Evolution

- **Evolution** is the process by which **inherited characteristics** in a population change over time due to **natural selection**:

- If this process repeats enough times, populations may change so much that they form whole new **species**.

- **The theory of evolution** states all species alive on earth today evolved from simple life forms over three billion years.

Natural selection: survival for fittest

- **Charles Darwin** is recognised for work on **natural selection** which he published in '**On the Origin of Species**' (1859).The accepted theory of **evolution** explains that it happens by natural selection.
- The key features are:

1. Individuals in a species show a wide range of variation and this variation is because of differences in their genes.
2. Individuals with characteristics most suited to their environment are more likely to survive and reproduce. This is commonly known as 'survival of the fittest'. The genes that allow these individuals to be successful within their environment are passed on to their offspring, which results in these specific genes becoming more common.
3. Those that are poorly adapted to their environment are less likely to survive and reproduce. Their genes are less likely to be passed on to the next generation.
4. Over a period of time, a species will gradually evolve.
5. Both genes and the environment can cause variation, but only genetic variation can be passed on to the next generation.
6. If two populations of one species become increasingly different in phenotype that they can no longer interbreed to form fertile offspring, this can result in the formation of two species.

Theory of Evolution

The **theory of evolution** states that all species on earth today have evolved from simple life forms over three billion years.

1. Lamarck's theory of Evolution

- At the beginning of the 19th century Jean-Baptiste Lamarck was a French scientist who developed an alternative theory of evolution before Charles Darwin.
- Lamarck's theory involved **two ideas:**

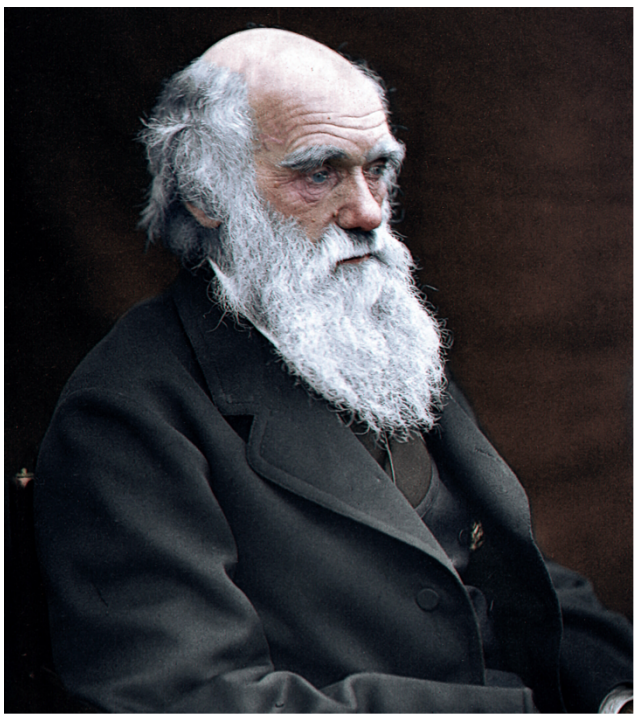
I. A characteristic which is used more and more by an organism becomes **bigger and stronger**, and one that is not used eventually **disappears**

II. any feature of an organism that is improved through use is **passed to its offspring**

- Lamarck's theory cannot account for all the observations made about life on Earth. For instance, his theory implies that all organisms would gradually become complex, and simple organisms disappear.
- **Example** : Lamarck's theory suggested that the giraffe's original short-necked ancestor repeatedly stretched its neck to reach the higher branches to eat. Lamarck believed that the stretching elongated the giraffe's neck, which became a useful characteristic and was passed onto future generations. This resulted in the length of the giraffe's neck increasing over time.

2. Darwin's theory of evolution

- Charles Darwin was an **English naturalist** who studied variation in plants, animals and fossils during a **five-year voyage** around the world in the 19th century. Darwin visited **four continents** on the **ship HMS Beagle.**
- Darwin observed many organisms including **finches, tortoises and mocking birds,** during his five week visit to the **Galapágos Islands,** near Ecuador in the Pacific Ocean. He continued to work and develop his ideas once he returned from his voyages.



