

# UNIT 7 - ADAPTATION

## Standards, Elements & Skills:

**S7L5. Students will examine the evolution of living organisms through inherited characteristics that promote survival of organisms and the survival of successive generations of their offspring.**

**a. Explain that physical characteristics of organisms have changed over successive generations (e.g. Darwin's finches and peppered moths of Manchester).**

### Skills:

1. Distinguish the nature of adaptation as a "species-wide process" involving multiple generations rather than as a "choice" an individual organism makes to change its own immediate circumstances.
2. Relate how the speed of species diversification varies based on the average amount of time to produce a new generation within the species.
3. List the ways that humans have affected the habitats of other organisms leading to adaptation of the species or endangerment/extinction.

**b. Describe ways in which species on earth have evolved due to natural selection.**

### Skills:

1. Explain the diversity of fish, birds, reptiles, and/or amphibians due to limiting factors within specific environments.

**c. Trace evidence that the fossil record found in sedimentary rock provides evidence for the long history of changing life forms.**

### Skills:

1. Explain how extinction occurs without adaptations and give examples (e.g. trilobites, dinosaurs, and mammoths).

## Key Learnings:

Students will know that:

1. Physical characteristics of organisms change over time.
2. Adaptation involves the species losing traits that are disadvantageous.
3. Changes in species occur due to natural selection, genetic mutation, and environmental pressure.
4. When the environment changes drastically, species that cannot adapt over several generations will become extinct.
5. Fossils provide evidence of change, but the origin of life on Earth is still a scientific mystery.

Students will be able to:

- Explain that physical characteristics of organisms change over time (giraffe neck length, peppered moths, Darwin's finches).
- Determine how the reproduction and survival of species is impacted by natural selection (adaptations such as mimicry, camouflage, and venom).
- Demonstrate understanding of the process of natural selection.
- Demonstrate understanding that the fossil record found in sedimentary rock provides evidence for evolution.

## Vocabulary:

- adaptation - a behavior or physical characteristic that allows an organism to survive or reproduce in its environment
- evolution - the gradual change in a species over time
- extinction - the disappearance of all members of a species from Earth
- natural selection - a process by which individuals that are better adapted to their environment are more likely to survive and reproduce than others of the same species
- homologous structure - body parts that are structurally similar in related species and that provide evidence for a common ancestor
- variations - any difference between the individual of the same species
- fossil records - the millions of fossils that scientists have collected

# **Essential Questions & Answers:**

## **How does the fossil record provide evidence for evolution?**

The preserved remains of organisms, when dated and compared to other similar fossil remains and living organisms, allow scientists to produce a timeline of change in different species of organism and show evolutionary relationships between species. A series of fossils might show a series of changes between an ancient, extinct species and a different, but related modern species.

## **Tracing evidence through the fossil record, explain how the fossil record provides evidence for the long history of evolution?**

The fossil record found in sedimentary rock shows a change in organisms over a large period of time. It provides evidence to support the theory of evolution, showing the relationship between organisms and the changes that occurred to them over time.

## **How have physical characteristics of organisms changed over time?**

Physical characteristics of organisms have changed over time through natural selection. Natural selection means that organisms with traits best suited to their environment will survive which can lead to gradual physical changes in a species. Two prominent examples of this type of change are Darwin's finches found in the Galapagos Islands and the Peppered moths of Manchester, England.

Darwin observed 13 species of finch on the Galapagos Islands that were similar, except for differences in eating habits, beak size and body shape. They were also similar to one species of finch he had observed on the South American coast. He reasoned that the finches on the Galapagos Islands originated from South America. Those finches with beak shapes that allowed them to eat available food sources survived and were able to pass on their traits to successive generations. Eventually they became separate species, each adapted to their type of food source.

There were two types of peppered moth in Manchester, England. One was a light "peppered" color and the other was a dark color. Before the Industrial Revolution, the trees in the surrounding area were light colored and made the perfect camouflage to hide the peppered colored moths from predators. The dark colored moths were easily seen and eaten, making this population predominantly peppered colored. During the Industrial Revolution, the trees bark became covered in soot. The peppered colored moths no longer had the advantage. They were easily seen by predators and now the darker phenotype of moth was easily hidden and had the trait that better suited them to their environment. After a certain period of time, the population's phenotype changed to predominantly dark colored moths.

## **How do genetic traits affect an organism's survival?**

The genetic traits of an organism (genotype) determine the physical and behavioral characteristics of that organism (phenotype). If the traits an organism receives are useful in their environment – such as helping them access resources or avoid predation – the organism will survive and likely pass on those traits to their own offspring. If those traits are not useful in the environment the organism is in, the organism may not survive and those traits may not be passed on.

## **How are Darwin's finches an example of evolution by natural selection?**

Darwin's finches show that depending on the demands of the environment certain traits may or may not be useful. Traits are beneficial if the trait helps the organism survive. When a number of finches started a population in the Galapagos islands, finches with beak's that were best able to access the different food sources on each island were more likely to survive and pass on those useful genes. Over time, each island developed a population of finches with beaks adapted to the food available on that island.