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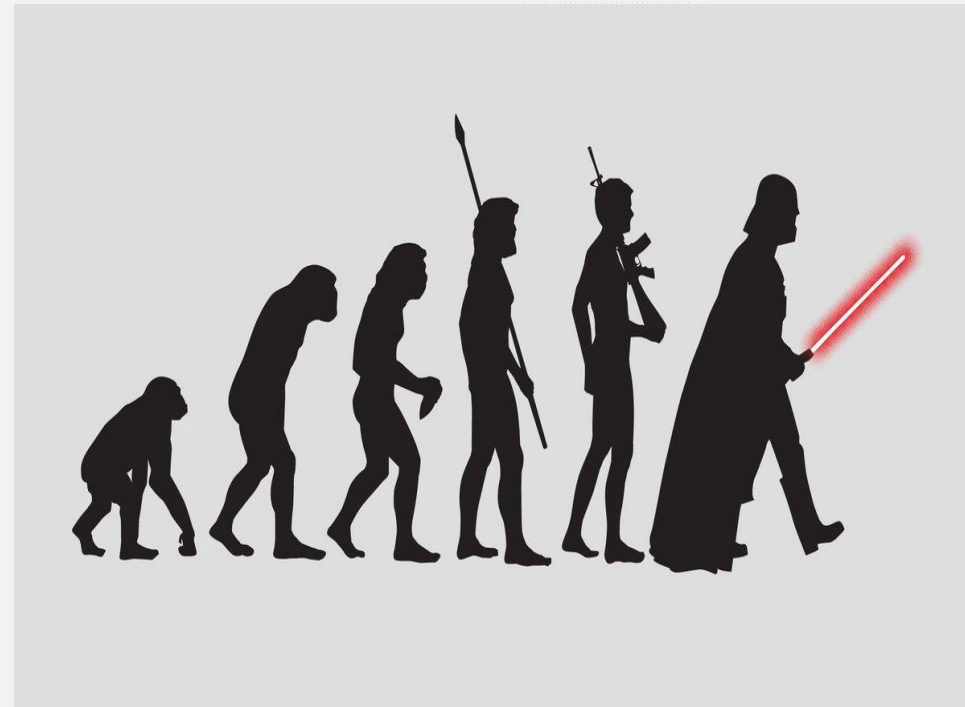
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Evolution

