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WHAT IS EVOLUTION ?

Evolution is the change in the characteristics of a species over several generations and relies on the process of natural selection.

WHAT IS NATURAL SELECTION?

In modern biology, natural selection is a process whereby species which have traits that enable them to adapt in an environment survive and reproduce, and then pass on their genes to the next generation. Natural selection means that species that can adapt to a specific environment will grow in numbers and eventually greatly outnumber those species that cannot adapt.

HOMINID SPECIES

Hominids are the group of primates that includes humans, gorillas, and chimpanzees, among others

HUMAN EVOLUTION

The human evolution story begins in Africa about 6 million years ago. Over 6 million years our ape-like ancestors evolved into upright walking, tool using and cultural modern humans, spreading out across the globe. There have been many different hominid species in the past, but only one – Homo sapiens sapiens – has been ultimately successful.

THE THEORY OF EVOLUTION

- ✓ The theory of evolution is a shortened form of the term “theory of evolution by natural selection,” which was proposed by Charles Darwin and Alfred Russel Wallace in the nineteenth century.
- ✓ The theory of evolution is based on the idea that all species are related and gradually change over time.
- ✓ Evolution relies on there being genetic variation in a population which affects the physical characteristics (phenotype) of an organism.
- ✓ Some of these characteristics may give the individual an advantage over other individuals which they can then pass on to their offspring.
- ✓ Individuals with characteristics best suited to their environment are more likely to survive,

finding food, avoiding predators and resisting disease. These individuals are more likely to reproduce and pass their genes on to their children.

- ✓ Individuals that are poorly adapted to their environment are less likely to survive and reproduce. Therefore their genes are less likely to be passed on to the next generation.
- ✓ As a consequence those individuals most suited to their environment survive and, given enough time, the species will gradually evolve.

DARWIN'S THEORY OF EVOLUTION

In 1871 Charles Darwin proposed in his book "The Descent of Man" that humans evolved in Africa and shared a common ancestor with great apes. This showed remarkable foresight as at that time there were no early human fossils and no DNA evidence.

Darwin's theory of evolution entails the following fundamental ideas.

- Species (populations of interbreeding organisms) change over time and space. The representatives of species living today differ from those that lived in the recent past, and populations in different geographic regions today differ slightly in form or behavior. These differences extend into the fossil record, which provides ample support for this claim.
- All organisms share common ancestors with other organisms. Over time, populations may divide into different species, which share a common ancestral population. Far enough back in time, any pair of organisms shares a common ancestor. For example, humans shared a common ancestor with chimpanzees about eight million years ago, with whales about 60 million years ago, and with kangaroos over 100 million years ago. Shared ancestry explains the similarities of organisms that are classified together: their similarities reflect the inheritance of traits from a common ancestor.
- Evolutionary change is gradual and slow in Darwin's view. This claim was supported by the long episodes of gradual change in organisms in the fossil record and the fact that no naturalist had observed the sudden appearance of a new species in Darwin's time. Since then, biologists and paleontologists have documented a broad spectrum of slow to rapid rates of evolutionary change within lineages.

THE PROCESS OF NATURAL SELECTION

Darwin's process of natural selection has four components.

- **Variation.** Organisms (within populations) exhibit individual variation in appearance and behavior. These variations may involve body size, hair color, facial markings, voice properties, or number of offspring. On the other hand, some traits show little to no variation among individuals—for example, number of eyes in vertebrates.
- **Inheritance.** Some traits are consistently passed on from parent to offspring. Such traits are heritable, whereas other traits are strongly influenced by environmental conditions and show weak heritability.
- **High rate of population growth.** Most populations have more offspring each year than local resources can support leading to a struggle for resources. Each generation experiences substantial mortality.
- **Differential survival and reproduction.** Individuals possessing traits well suited for the struggle for local resources will contribute more offspring to the next generation.

From one generation to the next, the struggle for resources (what Darwin called the “struggle for existence”) will favor individuals with some variations over others and thereby change the frequency of traits within the population. This process is natural selection. The traits that confer an advantage to those individuals who leave more offspring are called adaptations.

In order for natural selection to operate on a trait, the trait must possess heritable variation and must confer an advantage in the competition for resources. If one of these requirements does not occur, then the trait does not experience natural selection. (We now know that such traits may change by other evolutionary mechanisms that have been discovered since Darwin's time.)

WHAT IS THE RELATIONSHIP BETWEEN APES AND HUMANS?

Since scientists developed the ability to decode the genome and compare the genetic composition of species, they found that about 98.5% of the genes in people and chimpanzees are identical. This finding means chimps are the closest living biological relatives to humans, but it does not mean that humans evolved from chimps. This indicates that humans share a common ancestor

with African apes(i.e. gorillas and chimpanzees) , making humans very , very distant cousins. Humans are therefore related to these primates, but they did not descend from them.

Modern Humans differ from apes in many different ways . Human brains are larger and more complex , people have elaborate forms of culture and communication , and people habitually walk upright , can manipulate very small objects , and can speak.

OUR COMMON ANCESTOR

Most scientists believe our common ancestor existed 5 to 8 millions years ago. Then two species broke off into two separate lineages , one ultimately evolving into gorillas and chimps, the other evolving into early humans called hominids. In the million of years that followed , at least a dozen of different species of humanlike creatures have existed, reflected in the fossil discoveries of anthropologists , although many of these species are close relatives but not actual ancestors of modern humans.

THE FOSSIL RECORD

Fossils are the remains or imprints 'traces' of living things hardened in rock. All living organisms have not been preserved in the fossil record ; in fact, most have not because very specific conditions must exist in order to create fossils. Even so the fossil record provides a fairly good outline of the history of human evolution.