

adaptive radiation

the relatively rapid expansion and diversification of an evolving group of organisms as they adapt to new [ecological niches](#). Adaptive radiation is the process by which one species evolves into two or more species. This occurs as a result of different populations becoming reproductively isolated from each other, usually by adapting to different environments.

ecological niches

specific micro-habitats in nature to which populations or organisms adapt. They are usually seen in terms of being food getting opportunities in the environment.

evolution

genetic change in a population of organisms that occurs over time. The term is also frequently used to refer to the appearance of a new species.

inheritance of acquired characteristics

Lamarck's theory that evolution occurs as a result of an organism acquiring a change in form due to using or not using particular body parts during its lifetime and then passing the new trait on to its offspring. This is also referred to as the "use-disuse theory."

natural selection

an evolutionary mechanism that occurs when some individuals of a population are better able to adapt to their environment and, subsequently, produce more offspring. Nature, in effect, selects which members of a population are fit to survive long enough to reproduce. Differential reproductive success among individuals is the key. Those who produce more offspring have a greater influence on the gene frequencies of the next generation. This mechanism of evolutionary change was first described by Charles Darwin.

species

the largest natural population of organisms that can potentially interbreed to produce fertile offspring. It is commonly assumed that members of one species are reproductively isolated from members of all other species (i.e., they cannot mate with them to produce fertile offspring). However, we must be cautious in defining species with this criterion because members of very closely related species can sometimes produce offspring together, and a small fraction of those may be fertile to some degree. This is the case with mules, which are the product of mating between horses and donkeys. About one out of 10,000 mules is fertile. This suggests that some species differences are a matter of degree.

survival of the fittest

the idea that those individuals in a species that have characteristics selected for by nature are biologically the most fit. They are the ones who more frequently survive to be the parents of the next generation. The fittest individuals are not

necessarily the strongest, largest, quickest, or smartest. This concept was central to Charles Darwin's idea of natural selection.

taxonomy 

the branch of science concerned with the rules for naming, describing, and classification of organisms into different categories on the basis of evolutionary relationships. The biological sciences primarily use the Linnaean classification system for this purpose.

Analogous structures - A trait that is morphologically and functionally similar to another, but which arose from a different ancestral condition.

Coevolution - Evolution that results from the relationships between animals. For example, one animal might prey on another, meaning that only the fastest of the second animal survive, creating a selection pressure. As the second animal gets extremely fast, only the fastest of the first predatory animal can catch enough food to survive, creating selection pressure on the predator to become faster.

Convergent evolution - Pattern of evolution in which two unrelated species gradually become similar to each other through adaptation to a common environment, often resulting in analogous structures. Compare with divergent evolution and parallel evolution.

Divergent evolution - Pattern of evolution in which two closely related species gradually become more and more dissimilar. Compare with convergent evolution and parallel evolution.

Definition:

Attacks on evolution from conservative religious believers often include the claim that there is no hard evidence for evolution ever actually occurring. Many people are swayed by such claims, in part because while the claim can be made dramatically and with ease, rebuttals are necessarily time consuming, academic, and far less dramatic. The truth, however, is that there exists abundant evidence for evolution. The difference between analogous and homologous structures provides an interesting way for atheists (and theists who accept evolution) to describe evidence of evolution coming from two directions.

Analogous / Convergent Structures

Some biological characteristics are analogous (also called "convergent"), which

means that they serve the same function in different species but they evolved independently rather than from the same embryological material or from the same structures in a common ancestor. An example of an analogous structure would be the wings on butterflies, bats, and birds.

Another important example would be the development of a camera-type eye in both mollusks and vertebrates. This example of analogous structures is especially useful because one of most common claims made by religious creationists is that something as complex as an eye couldn't possibly have evolved naturally - they insist that the only viable explanation is a supernatural designer (which is always their god, though they rarely admit this outright).

The fact that eyes in different species are analogous structures proves not only that the eye could evolve naturally, but that it in fact evolved several times, independently, and in slightly different ways. The same is true of other analogous structures as well, and this is because certain functions (like being able to see) are just so useful that it's inevitable they will evolve eventually. No supernatural beings, whether gods or not, are necessary to explain or understand how eyes evolved multiple times.

Homologous Structures

Homologous structures, on the other hand, are characteristics which are shared by related species because they have been inherited in some way from a common ancestor. For example, the bones on the front fins of a whale are homologous to the bones in a human arm and both are homologous to the bones in a chimpanzee arm. The bones in all of these different body parts on different animals are basically the same bones, but their sizes are different and they serve slightly different functions in the animals where they are found.

Homologous structures provide evidence of evolution because they allow biologists to trace the evolutionary path of different species, linking them up in the larger evolutionary tree that links all life back to a common ancestor. Such structures are also strong evidence against creationism and Intelligent Design: if there were a deity who created all the different species, why use the same basic parts over and over in different creatures for different functions? Why not use completely new parts that are specially designed for specific and different purposes?

Surely a "more perfect hand" and a "more perfect flipper" could be created if based on parts designed for their specific purpose. Instead, what we have in reality are imperfect body parts — and they are imperfect in part because they are all derived from bones that originally existed for other reasons entirely. The bones were adapted, over long stretches of time, for new purposes that they needed to just barely succeed at. Evolution only requires that one be better than competitors, not that one be the best that's theoretically possible. This is why imperfect features and structures are the norm in the natural world.

As a matter of fact, the entirely biological world can be said to be composed of homologous structures: all of life is based on the same types of nucleotides and the same amino acids. Why? A perfect and intelligent designer could easily create life from a variety of amino acids and DNA structures, all specifically suited for particular

purposes. The presence of the same chemical structures in all of life is evidence that all of life is related and developed from a common ancestor. The scientific evidence is unambiguous: no gods or other designers had a hand in the develop of life generally or human life in particular. We are what we are because of our evolutionary inheritance, not because of the desires or will of any deities.

Phylogeny -The sequence of events involved in the evolutionary development of a species or taxonomic group of organisms

A structure or organ is vestigial if it has diminished in size or usefulness in the course of **evolution**. Vestigial **structures** are **markers** of evolutionary descent. For example, boa constrictors, which are descended from four-legged reptiles, grow tiny hind legs. Duckbill platypuses, which are descended from extinct platypus species that had teeth as adults, grow and re-absorb teeth before birth. In human beings, the vermiform **appendix** (a hollow, worm-shaped organ about the size of a pencil, attached to the beginning of the **large intestine**) marks descent from mammals that had a much larger sac in this position and used it to digest their high-cellulose **diet** (as many species, including other primates, still do).

From the late nineteenth century until the 1960s, biologists thought that **the human body** contained scores of useless vestigial structures, including the coccyx, ear muscles, pineal gland, thymus, vermiform appendix, wisdom teeth, and others. Most of these structures are now known to have at least minor functions, leading to controversy over whether the human body contains any vestigial structures at all. However, the discovery of a function for a structure does not necessarily mean that it is not vestigial. A vestigial structure may be completely without function, like fetal platypus teeth, or it may be changed and diminished in function. The human appendix appears to be a vestigial structure with changed and diminished function; it is attached to **the digestive system** just where an anatomically similar, essential digestive organ is attached in many other mammals, but performs no digestive or other essential function. (People who have had their appendixes removed suffer no known ill effects.) Some biologists assert that the appendix assists the **immune system**; if so, the appendix's tiny opening on the large intestine still

appears to be a truly useless (or worse than useless) vestige of this organ's digestive origin. Hardened feces can block this opening and cause the appendix to swell and rupture, a potentially fatal disorder that afflicts about one person in every thousand annually.