Unit 5

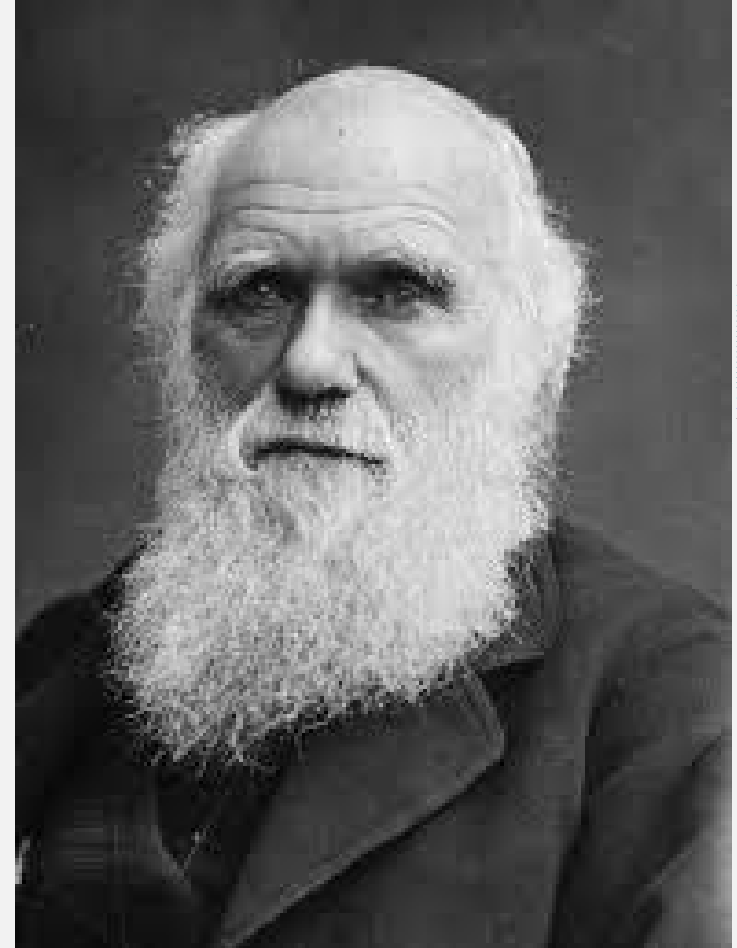
The Theory of Evolution

- “ Evolution, or change over time, is the process by which modern organisms have descended from ancient organisms.
- “ The theory of evolution can explain Earth's biodiversity.
- “ A scientific theory is an explanation of natural events that is supported by evidence and can be tested with new evidence.



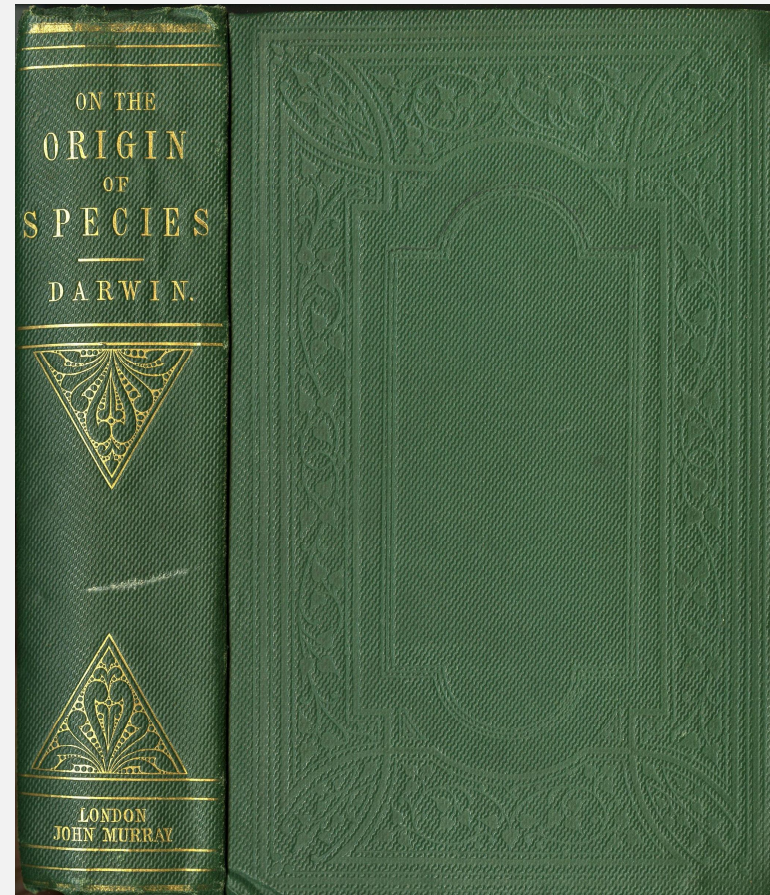
Charles Darwin

- “ Charles Darwin added the most to our understanding of evolution.
- “ In the 1830s, Charles Darwin sailed around the world and made many observations and collected evidence.
- “ He saw that many plants and animals were very well suited to their environment.
- “ Darwin collected fossils, or the preserved remains of ancient organisms. Some of the fossils were unlike any creatures he had ever seen.
- “ He wondered why the species in the fossils had disappeared.



