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**Learning Modules – Your Inner Fish**

## What is Evolution?

### The definition

Biological evolution, simply put, is descent with modification. This definition encompasses small-scale evolution (changes in gene frequency in a population from one generation to the next) and large-scale evolution (the descent of different species from a common ancestor over many generations). Evolution helps us to understand the history of life.

### The explanation

Biological evolution is not simply a matter of change over time. Lots of things change over time: trees lose their leaves, mountain ranges rise and erode, but they aren't examples of biological evolution because they don't involve descent through genetic inheritance.

The central idea of biological evolution is that all life on Earth shares a common ancestor, just as you and your cousins share a common grandmother.

Through the process of descent with modification, the common ancestor of life on Earth gave rise to the fantastic diversity that we see documented in the fossil record and around us today. Evolution means that we're all distant cousins: humans and oak trees, hummingbirds and whales.

**Exploring Life's Origins** http://exploringorigins.org/index.html

Visit the Exploring Life's Origins website for beautiful computer-animated videos that bring RNA world with fatty acids and nucleic acids to life, and explore a timeline of life's evolution complete with images.

**Sources**: Understanding Evolution

- URL: http://evolution.berkeley.edu/evolibrary/article/0_0_0/evo_02

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## What is Embryology?

Embryology is the study of the formation of life. Developmental biology examines how all life forms begin and how they develop into fully formed and functioning organisms. Embryology's focus is much narrower.

Embryology looks at the very beginning of life from the one-celled organism. Embryologists examine fertilization and track the development of the embryo (an organism in the early stages of development which cannot survive on its own) until it bears a resemblance to its progenitors. For example, in human conception, embryologists would be interested in both sperm and egg, and the meeting of the two, and then would follow egg implantation and the growth of an embryo until it reaches the fetal stage. In humans, the study of an embryo would last until about the second month of a pregnancy.

**Human Embryology** http://www.embryology.ch/indexen.html
Check out this online course in embryology for medicine students and explore learning modules for embryogenesis and organogenesis, developed by the universities of Fribourg, Lausanne, and Bern (Switzerland) with the support of the Swiss Virtual Campus.

**Source:** Wise Geek

- URL: http://www.wisegeek.com/what-is-embryology.htm

## What is Phylogeny?

The connections between all groups of organisms as understood by ancestor/descendant relationships. Not only is phylogeny important for understanding paleontology, but paleontology in turn contributes to phylogeny. Many groups of organisms are now extinct, and without their fossils we would not have a clear picture of how modern life is interrelated. We express the relationships among groups of organisms through diagrams called *cladograms*, which are like genealogies of species.

**Tree of Life Web Project** http://tolweb.org/tree/learn/concepts/concepts.html
"All organisms are connected by the passage of genes along the branches of the phylogenetic Tree of Life." We have mentioned this website before, but it is a great resource for those wishing to explore evolution and phylogeny – the genetic connections between organisms.

**Source:** University of California Museum of Paleontology

- URL: http://www.ucmp.berkeley.edu/exhibit/introphylo.html

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**What is Morphology?**
Morphology is the study of animal form, shape, and structure. It helps us understand animal diversity and animal history. Also, it allows scientists to learn how organisms function (i.e. run, swim, eat, or fly) and survive.
**Source:** Encyclopedia.com

- URL: http://www.encyclopedia.com/topic/Morphology.aspx

**What are Homologous Chromosomes?**
Homologous chromosomes contain genes for the same characteristics of an organism. Each copy of the chromosome has the gene of a particular characteristic located in the same position, called locus. Chromosomes are tightly coiled in the nucleus and are composed of protein and DNA (deoxyribonucleic acid), which carries instructions for the inheritance of characteristics within organisms.
**Source:** Wise Geek

- URL: http://www.wisegeek.com/what-are-homologous-chromosomes.htm

**What are Homologous Structures?**
Homologous structures are those which have the same embryonic origin and basic structure, though they may or may not perform the same functions (i.e. running, swimming, flying or grabbing). Homologous structures provide evidence of evolution because they allow biologists to trace the evolutionary path of different species linking them up in a larger evolutionary tree that links all life back to a common ancestor.
**Source:** Tutor Vista

- URL: http://www.tutorvista.com/science/homologous-structures

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**What is Genetics?**
Genetics is the science of genes (a DNA segment that contributes to structure and function), heredity (genes passed from parent to offspring), and the variation of organisms. Humans began applying knowledge of genetics in prehistory with the domestication and breeding of plants and animals. In modern research, genetics provides important tools in the investigation of the function of a particular gene, e.g. analysis of genetic interactions.
**Source:** Bio News Online

- URL: http://www.bionewsonline.com/a/what_is_genetics.htm

**What are Hox Genes?**
Hox genes are a set of transcription factor genes that exhibit an unusual property. They provide a glimpse of one way in which gene expression is translated into the many different forms that animals (metazoans) exhibit. The genome seems to be a welter of various genes scattered about randomly, with no order present in their arrangement on a chromosome. The order only becomes apparent in their expression through the process of development. These genes specify segment identify – whether a segment of the embryo will form part of the head, thorax, or abdomen, for instance. These gene segments are clustered in one spot and within the group.
**Source:** Scitable by Nature Education

- URL: http://www.nature.com/scitable/topicpage/Hox-Genes-in-Development-The-Hox-Code-41402