# EVOLUTION AND INTERACTION

## History of Life on Earth

Over 3.5 billion years ago, the Earth was much different than it is today. Scientists believe that early Earth's atmosphere was made up of nitrogen, water vapor, carbon dioxide, and methane.



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We would ecause there was sts believe that early life began during this period of time on Earth.

***Lesson Checkpoint: Would humans have been able to live on Earth over 3.5 billion years ago?***

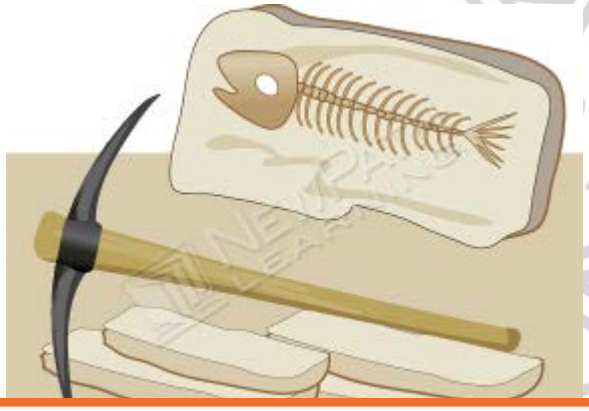
## Early Life Forms

Scientists believe that early life forms resembled bacteria. They hypothesized that the early life forms did not need oxygen, that they lived in the oceans, and that they were unicellular organisms.

In 1953, Harold Urey and Stanley Miller conducted an experiment that simulated early Earth. They ran an electrical current through the mixture and noticed that subunits of proteins began to form, which are the building blocks of life. Today life cannot spontaneously appear, but the conditions on early Earth could support life arising from nonliving matter.

Other scientists experimented further with this simulation and ended up with chemicals that go together to form carbohydrates and nucleic acids. Scientists then hypothesized that chemicals formed gradually over millions of years in Earth's oceans.

Today, scientists dig up fossils of ancient organisms that lived on Earth long ago.





## Darwin's

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His job wa during his voyage. Darwin saw an amazing number of life forms that he had never seen before. He drew a picture of each organism and observed it in its natural habitat.

Darwin's observations brought him to a theory that is still discussed today: **The theory of evolution by natural selection.** Darwin discovered an enormous number of species on his voyage. A **species** is a group of organisms that can produce fertile offspring.

Four years into the trip, the HMS Beagle reached the Galapagos Islands off of the west coast of South America. It was here that Darwin witnessed the most diverse species. Darwin noticed that many of the plants and animals were similar to the species that he had seen in South America, but they had important differences as well. For example, iguanas on the mainland had short claws that allowed them to climb trees so that they could eat leaves, while iguanas on the

Galapagos had long claws so that they could grasp onto the slippery rocks along the shore where they eat seaweed.

Darwin hypothesized that a number of plant and animal species somehow i ica.

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***Lesson Checkpoint:***
***Where did Darwin see the most diverse species?***

## Adaptations of Organisms

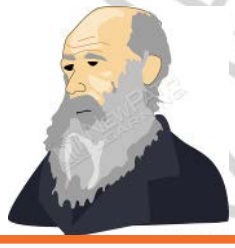
Darwin also noticed that the finch species were different on each island. The most noticeable of the differences was the size and shape of their beaks, which Darwin believed was because they ate different food from island to island.

Darwin hypothesized that the finches on each of the islands had changed according to the types of food they eat. Darwin considered this to be an adaptation. An **adaptation** is a trait that helps the species to survive and reproduce in a particular environment.

After returning to England, Darwin continued his research on what he had seen on the Galapagos Islands. He reasoned that the different species that lived on the Galapagos Islands faced different environmental challenges than those that lived in South America. This lead him to the hypothesis that the different species slowly change through the generations to become better adapted to their particular environment. We know this as **evolution**, which is the slow change that a species undergoes over a period of time.

## Natural Selection

In 1859, Charles Darwin published the book *The Origin of Species* that described his theories on the mechanisms behind evolution.



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**Variations**: Genetic variation allows for diversity within a species. Variation is the difference between individuals of the same species. Certain traits are more effective in a particular environment than others. The beaks of the finches Darwin noted are an example of variation.

**Overproduction**: The majority of species produce more offspring than could possibly survive given the available environmental resources (food, water, etc.).

**Competition:** There is a limit on the amount of food that can be produced in a particular environment. Organisms are constantly competing to get those food resources to help them survive. Competition is the struggle between organisms to survive in the same environment with the same resources. This type of competition is not a direct fight to the end between two organisms; rather, it is competition for the available food sources.

There are many species of Paramecium, but two of these species were studied by a Russian ecologist. He tested the affect of placing the same amount of food in each Paramecium population. Both species grew rapidly. He then tried to breed both species together and he noticed that one species of Paramecium reproduced rapidly, while the other species died out completely. This is not to say that two species cannot coexist in the same habitat if they eat the same food source.

## Predation and Adaptation

**Predation** is any interaction between two organisms where one hunts and kills an organism for food. The **predator** is the organism that hunts and kills the other organism. The **prey** is the organism that is hunted and killed.

Over time, both the predators and the prey adapt to be more successful in their relationship to the other. Predator adaptations increase its survival and reproductive success by being better able to catch the prey that it feeds on. The Deep Sea Angler Fish adapted to lure prey c



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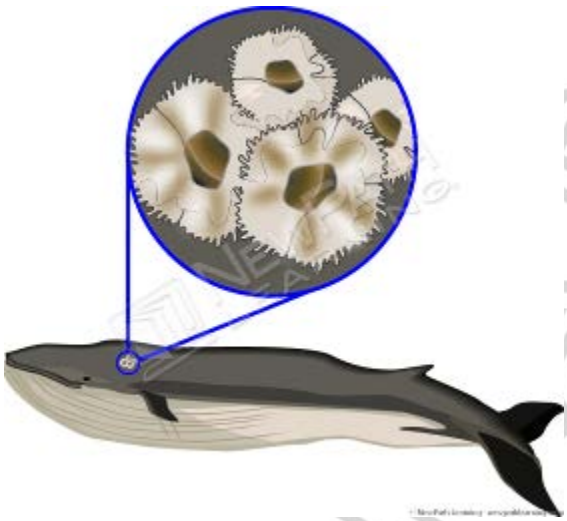
## Symbiosis

Symbiosis is a relationship between two species in which each is dependent on the other. There are three different types of symbiotic relationships: commensalism, mutualism, and parasitism.

**Commensalism** is when one species benefits and the other species is neither helped nor harmed by the relationship. A shark is followed by many smaller fish waiting for the shark to attack and kill its prey. The smaller fish will eat the scrap that the shark did not eat.



**Mutualism** is a relationship between two species where both species benefit from the relationship. A bee will visit as many flowers as possible to obtain food. The flower is benefiting because the bee is taking its pollen to the other flowers of its species and allowing the flower to reproduce.



**Parasitism** is when one species lives on or within the other species and causes harm to the organism. A **parasite** is the organism that benefits from the relationship. The **host** is the organism that is harmed by the relationship. The relationship between us humans and a mosquito is an example of a parasitic relationship. The mosquito feeds on our blood and could potentially give the human a virus or disease, which harms the human.