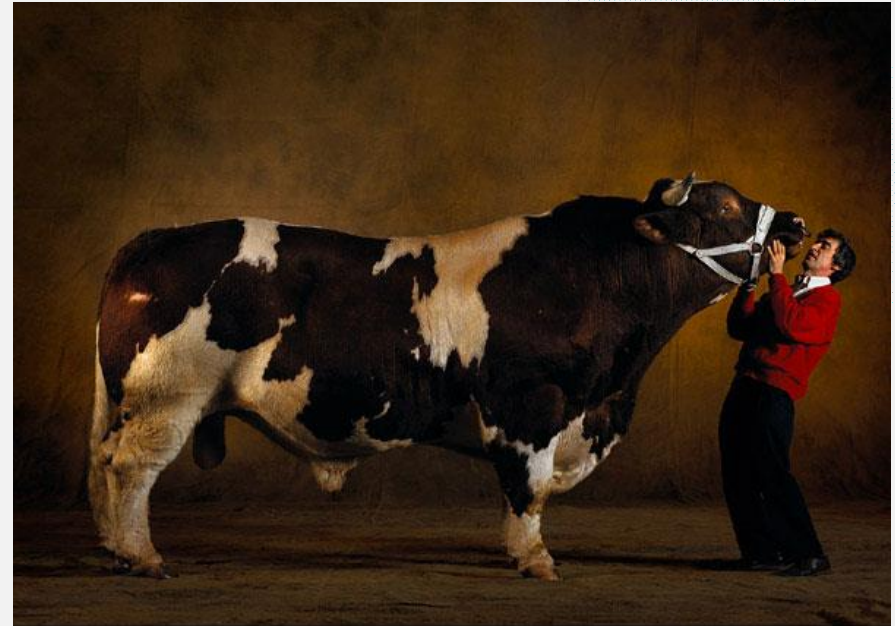
On the Origin of Species

- “ Darwin was hesitant to publish his ideas because they were so extreme.
- “ When he learned that another scientist had the same ideas, Darwin published *On the Origin of Species* in 1859.
- “ In the book, Darwin supplied evidence that evolution has occurred. He also explained his ideas about how evolution occurs.



Artificial Selection

- “ Darwin's theory was based on artificial selection.
- “ In artificial selection, nature provided the variation, and humans selected those variations that they found useful.
- “ For example, animal breeders used only the largest pigs, fastest horses, or cows that produced the most milk for breeding.
- “ This can also be called selective breeding.



Natural Selection

- “ Darwin thought that a similar process occurs in nature. He called this natural selection. This process can be summed up as follows:
- “ Individuals differ, and some of the differences can be passed on to their offspring.
- “ More offspring are produced than can survive and reproduce.
- “ There is competition for limited resources, or a struggle for existence.
- “ Individuals best suited to their environment survive and reproduce most successfully.



