

Evolution

Evidence for Evolution

Fossil evidence shows a long history of life on Earth. The fossil record shows that forms of organisms appeared, lasted for long periods of time, and then disappeared, only to be followed by newer forms of life that also eventually disappeared. The history of life is one of constant change and a tremendous diversity of life-forms.

What is a fossil?

- A fossil is a trace of a long-dead organism
 - Often found in layers of sedimentary rock
 - Usually develop from the hard body parts of an organism – shell, bones, teeth, woody stem

How does a fossil form?

- over long periods of time, hard minerals replace the tissue of the organism
 - this leaves a rocklike structure

What are some types of fossils?

Types of fossils

- * Amber – the fossilized sap of trees
- * Mold – an imprint in rock of the shape of an organism
- * Cast – a rocklike model of the organism

Who was the first person to decide that fossils were the remains of plants and animals?

- ☺ Robert Hooke, in 1668
 - Studied petrified wood
 - Hypothesized that living organisms had been turned to rock
 - Hooke's views were shared by others
 - Nicolaus Steno (1638-1686)
 - In 1669 proposed the law of superposition

Law of Superposition

- * Successive layers of rock or soil were deposited on top of one another by wind or water
- * Lowest layer – stratum – is the oldest
- * Newer layers are deposited on the older layers
- * Fossils within a single stratum are of approximately the same age

So just HOW OLD is the Earth???

Scientists believe that the earth is more than 4 billion years old!

- ◆ 700,000 times as long as the period of recorded history
- ◆ 50 million times as long as an average human life span
- ◆ estimated by radioactive dating

Theories of Evolution

The word evolution refers to an orderly succession of changes. Biological evolution is the change of populations of organisms over generations. Early scientists noticed that new life-forms appeared to be modifications of fossil forms found in the same geographical area. This strongly implied that a natural modification process was at work.

Jean Baptiste de Lamarck (1744-1829)

- ➔ hypothesized that species evolve over time
 - new types of organisms are modified descendants of older types

Charles Darwin (1809-1882), Alfred Wallace (1823-1913)

- ➔ hypothesized that species were modified by natural selection

What is natural selection?

Natural selection – organisms best suited to their environment reproduce more successfully than other organisms

- a population of organisms adapt to their environment as their proportion of genes for favorable traits increases
- evolution is the change in the genetic makeup of a population over generations

Darwin's Theories

1. Descent with Modification
 - a. The newer forms appearing in the fossil record are actually the modified descendants of older species
 - b. All species had descended from one or a few original types of life
 - c. All living things probably had descended from one or a few remote common ancestors
2. Modification by Natural Selection

- a. States how evolution occurs
- b. Environment limits the growth of populations
 - i. Increasing the rate of death
 - ii. Decreasing the rate of reproduction
- c. environment may affect individual organisms in a population in different ways
- d. some fare better than others – these leave more offspring

Evolution in Process

Evolution is a continuous process. By examining genotypic and phenotypic evidence in modern organisms, we can see evidence that evolution has occurred. By considering species in relation to one another, we can also detect definite patterns of evolution.

Evidence of Evolution

Homologous and Analogous Structures

- ➔ similar features that originated in a shared ancestor are described as homologous features
- ➔ the presence of homologous features in different species indicates that the species shared a fairly recent common ancestor

Analogous features serve identical functions, and they look somewhat alike

- ♣ they have very different embryological development
- ♣ may be very different in internal anatomy

Example: Wings of a hummingbird and wings of a humming moth

Vestigial Structures

- features that seem to serve no useful function
- were useful to an ancestor, but they are not useful to the modern organism
- are evidence that the structure was functional in some ancestor of the modern organism
- a species with a vestigial structure probably shares evolutionary origins with a species that has a functional form of the structure

Patterns of Evolution

Coevolution

- ➔ the change of two or more species in close association with each other
 - predators and their prey
 - parasites and their host
 - plant-eating animals and the plants they feed on

Example: plants and the animals that pollinate them

Convergent Evolution

- ➔ process where unrelated species become more similar as they adapt to the same kind of environment
 - occurs when the environment selects similar phenotypes
 - analogous structures are associated with convergent evolution

Example: Sharks and porpoises – have very different origins – many features, however, are very similar

Large streamlined bodies

Fins resemble each other (analogous structures)

Divergent Evolution

- ➔ two or more related populations or species become more and more dissimilar
 - usually a response to differing habitats
 - can ultimately result in new species

Types of Divergent Evolution:

1. Adaptative radiation
 - a. Many related species evolve from a single ancestral species – Galapagos finches are an example of this type
2. Artificial selection
 - a. Breeding of organisms by humans for specific phenotypic characteristics – Domestic dog breeds is an example of this type
 - b. Sped up many times beyond what could have occurred in nature