

## Science Information from the Beagle:

# Some Facts about Evolution

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Evolution acts at the species level. In natural selection an individual in a given population is of little consequence to evolution.

A species is a group of freely interbreeding individuals that is reproductively isolated from other such groups.

Evolution is not directed, that is, species evolve according to the selective pressures of their environments not so they become more advanced or complicated, but to become more adapted to their environments

Evolution proceeds by the action of natural selection. The results of natural selection, while usually considered to be elegant in any given organism are, upon closer examination, often seem to be a kludge. Organisms can be properly thought of as cobbled together; if they had been designed, the result would likely have been far simpler, more logical and more reliable. In addition, organisms that were designed would not likely be driven to extinction...the fate of all life on our planet.

Natural selection, and therefore, evolution is not random. Natural selection, as Darwin understood it, is descent with modification. As with all modifications some are highly advantageous and other (the majority in fact) are disasters, while some are neutral.

Mutations in the genes are random and most genetic mutations are either undetectable as an observable trait in the organism and its subsequent offspring, or they are lethal. Genetic mutations that result in an observable trait are probably acted upon by natural selection, and it is just as probable that many of those traits that are, will be eliminated from the population by the process. A trait upon which selection acts and is advantageous will become increasingly common in a given population. A trait that is disadvantageous and upon which selection acts will be eliminated from the population over time. Neutral mutations will not show up in the population as macroscopically observable traits but can be observed at the DNA level.

Darwin's theory did not take into account how life came to exist on earth, nor how the earth, the solar system or the universe came into existence. It is not a theory of how life began; to state otherwise is to demonstrate a general ignorance of the Darwinian theory.

The *Theory of Evolution by Natural Selection* is a scientific theory and, as with all scientific theories it is incapable of being proved. Scientific theories must be falsifiable; that is, one must be able to propose a rational method whereby the theories can be disproved. Intelligent design, whether by a supernatural being or alien beings cannot be disproved.

Evolution theory does not state that humans evolved from monkeys; it does state that all life on earth, most likely, shares a common ancestor. The fossil record is spotty, and always will be, but hundreds of thousands of transitional fossils have been found, and more are being, and will be, found. Paleontology is a legitimate science and as such is self-correcting; no one is more critical of a scientist's misperception, incorrect observation or misstated theory than another scientist

The second law of thermodynamics says, "no process is possible in which the sole result is the transfer of energy from a cooler to a hotter body." Phrased in another way, the 2<sup>nd</sup> law says, "the entropy of a closed system cannot decrease." The earth and its environments are not closed systems, and order from disorder, or entropy, happens not only in living things, but in nonliving things, as well (e.g. crystal growth from solution). Evolution does not violate the 2<sup>nd</sup> law.

Evolution is the theoretical glue that holds the science of biology together much in the same way atomic theory holds the science of chemistry together. To assume that there are equally valid scientific theories that explain life on this planet as cogently as evolution, is to demonstrate a serious lack of understanding. Intelligent design is no more a valid scientific theory in opposition to the theory of evolution than the "theory of intelligent falling" is oppositionally valid to the theory of universal gravitation.

Evolution is only a theory and to state that an hypothesis is a theory is to give it the highest possible standing in science. In science one makes observations (collects facts) and proposes an hypothesis; the hypothesis is tested with the purpose of falsifying (disproving) it, and then a theory is proposed. Science builds upon observations (facts) towards a theory that is continuously tested for its ability to be predictive as well as retrodictive; that is it must be able to predict what will happen in the future as well as explain what has happened in the unobservable past.

Evolution is evolution whether it is microevolution, macroevolution or mesoevolution. When one is allowed the others logically follow. In his recent article, "Use the word evolution," John N. Thompson gives a short list of euphemisms that are commonly used instead of the word "evolution." His list is reproduced below.

Some alternatives for the word evolution found in the scientific literature and in popular science writing<sup>1</sup>

Alternative	Example (from one or more articles)
Accelerate	...pest resistance... <i>accelerated</i>
Acquire	... <i>acquired</i> new traits
Become	...weeds are <i>becoming</i> resistant
Change	...influenza virus...frequently <i>changes</i> ...
Create	... <i>creates</i> ...new strains
Develop	... <i>developed</i> resistance
Emerge	... <i>emergence</i> of resistance
Grow	...pathogens have <i>grown</i> resistant
Overcome	... <i>overcome</i> their vulnerability
Sprout	...resistant [forms]...have begun <i>sprouting</i> and spreading

Thompson states that these alternative words are, in some cases, carry-overs from early works on evolution. When faced with a choice of words one should endeavor to use “evolved,” “evolving,” “evolve,” “evolution,” and “evolving” in place of the italicized words above.

#### Bibliography:

<sup>1</sup> Thompson, John N., 2008, *Evolution: Education and Outreach*, <http://www.springerlink.com/content/n920495054q4630l/fulltext.html>, 1:42-43.