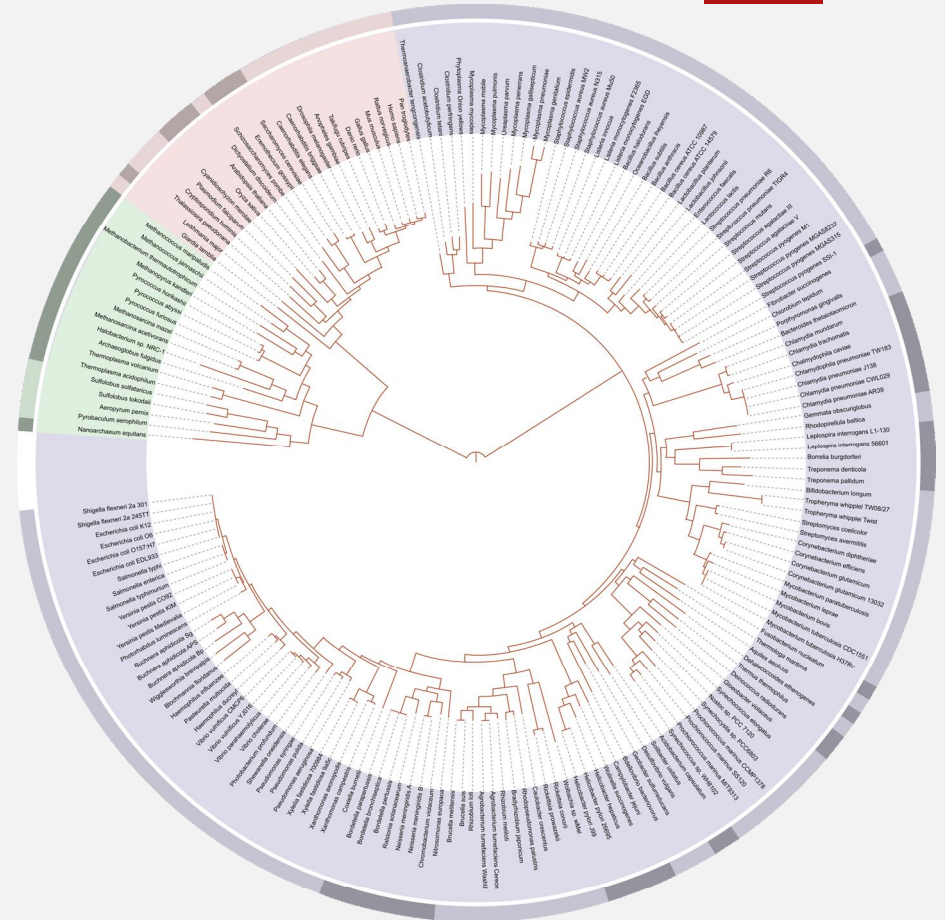
Survival of the Fittest

- “ Natural selection can also be described as survival of the fittest.
- “ Fitness is the ability to survive and reproduce in a given environment. It results from adaptations.
- “ Adaptations are inherited traits that increase an organism's chance of survival.
- “ Only the fittest organisms pass on their traits.
- “ Because of this, a species changes over time.



Principal of Common Descent

- “ Darwin argued that species alive today descended with modification from species of the past.
- “ Darwin also introduced the principle of common descent. This principle holds that all species come from common ancestors.
- “ The principle of common descent links all organisms on Earth into a single tree of life.
- “ Darwin argued that living things have been evolving on Earth for millions of years. He presented four types of evidence in support of evolution.



Evidence of Evolution

The Fossil Record:

- “ Comparing fossils from older and younger rock layers provides evidence that evolution has taken place.

Geographic Distribution Of Living Species:

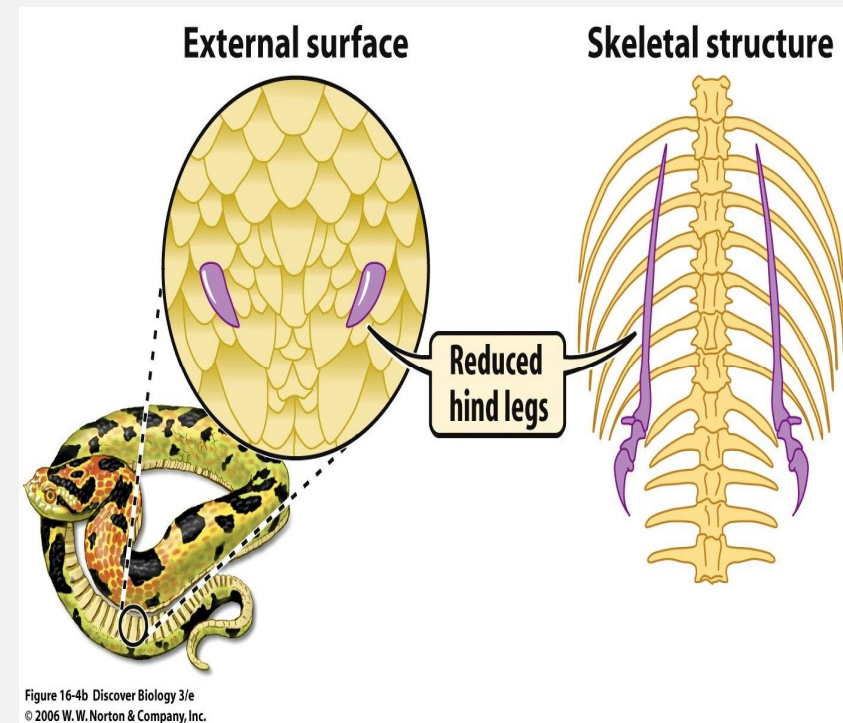
- “ The presence of similar but unrelated organisms in similar environments suggests the action of natural selection.