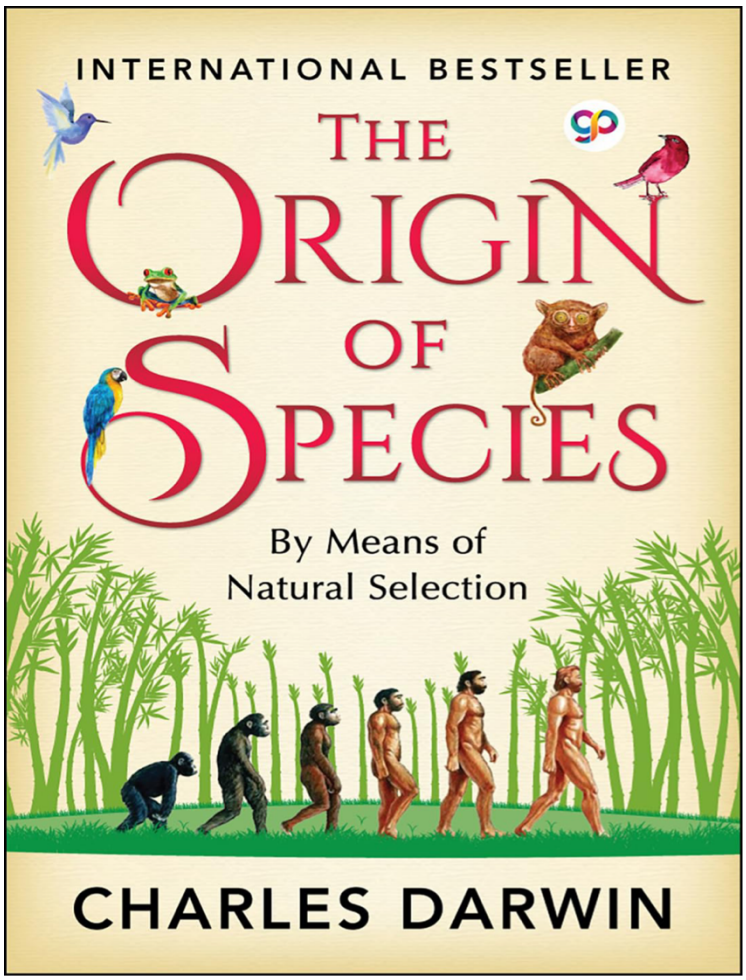
- **Darwin's theory of evolution** challenged the idea that God made all the animals and plants that live on Earth, which contradicted the commonly held Christian views of his era. He did not publish his scientific work and ideas until 28 years after his voyage.
- Finally, as a result of Darwin's world expedition and observations, which were backed by many years of experimentation; his discussions with like-minded scientists and his developing knowledge of geology and fossils; he proposed the theory of evolution by **natural selection.**

➤ Darwin Theory proposed that:

① individual organisms within a particular species show a wide range of variation for a characteristic

② individuals with characteristics most suited to the environment are more likely to survive to breed successfully

③ the characteristics that have enabled these individuals to survive are then passed on to the next generation. This theory is called **natural selection.**



Problems with Darwin theory of evolution

- Darwin ideas were documented in the book ***On the Origin of Species***, which was published in 1859. The naturalist's ideas created controversy in Victorian society.
- The theory of evolution through the process of natural selection was only gradually accepted because:

I. The theory challenged the idea that God made all animals and plants that live on Earth (creationism)

II. There was insufficient evidence when the theory was published to convince many scientists

III. The mechanism of inheritance and variation was not known until 50 years after the theory was published

Speciation:

- **Speciation** is the formation of new **species** and can happen as a result of **isolation** and **natural selection**.
- It happen when populations of same species changes enough to become reproductively isolated- it means they can't interbreed to produce new offspring.

Extinction

- **Extinction** is when there are no remaining living individuals of a **species**. Organisms can become **extinct** if they cannot **adapt** to a change quickly enough.
- Factors that could cause **extinction** include:

  - A new **disease**.
  - A new **predator**.
  - A new **competitor**.
  - A change to the **environment**, i.e. **climate change** or **habitat destruction**.
  - A **catastrophic event**, e.g. **volcanic eruption** or an **asteroid** hitting the earth.

- Animals can also cause **extinctions** through hunting, habitat destruction or introduction of new species e.g. the extinction of the dodo.
- When some species become **extinct**, others **evolve** more and thrive.