

Refer to the Senior Links (Biology) for websites comparing and contrasting various theories such as Evolution and Creationism.

THEORY OF EVOLUTION

- ◆ 'Evolution' means 'unfolding' or 'unrolling', and is meant to explain a gradual orderly change in the events of the universe, including both living and non-living things.
- ◆ Inorganic Evolution involves the evolution of non-living things. It is the evolution of the universe from 'nothing' to form atoms and then the cosmos. This involves the Big Bang Theory, and the subsequent nuclear fusion of smaller nuclei such as hydrogen to form larger nuclei such as helium and so on.
- ◆ Organic Evolution is the development of carbon-containing living organisms from simple bacteria to complex plants and animals. This includes Darwin's Theory of Natural Selection.
- ◆ Geological Time Scale is the chart that shows the bacteria formation from non-living compounds 4000 million years ago to the development of complex plants and animals in the last 100 million years.

PREVIOUS THEORIES OF EVOLUTION

- ◆ Thomas Malthus (1798) was an English political economist who studied the factors that affected human population growth (e.g. availability of food, disease and war).
- ◆ Charles Lyell (1830) was an English geologist who stated that the earth was undergoing constant change as a result of natural forces such as erosion, deposition and volcanoes over long time periods.
- ◆ Jean de Lamarck (1809) was a French botanist who stated that the change of the organisation of living organisms was as a result of time and the environment. He believed that an organism can alter its characteristics throughout its lifetime (for example, a giraffe during its lifetime grew a longer neck to reach leaves on tall trees). This concept is wrong as it is now known that characteristics are the result of genes, and cannot be altered appreciably during the lifetime of an organism.
- ◆ Charles Darwin (1859) was an English naturalist who wrote 'On Origin of Species', outlining his Theory of Natural Selection. This followed his sea journey on the HMS 'Beagle' to the Galapagos Islands where he observed differences in the species of finches.
- ◆ Alfred Wallace (1859), also English, independently of Darwin came up with the idea of natural selection.
- ◆ Gregor Mendel (1866) was an Austrian monk whose pea plant breeding experiments formed the basis of genetics. He called genes 'factors'.
- ◆ Alfred Wegener (1908) was a German geologist who devised the Theory of Continental Drift, which has since been expanded to include Plate Tectonics.

THE PRESENT THEORY OF NATURAL SELECTION

1. The gene pool is the total of all the genes of a population of a species in a given area. The gene pool includes genes for both better-adapted and poorly-adapted characteristics. The gene pool has genetic variation as a result of:
 - ◆ Mutations
 - ◆ Chromosomal changes during meiosis and mitosis
 - ◆ Variations of combinations of gametes in sexual reproduction

2. Gene frequencies are the frequencies or numbers of genes of particular types in a population. Gene frequencies alter because of 3 factors:
 - ◆ Migration into or out an area
 - ◆ Isolation
 - ◆ Adaptation
3. Isolation is of 3 types:
 - ◆ Geographic Isolation (e.g. birds on different islands, wind-pollinated plants on different sides of a mountain)
 - ◆ Behavioural Isolation (e.g. nocturnal and diurnal feeders)
 - ◆ Reproductive Isolation (i.e. a social or structural difference that prevents mating)
4. Adaptations are characteristics possessed by an organism that causes it to be better suited or better able to survive in its surroundings. Adaptations may be:
 - ◆ Structural Adaptation (e.g. streamlined shape of fish)
 - ◆ Physiological Adaptation (e.g. hibernation of bears in cold climates)
 - ◆ Colour Adaptation (e.g. camouflage, mimicry)
 - ◆ Behavioural Adaptation (e.g. nocturnal feeders in hot climates)
 - ◆ Reproductive Adaptation (e.g. peacock's fanning display to attract a mate)

Organisms with better-adapted characteristics will breed, passing the better-adapted gene to future generations, and increasing the gene frequency of the better-adapted gene.

Organisms that are poorly-adapted will breed less if at all, reducing the gene frequency of the poorly-adapted gene, possibly to the point of extinction.
5. Speciation - New species that can no longer interbreed with the original species develop over time in different areas.

THEORY OF CONTINENTAL DRIFT AND PLATE TECTONICS

- ◆ About 640 million years ago, there may have been a super-continent called Pangaea, which 'drifted' apart on the mantle to form a northern hemisphere super-continent (Eurasia) and a southern hemisphere super-continent (Gondwanaland).
- ◆ Laser evidence shows that the crustal plates supporting the continents are moving at a rate of a few centimetres a year.
- ◆ Some of the crustal plates are moving apart, allowing molten magma to force through as volcanoes.
- ◆ Some of the crustal plates are moving towards each other, causing earthquakes.
- ◆ This could explain why there are plants and animals of all types on all continents, but they differ slightly also.

Refer to diagrams showing Continental Drift, and the locations of earthquakes and volcanoes in your textbook.