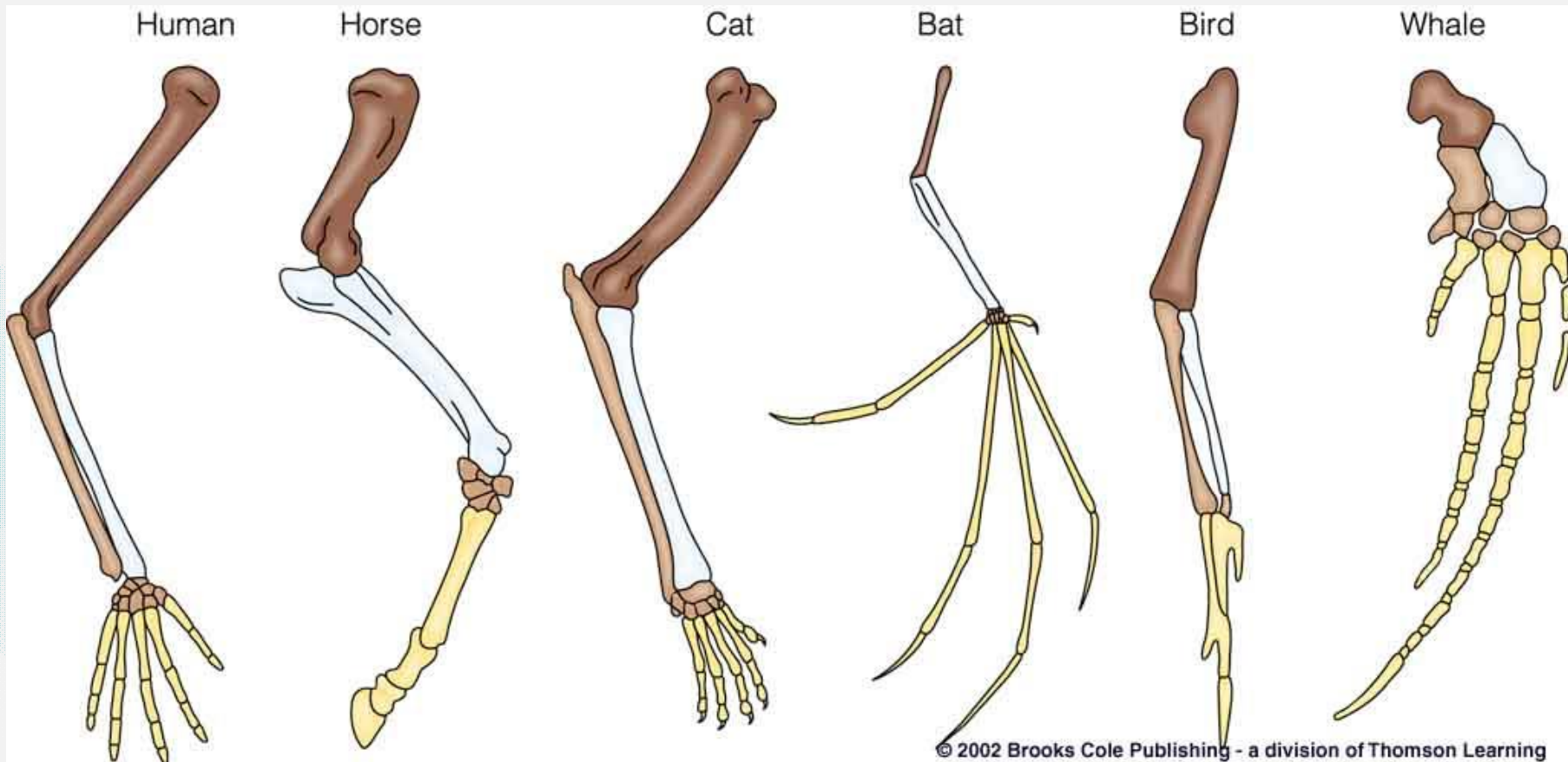
Evidence of Evolution

Homologous structures of living organisms:

