

Cells and Heredity

Chapter 6: Change Over Time

8th Grade

Lesson 1 (Darwin's Theory)

Charles Darwin

- Hypothesized that species gradually change over many generations and become better adapted to new or changing conditions.
- He thought these changes could make organisms so different that they produce new species over time.
- His main evidence came from observations of life on the **Galapagos Islands**.
- He noticed many similarities between Galapagos organisms and those found on mainland South America, but also many differences.
- The island species had become different from their mainland relatives by being isolated over time.
- He also noticed differences among organisms on different Galapagos Islands.

Adaptation – an inherited behavior or physical characteristic that helps an organism survive and reproduce in its environment

Species – a group of similar organisms that can mate with each other and produce fertile offspring

Evolution – the gradual change in a species over time

Convergent evolution – the process by which unrelated organisms evolve similar characteristics

- Evolving in similar environments can result in similar characteristics over time.

Examples:

Turtles, frogs, and ducks have all developed webbed feet to help them swim, but are not closely related.

Birds, insects, and bats have all developed wings to help them fly, but are not closely related.

Natural selection – the process by which organisms that are best adapted to their environment are most likely to survive and reproduce

- The offspring then inherit the traits that allowed the parents to thrive.
- Over time, those beneficial traits are common in the population.
- Unfavorable traits disappear in the population over time.

Factors That Affect Natural Selection :

1. **Overproduction** – producing far more offspring than what can possibly survive
 - Those with the best adaptations will survive.
 - Overproducing offspring ensures that some will survive to reproduce.

2. **Variation** – any difference between individuals of the same species
 - Those with helpful variations are more likely to survive.
 - Without variations, all the members of a species would have the same traits and the same chance of surviving and reproducing (or perishing).

3. **Competition** – food, space, and other resources may be limited
 - Those better adapted to use limited resources will out compete the others and survive to reproduce.

4. **Environmental change** – can affect an organism's ability to survive
 - Without the right adaptations, organisms may not survive the change.

Examples: Changes in water or soil conditions, extreme temperature change, natural disasters, disease, drought

5. **Genes** – inherited genes may result in the offspring having different characteristics than the parents
 - These traits may lead to an increased chance of survival.

Lesson 2 (Evidence of Evolution)

Evidence of Evolution:

1. Fossils

- The fossil record shows that organisms that lived in the past were very different from organisms alive today.
- It also provides clues about how and when new species evolved and how organisms are related.

2. Patterns of Early Development

- Many organisms that look very different as adults look similar during their early stages of development, indicating that they are related and share a common ancestor.

3. Similarities in body structure

- Fish, amphibians, reptiles, birds, and mammals all have an internal skeleton with a backbone, providing evidence that they all evolved from a common ancestor.
- Many different species have structures that are similar to those of other species in shape, position, and function.

Homologous structures – structures that are similar in different species and that have been inherited from a common ancestor

4. Similarities in DNA

- Similar DNA results in similar body structures, traits, and development patterns.
- Similar DNA among different organisms means they inherited many of the same genes, indicating they share a common ancestor.

5. Similarities in protein structure

- Because of similarities in DNA, many different species have similar protein structure, indicating they have a common ancestor.

Lesson 3 (Rate of Change)

A new species can form when a group of individuals remains isolated from the rest of its species long enough to evolve different traits that prevent reproduction.

Gradualism – a pattern of evolution that involves the slow and steady accumulation of small genetic changes over long periods of time

- Small changes add up to major changes over time.

Punctuated equilibrium – a pattern of evolution in which long stable periods are interrupted by brief periods of more rapid change

- A species may have a short period of change, then not change for a long time.