homo erectus* to continue unharmed during times of great physical stress, and led to its ability for increased endurance. The increased brain size represents a physical adaptation that gave *Homo erectus* a predatory advantage. In addition to this technique of chasing prey until the target is exhausted, the *Homo erectus*, like other species, used tools. The Acheulian tool kit shows examples of large core tools such as handaxes, picks and cleavers. These “bi-faced” tools were perfect for butchering and slicing meat from large animals, as described in class. These tools and Fialkowsky’s brain resistance theory provide evidence that the *Homo erectus* was more like a hunter than a scavenger.

The next member along the human evolutionary branch is the Archaic *Homo sapiens*, also known as Neanderthal. This species originated around 0.5 million years ago, and was first discovered in the Neanderthal river valley in Germany. The physical characteristics of this species are very peculiar. They have the biggest brain of all the hominid species discussed so far, and their facial features were very prominent with big jaws, teeth and frontal bone (Harris 86). In contrast to the *Homo erectus*, this species was short and round. This body shape, as the Bergman’s rule explains, is adapted to withstand low temperatures such as the glaciers in Europe. According to the film “In Search of Human Origin: The Creative Revolution”, scientists argue about whether modern humans share these ugly physical characteristics with the Neanderthal. The debate specifically regards whether modern humans share genes with the Neanderthals or whether the Neanderthals were an unrelated offshoot, now extinct, of the hominid branch of the evolutionary tree. What is clear is that Neanderthals’ behavior was more advanced than

the preceding species. Archeologists have found Neandertal remains of personal adornments and burial rituals (Harris 87). This provides evidence that Neandertals' lifestyle was closer to that of the Homo sapiens. Even the design of their tools is more modern. They started using compound tools. One example of this kind of tool is a spearhead glued to a wooden stick, thus making a spear to hunt, as seen in class.

The human evolutionary tree ends with the Homo sapiens sapiens around 0.13 million years ago. There are two possible locations where the first modern human originated. The first archaeological remains were found in the Klasies River Mouth in Africa, and the second at Qafzeh Cave near Nazareth, Israel. The archaeological findings in these two locations expose the theory that the Homo sapiens first appeared occurred in several parts of the world. What makes the Qafzeh site more interesting is that archeologists found remains of Neanderthals nearby (Harris 92). Therefore, Neanderthals and Homo sapiens may have overlapped in the Middle East for around 30,000 years, whereas in Europe this overlap was much shorter, around 5,000 years. In the Middle East, Neanderthals and Homo sapiens made and used the same kinds of tools during this period of overlap, an occurrence which was not observed in Europe. Harris argues that this geographic difference in overlap and tools used between the two species occurred because the Homo sapiens in the Middle East were less advanced and probably lacked the linguistic and cultural capabilities of more modern Homo sapiens, and thus were probably more similar to Neandertals (Harris 93). Despite the common tools, according to the film "In Search of Human Origin: The Creative Revolution" these two cultures may never have met until the Homo sapiens moved to Europe. The remains of the first modern human in France show the cultural advance of this species compared to

Neandertals. The remains discovered in France show the better strategic location for Homo sapien's camps and the improved quality of the tools in contrast to the Neandertals. While early modern humans positioned their camp on the top of the hill where they could observe the whole valley, facilitating the view of their prey in order to plan their hunt, the Neandertals took the low parts of the valley where it was more difficult to hunt (Creative Revolutions). The tools found in camps of the earlier modern human were not just cores and flakes, they were perfect tools for slicing, carving and drilling. However, the most important advance for this culture was the use of language.

Language may be the reason why modern human beings persist, and the Neandertals became extinct. According to Harris, Neandertals lacked language capabilities due to a less developed pharynx, which was related to their shorter necks and the angle of their head in relation to their necks. Homo sapiens sapiens, on the other hand, had elongated and flexible pharynges which allowed for the production of vowel sounds (Harris 82). Language was the tool that allowed Homo sapiens to advance to their cultural takeoff, while the Neandertals were left behind. One example of this cultural takeoff is found in the caves of Lascaux, France, where some of the first paintings of hunting scenes may be interpreted as a tribute to animals being hunted (Harris 97). Art was used as a way to express Homo sapien's developing religious beliefs, and paintings were probably used as part of religious ceremonies. No doubt that Homo sapien's emerging language was one of the causes of this creative revolution.

In conclusion, the interrelated nature of evolutionary process can be briefly summarized as random gene mutations and other genetic variations that lead to new

genes that sometimes make an organism more adapted to its environment. These adaptations get selected upon to persist in the population when they enable an organism to be fit for its environment and therefore reproduce more successfully. Human biological evolution is an important example of these evolutionary forces and it can be observed from the *Australopithecus afarensis* to *Homo sapiens sapiens*. The *Australopithecus afarensis* was the first hominid to walk on two feet. Therefore, as a result they were able to use their hands for other activities such as the use of tools to obtain food. Next, the *Homo habilis* was able to build new tools using rocks. This advance in tool making may be the consequence of their bigger brain size compared with their predecessors. The most notorious significance for the *Homo erectus* is their predatory advantage due to their long distance endurance. The *Homo erectus*, as a consequence of the size of their brain, had better resistance to heat stress which resulted in advances in hunting food. In the Neanthertals, we can find cultural advances that were never seen previously. For example, personal adornment has been found in their remains. Also, the development of compound tools was another big breakthrough in the life of this species. The last member of the human biological evolution is the *Homo sapiens sapiens*. This species is responsible for a cultural take off and the first use of language. In summary, evolutionary processes, such as adaptations and natural selection, can be seen in the study of the evolution from *Australopithecus afarensis* to *Homo sapiens sapiens*.

Works-Cited

Harris, Marvin. Our Kind. New York: HarperPerennial, 1990.

In Search of Human Origin: The Creative Revolution. DVD. PBS, 1995.