- “ Homologous structures have different mature forms but develop from the same embryonic tissues. They provide strong evidence that organisms have descended, with modifications, from common ancestors.
- “ Some homologous structures no longer serve major roles in descendants. If the structures are greatly reduced in size, they are called vestigial organs. For example, the appendix in humans is a vestigial organ. It carries out no function in digestion.



Homologous Structures



Evidence of Evolution

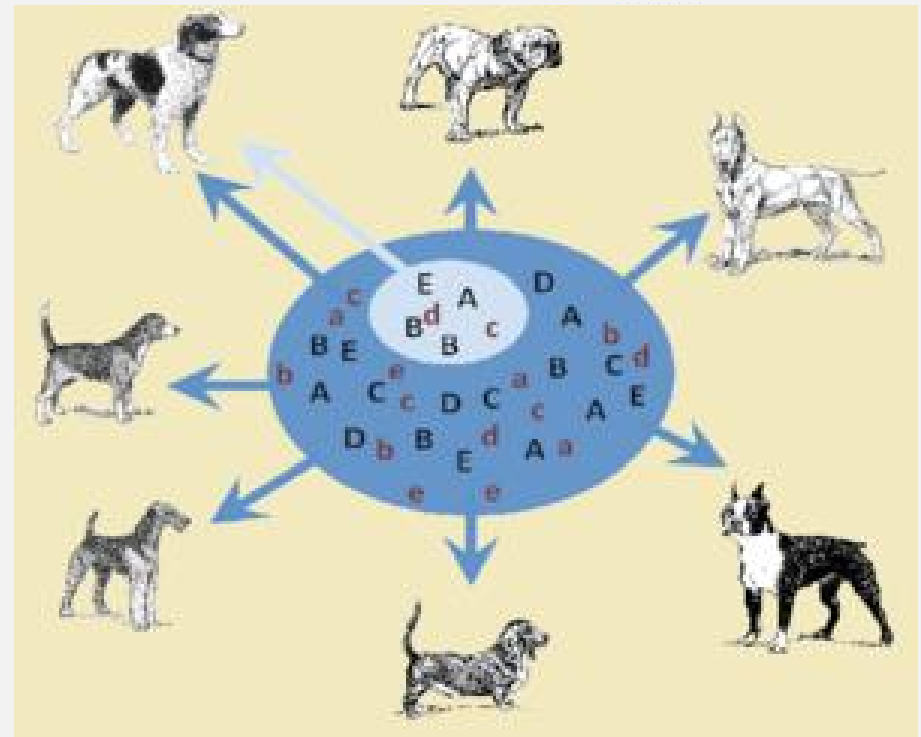
Similarities In Early Development:

“ The early stages, or embryos, of many animals are very similar. These similarities are evidence that the animals share common ancestors.



