TOPIC 5.1: EVOLUTION

Evolution

Evolution is the cumulative change in the heritable characteristic of a population (i.e. biological change over time)

- These characteristics are encoded by genes and transferred between generations as alleles

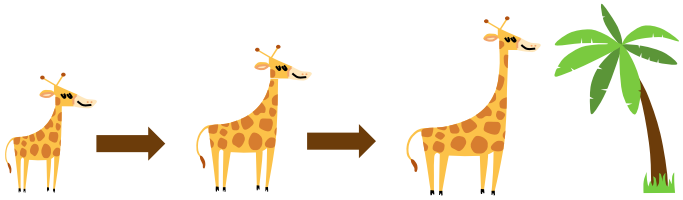
Hence, evolution is a change in the allele frequency of a population's gene pool over successive generations

Theories of Evolution

Lamarck

Proposed that species change via habitual use and disuse

- A giraffe stretches it neck to reach leaves in tall trees
- The giraffe's neck becomes extended from constant use
- The giraffe's offspring inherit its long neck

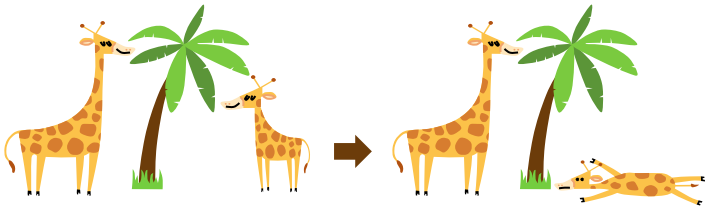


This theory has been **rejected** because these acquired traits do not have a genetic basis (and thus cannot be inherited)

Darwin (and Wallace)

Proposed that species change via natural selection

- A giraffe with a longer neck can reach leaves in tall trees
- The giraffe will get enough food to survive and reproduce
- The giraffe has more offspring (that inherit a long neck)



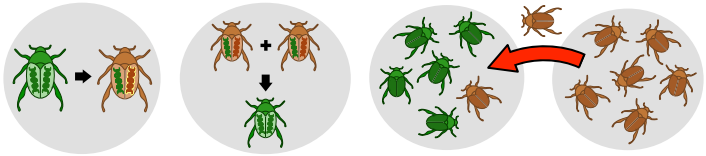
Darwin's theory has been **reinforced** by our understanding of modern genetics (incorporated as neo-Darwinism)

Mechanisms of Change

Fundamental to the process of evolution is the presence of variation within populations upon which selective forces act

There are three main mechanisms by which genetic variation within a population is maintained:

- Mutations – changes to the gene sequence
- Sexual reproduction – new gene combinations
- Gene flow – immigration and emigration

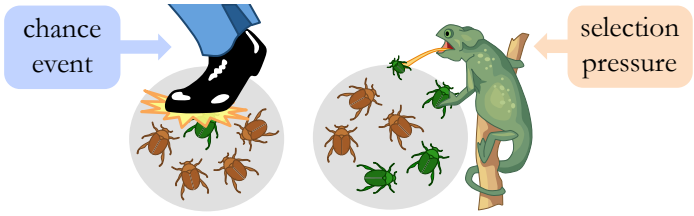


Mutation | Sex | Gene Flow

There are two mechanisms by which population variety can be altered (⬇ biodiversity):

- Random chance (genetic drift)
- Directed intervention (natural or artificial selection)

The impact of a change is greater if the population is small (this may occur via population bottlenecks or founder effect)



Genetic Drift | Natural Selection

Speciation

If populations become isolated, the level of genetic divergence gradually increases the longer the populations remain separated

- Continuous variation across a geographical range of related populations matches this concept of gradual divergence

Speciation will occur when populations diverge to the extent that they can no longer interbreed and produce fertile, viable offspring