Organic Evolution

Organic, or biological, evolution is the modification of living organisms during their descent, generation by generation, from common ancestors. It is to be distinguished from other phenomena to which the term evolution is often applied, such as chemical evolution, cultural evolution, or the origin of life from nonliving matter. Organic evolution includes two major processes: anagenesis, the alteration of the genetic properties of a single lineage over time; and cladogenesis, or branching, whereby a single lineage splits into two or more distinct lineages that continue to change anagenetically.

Organic evolution is the **theory** that more recent types of plants and animals have their origins in other pre-existing forms and that the distinguishable differences between ancestors and descendents are due to modifications in successive generations. Charles Darwin (1809–1882) did not invent the idea of organic evolution; generations preceding him entertained the notion such as the French zoologist Jean Baptist de Lamarck (1744–1829), a pioneer in invertebrate paleontology, and Erasmus Darwin (1744–1802), grandfather of Charles. Until Charles Darwin’s time, however, the idea had never had wide currency because earlier workers lacked important data and the Huttonian concept of geologic time, which are both vital for the evolutionary argument. Charles Darwin’s contribution was to propose a mechanism—natural selection—to explain how this change could occur.

Charles Darwin’s “The Origin of Species” accomplishes two things. Darwin marshals evidence from every quarter of biology and geology that evolution has in fact occurred: that living things are descended with modification from common ancestors. Second, he presents an explicit, purely mechanistic theory of the causes of evolution. Every species, Darwin points out, has hereditary variation in numerous characteristics. Some variants will be better suited to the exigencies of life than others, and so will survive better or reproduce more prolifically than the inferior variants. Since descendants inherit their superior properties, the proportion of individuals in the population that bear superior characteristics will increase, and the proportion with inferior traits will decrease from generation to generation, until the species has been transformed. The new character itself is subject to further variation and to further alteration by this process of natural selection, so that in the vastness of time the feature comes to differ extremely from the original form—but it is a great change accomplished in small steps. Because different populations experience different environments and adapt to different resources, numerous forms may diverge from an original stock, each adapted to a different environment or way of life. This branching process, continued through the immensity of geological time, gives rise to the great “tree of life.”

In his work "On the Origin of Species", first published in 1859, Darwin demonstrated the existence of organic evolution to scientists and non-scientists alike. Geologic thought, indeed all philosophical thought, has never been the same. Eicher (1976) provides the following summary:

- Populations of animals and plants produce progeny at such a rate that were they all to survive; they would increase rapidly year after year.
- Spectacular progressive increases in population size do not, in fact, occur. Although most populations fluctuate year by year, they remain essentially constant over the long term.
- A very real struggle for existence occurs in nature. Each individual must compete for food and must cope successfully with every facet of the environment—both physical, such as climate extremes, and biological, such as diseases and predators—in order to live to produce progeny.
- Each individual differs from virtually all others in its species. By Darwin's time, striking variation in domestic animals had already been produced by selective breeding. Darwin noted that species in nature had similar potential for modification.
- Here Darwin made a break with all previous suggestions on the subject. Instead of postulating that modifications are induced by the environment and are then passed on from generation to generation, he suggested that new characteristics arise from within an organism entirely by chance. (We now know that these arise as genetic mutations.) However, not all of these new characteristics will have adaptive significance or survival value, and many may even be lethal.
- Some of the new characteristics enhance an individual's success in coping with the environment and may even allow the organism to push beyond previous environmental barriers. Others will be unsuccessful, and individuals with these modifications will simply not survive to pass them along; Darwin termed this process natural selection.

But Darwin's theory of the cause of evolution, natural selection, was not widely accepted for lack of sufficient evidence. It fell even deeper into disrepute in the early twentieth century, when the new science of genetics (developing after the rediscovery in 1900 of Mendel's work) seemed to provide alternative mechanisms for evolution, such as mutation. Gregor Mendel (1865), demonstrated that organisms acquire traits through "discrete units of heredity," later to become known as genes. Much later, scientists in the 1930s showed that genes are the ultimate source of variation within a population. That is, all variations arise through changes, called mutations, in genes. If a mutation enables an organism to survive or reproduce more effectively, that mutation tends to be preserved and spreads in a population through natural selection. Hence, evolution depends on both natural selection and genetic mutations: mutations provide abundant genetic variation, and natural selection sorts out the useful changes from the deleterious ones . With the discovery of DNA (deoxyribonucleic acid) in 1953 by Francis Crick and James Watson, the study of evolution entered yet another phase, taking it to its most fundamental level. Crick and Watson found that DNA contains the genetic instructions used in the development and functioning of all known living organisms. Chemically DNA is a long polymer of simple units called nucleotides, with a backbone made of sugars and phosphate atoms joined by ester bonds. Attached to each sugar is one of four types of molecules called bases. It is the sequence of these four bases along the backbone that encodes information, and the main role of DNA is the long-term storage of information. Eukaryotic organisms such as animals, plants, and fungi store their DNA inside the cell nucleus, while in prokaryotes such as bacteria it is found in the cell's cytoplasm. Within cells, DNA is organized into structures called chromosomes and the set of chromosomes within a cell make up a genome. These chromosomes are duplicated before cells divide, in a process called DNA replication.

DNA is the ultimate source of both change and continuity in evolution. The modification of DNA through occasional changes or rearrangement in the base sequences underlies the emergence of new traits, and thus of new species. At the same time, all organisms use the same molecular codes of the four DNA base sequences. This uniformity in the genetic code is powerful evidence for the interrelatedness of living things, suggesting that all organisms presently alive share a common ancestor that can be traced back to the origins of life on Earth.

The great diversity of organisms has come about because individual lineages (species) branch into separate species, which continue to diverge by the processes described above. This splitting process, speciation, occurs when genetic differences develop between two populations that prevent them from interbreeding and forming a common gene pool. The genetically based characteristics that cause such reproductive isolation are usually termed isolating mechanisms, but there is little reason to believe that they evolve specifically to prevent interbreeding, as the unfortunate term mechanism implies. Rather, reproductive isolation seems to develop usually as a fortuitous by-product of genetic divergence that occurs for other reasons (either by natural selection or by genetic drift). The most common mode of speciation is undoubtedly genetic divergence among populations that are sufficiently spatially isolated that their gene pools are not homogenized by gene flow. This allopatric mode of speciation may occur when two widespread populations are separated by unsuitable habitat (for example, European and American populations), but is probably more frequent and more rapid when a population in a restricted locality is cut off (for example, by colonization across a habitat barrier) from the main body of the species, and undergoes rapid divergence because of genetic drift and different selection pressures. If sufficient genetic divergence transpires before these populations expand and encounter each other, they will not exchange genes when they meet; if divergence has been insufficient, they interbreed and speciation has not been completed.

Summary:

“Changes in the genetic makeup of species in a population as a result of responding to environmental changes is organic evolution”

Living entities possess the basic characteristic of reproducing. Entities being reproduced can sustain life only if there is proper coordination and adaptation with the changing environment. To maintain harmony in the ecosystem, changes must be endured and suitably adapted. Structural changes in living entities can be permanently integrated through changes in the genetic composition.

Evolution is a gradual and continuous process.

Evidence For Organic Evolution:

Organic evolution is not a hypothetical concept. Some evidence can provide proof depicting existence and occurrence of organic evolution. The evidence includes:

- Fossils
- Vestigial organs
- Homologous organs
- Atavism
- Analogous organs
- Embryology
- Connecting links

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