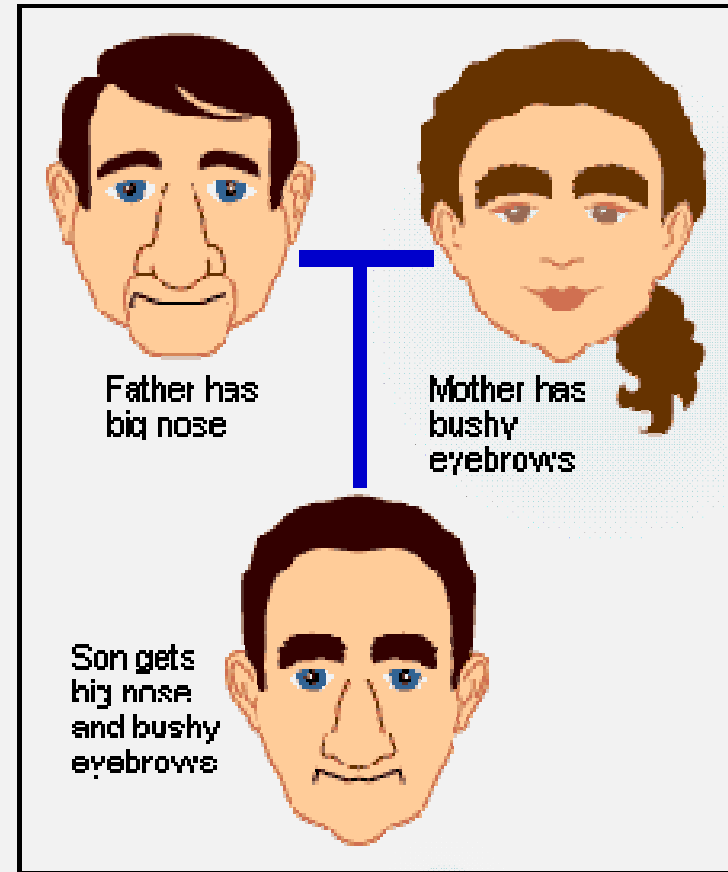
Genetic Variation

- “ To understand evolution, genetic variation is studied in populations. A population is defined as a group of individuals of the same species that interbreed.
- “ Members of a population share a common group of genes, called a gene pool. A gene pool consists of all the genes, including all the different alleles, that are present in the population.
- “ In genetic terms, evolution is any change in the relative frequency of alleles in a population.
- “ The relative frequency of an allele is the number of times the allele occurs in a gene pool, compared with the number of times other alleles for the same gene occur.



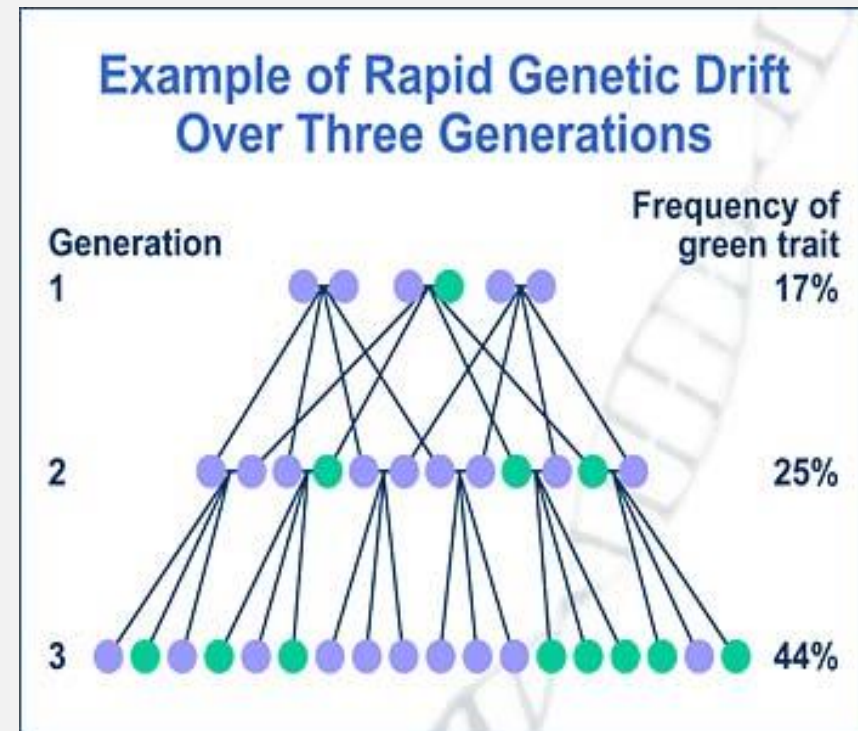
Genetic Variation

- “ The two main sources of genetic variation are mutations and gene shuffling.
- “ A mutation is any change in a sequence of DNA.
- “ Gene shuffling occurs during the production of gametes in sexual reproduction.
- “ It can result in millions of different combinations of genes.
- “ Mutation and gene shuffling do not change relative allele frequencies. However, they increase genetic variation by increasing the number of different genotypes.



