

Scientific theories before the 1800s:

- The earth is young (about 6000 years)
- Species don't evolve (current species are the same as ancestral species)

Modern scientific theories

- The earth is ancient (about 4.5 billion years old)
- New species evolve from ancestral species by natural selection

Natural selection

- There is genetic variation among the members of a population
  - √ Combinations of alleles and new alleles by random mutation generate the genetic variation in each generation
- Some alleles are beneficial. They help the organism survive
- In every generation, the individuals with those beneficial alleles survive better and leave more offspring.
  - √ The population will therefore change over generations as more individuals inherit the beneficial alleles

Charles Darwin

The biologist who discovered evolution by natural selection while studying finches on the Galapagos islands while traveling on the HMS Beagle

- He published this theory in his book “The origin of species by natural selection” in 1859

Supporting evidence for evolution comes from many sources, including vestigial organs, fossils, and comparing the genomes of species

### Vestigial organs

Organs that have little or no function in a species but that are relics of important organs in the ancestral species

- Examples: Hip bones in whales and snakes

### Fossils

Skeletons, shells, leaves, and other parts of organisms that have been turned into minerals in the geological strata

- Ancient species are unlike present species
- Transition forms (fossils that blend features of newer and older species) have been found

Genome comparisons

Comparing the chromosomes and DNA sequences of different species

Example: Comparing human and chimpanzee genomes

1) Human genes are closest in sequence to chimpanzees genes (over 98% identical in sequence)

2) The same genes occupy the same locations on human and chimpanzee chromosomes

- Humans have 46 chromosomes. Chimpanzees have 48 chromosomes.
- Human chromosome 2 was made by fusion of two smaller chimpanzees chromosomes

3) Non-functional DNA sequences (such as pseudogenes) are also most similar in humans and chimpanzees

- Example: The GULO gene (which is involved in making vitamin C) is a non-functional pseudogene in humans and chimpanzees
- The mutations that make the GULO gene non-functional are identical in humans and chimpanzees