Domain: 5.8

relates the structure and function of living things to models, theories and laws

# What is Evolution?

Evolution means the development of more *complex* living things from *simpler* ones. It is a process of change over a long period of time. Evolutionary theory holds that all species evolved from a single form of life which lived about 3.5 billion years ago. This basic form of life evolved into more than 2 million species living on the Earth today.

# **Evidence For Evolution**

#### 1. Fossil Record:

A continuous record of past life can be found in successive lavers of sedimentary rocks all around the world. Fossils of *simple* forms of life can be found in the *older* rocks. Younger rocks contain fossils of more complex life. The fossil is incomplete as not all living things from the past have been fossilised. Examples of information gained from fossils about evolution include:

Archaeopteryx- a reptile-like bird found in rocks 150 million years old supports the idea that birds evolved from reptiles.

Echippus- was a 30 cm high horse which lived 65 million years ago. Fossils show a gradual change from this horse to the *modern-day* horse.

# 3. Comparison of body parts

#### (comparative anatomy):

The forelimbs of certain vertebrates show important similarities. They have the same basic layout, known as the pentadactyl plan. This similar plan suggests that mammals, birds, reptiles and amphibians have evolved from a common stock.

#### 2. Distribution of species:

Australia's unique species of **fauna** provide further evidence for evolution. Primitive mammals appeared in the Jurassic period. At about this time Australia started separating from the other continents which made up Gondwanaland. There were three orders of mammalsmonotremes, marsupials and placentals. As Australia became isolated, the monotremes and marsupials survived and developed. On other continents the more advanced placentals developed and *displaced* the monotremes and marsupials.

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For example, fossil teeth have been found in South America which are thought to belong to the ancestor of the *platypus*. Today, the platypus is only found in Australia.

#### 4. Study of embryos (comparative embryology):

In the early stages of development, the embryos of fish, lizards, birds and mammals are very similar. For example, they all have gill pouches. Even the human embryo has these gill pouches at one stage of its development.

### Lamarck's Theory of Evolution

Jean Lamarck (1744-1829), put forward a theory to explain why organisms changed. He believed that living things acquired certain characteristics which they passed on to their offspring. For example, a giraffe stretched its neck to reach high foliage. Lamarck believed the giraffe retained this stretched characteristic and passed it on to its offspring. Lamarck's theory is stated as follows: "Acquired characteristics are inherited". Lamarck's theory was later proved to be *incorrect*.

### Darwin's Theory of Evolution

Charles Darwin (1809-1882) was the first to put forward reasoned arguments to support the idea of evolution. Much of his material was collected during a voyage around the world in HMS Beagle. He spent much time on a group of islands off the coast of Sth. America- the Galapagos Islands. Here he studied a particular type of bird called the finch. He found that each island in the group had particular species of finches which were **not** found on other islands. Darwin believed that the finches had evolved from a *common ancestor* which had originated from South America.

The offspring then spread out, inhabiting many of the islands in the group. He believed the finches then evolved *differently* according to their *habitat* (living place) and *diet*.

For example, some finches ate **seeds** on a particular island. Their beak was adapted for cracking open the seeds. On another island, the main source of food was **insects**. These finches had evolved different beaks. The diagram shows examples of two types of beaks— a seed-eater and an insect-eater. Darwin found 14 different species of finches on the Galapagos Islands.





#### On The Origin Of Species

2. that new species are produced by change and Natural Selection.

**Natural Selection-** is the process in which organisms with <u>favourable adaptations</u> or <u>variations</u> survive. It is these individuals which go on to <u>reproduce</u>, passing on the favourable characteristics to their offspring. This theory is often stated as: *"survival of the fittest"*.

South America

#### Modern Evolutionary Theory

Hugo De Vries linked the work of Darwin and Mendel. The work of De Vries and other scientists led to the development of the *Modern Theory of Evolution*. The important points related to the Modern Theory of Evolution are:

- The zygote contains genes from the male and female gamete.
- The genes determine the whole development of the organism.
- Genes can change. This produces a variation which can be passed on to future offspring. The change is called a mutation.
- Variations produced by genes are controlled by natural selection.
  This summarised on the next page.



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CARIBBEAN

Class:.....





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Ň	1. Lamarck's Theory:	2. Darwin's Theory:		
o Darwin's the	Giraffes had short necks which were frequently stretched to reach the foliage of trees.	Giraffes had necks with varying length. The variations were hereditary.		
narck's theory to	The offspring also had longer necks which were stretched frequently to reach food.	Competition and natural selection led to survival of longer-necked offspring because they were able to reach high foliage.		
comparing Lan	Eventually the continued stretching of the neck caused the modern-day giraffe to have a long neck.	Eventually only long-necked giraffes survived the competition.		
Questions:         1. What does evolution mean?         2. What are four important sources of evidence for evolution?         3. Complete the sentence: "older rocks contain fossils of forms of life".         4. What was Archaeopteryx and why is it important in supporting evolution?         5. What was Echippus and why is it important in supporting evolution?         6. What is the "pentadactyl plan" and how is it important in supporting evolution?         7. Why did marsupials survive in Australia and not in other parts of the world?         8. What can be said about the embryos of fish, lizards, birds and mammals in the early stages of development?         9. (a) Whate did Darwin collect much evidence for his theory?         (b) Why type of birds did he study?         (c) How did he explain the differences between these birds on different islands?         11. What two contentious ideas did Darwin put forward in his book- "On The Origin Of Species"?				

- "On The Origin Of Species"?
- 12. What is meant by the term- natural selection?
- 13. What are the basic points related to a Modern Evolutionary Theory?
- 14. (a) What is a mutation and how can they occur? (b) What can cause the rate of mutations to increase?
- 15. What are the differences between favourable and unfavourable phenotypes in relation to natural selection?



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CARIBBEAN

Darwin published his findings in a book called *On The Origin Of Species*. In it he put forward to very contentious ideas:

#### On The Origin Of Species

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- 1. species are continually changing;
- 2. that new species are produced by change and Natural Selection.

**Natural Selection-** is the process in which organisms with <u>favourable adaptations</u> or <u>variations</u> survive. It is these individuals which go on to <u>reproduce</u>, passing on the favourable characteristics to their offspring. This theory is often stated as: *"survival of the fittest"*.

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# EVOLUTION SCIENCE