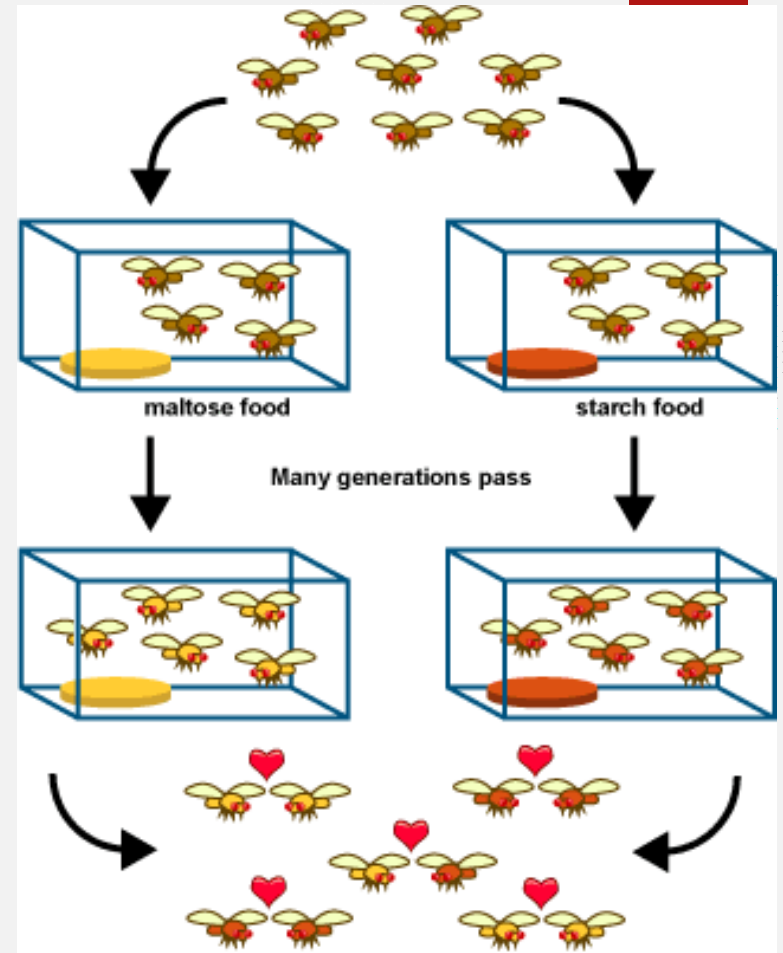
Evolution as Genetic Change

- “ Natural selection acts on individuals. Evolution acts on populations.
- “ Natural selection acting on individuals leads to the evolution of populations.
- “ Natural selection is not the only source of evolutionary change. In small populations, alleles can become more or less common simply by chance.
- “ This kind of change in allele frequency is called genetic drift. It occurs when individuals with a particular allele leave more descendants than other individuals, just by chance.
- “ Over time, this can cause an allele to become more or less common in a population.



The Process of Speciation

- “ Speciation means the formation of new species.
- “ For one species to evolve into two new species, the gene pools of two populations must become separated, or reproductively isolated.
- “ Reproductive isolation has occurred when the members of two populations cannot interbreed and produce fertile offspring.
- “ Reproductive isolation can involve behavioral, geographic, or temporal isolation.



The Process of Speciation

- “ Behavioral isolation occurs when populations have different courtship rituals or other behaviors involved in reproduction.
- “ Geographic isolation occurs when populations are separated by geographic barriers, such as mountains or rivers.
- “ Temporal isolation occurs when populations reproduce at different times.

