# Naturally Selected to Survive

by Michael Stahl

The earth has changed, over and over again, throughout the course of its history. Some of these changes have happened quickly. Others have occurred over long stretches of time. For example, the planet has experienced ice ages that took place over *thousands* of years. During those eras, huge sheets of ice covered much of the surface of the globe. Then for a few thousand years between the ice ages, the earth warmed up. Scientists believe that this cycle has actually occurred a few times.

As the planet goes through this cycle, environments may go through changes. In order to survive in changing environments, species oftentimes must undergo a process of adaptation. Adaptation refers to a mutation or genetic change that enables an organism such as an animal or plant to survive in its environment. This trait is passed down from one generation to the next, becoming an inherited trait of the species. A species may have to adapt to warmer temperatures, increased precipitation, or even developing air pollution. If the organisms of a species cannot change along with the area in which they live, they risk dying out. Though an uncountable number of species that have roamed the earth have become extinct, the planet has seen many others adapt as well. These select organisms have been able to go on living in their environment.

A species adapts to a changing environment as organisms with favorable traits reproduce and survive. These favorable traits, which help the species survive, are passed down through different generations of the species. This process is called "natural selection." Recent history has given us an important example of how organisms are able to survive once their environments change.

Light gray peppered moths and dark-colored peppered moths lived in the countryside between the cities of Manchester and London in England. Many years before the 19th century, more of the light gray peppered moths had been able to survive in their environment mostly because of their color. Their thin layer of skin, as well as their large wings, was mostly gray with a little bit of black "peppered" all around. This color was advantageous because the light gray peppered moths were camouflaged when they stayed on gray-colored areas on the sides of trees in their habitat. Predators, which were mostly birds, could not see the light-colored moths on the trees because the color of the moths blended in with the color of the trees. Instead, the predators were able to see the dark-colored peppered moths more easily.

In the early 19th century, though, England began the first years of its Industrial Revolution. Many areas, especially in and between the cities of Manchester and London, became populated by a growing number of factories. This was because companies began to use a lot of new machinery that

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had been invented in the decades before. These machines made work a lot easier in many ways. The companies could build more products faster than ever before. However, many of these factories needed coal to provide energy for the machines. When coal burns, it gives off a lot of dark-colored smoke. Soot is a black substance that collects on a surface that comes into contact with smoke. Smoke's dark particles stick onto surfaces like paint. In the English countryside near industrialized areas, the trees began to blacken with soot because of all of the smoke in the air from the factories. This made the light gray peppered moths much more vulnerable. Predators could see them on the trees more clearly and easily hunt them down.

Sometime in the next hundred years, scientists began to notice a huge change in the moth population living in and between the cities of Manchester and London near where many of those factories had been constructed. Most of the peppered moths were the dark-colored kind! What caused this change was the fact that predators had eaten a lot of the light gray peppered moths because the moths were clearly visible on the black-colored trees. The dark-colored peppered moths in the area survived much more easily and mated with other dark-colored peppered moths until most of the population of peppered moths became dark-colored.

Many scientists feel that this example of evolution in a species supports Charles Darwin's theory of natural selection. An author named J.W. Tutt published a report about the moths a few years after Darwin's death, writing that the change in the peppered moth population seemed to support Darwin's ideas. Though Darwin was not alive to read the Tutt report, his teachings about nature live on.

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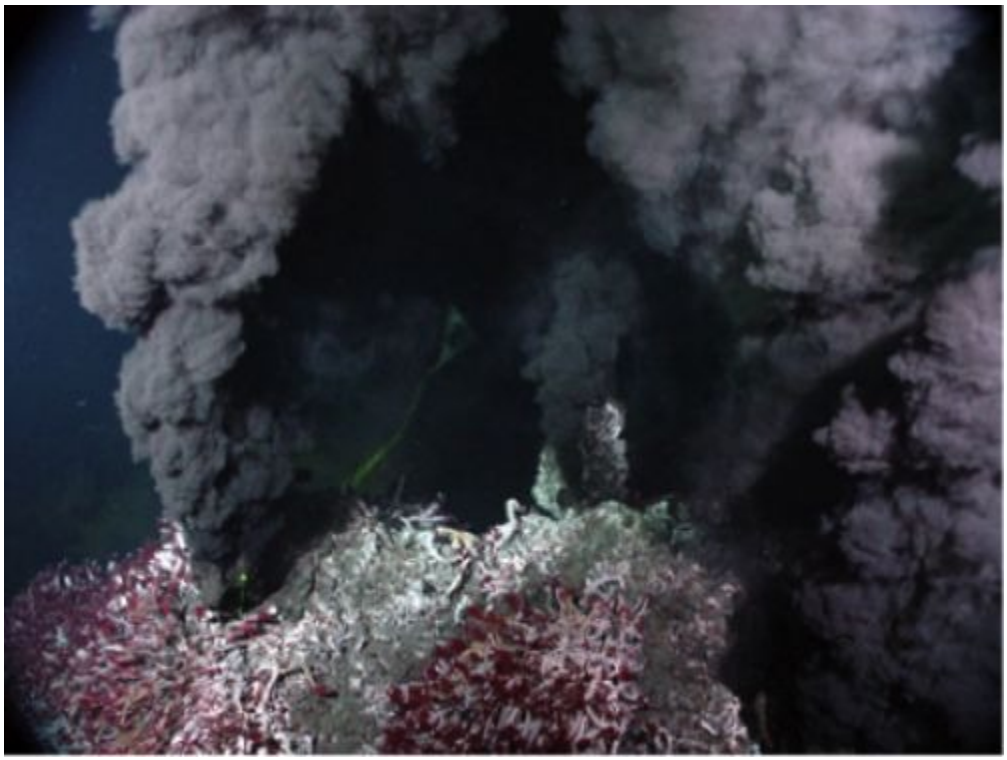
# Life Finds a Way

by ReadWorks



Deep, deep under the ocean, there is a place unlike anywhere else on Earth. In a place so deep that it's impossible for sunlight to reach it, great rocky tubes shoot up from the sea floor. These tubes, or chimneys, belch out what looks like black smoke, all day and all night. The "smoke" is in fact a mixture of minerals from deep within the earth, which shoot out of the chimneys at extremely hot temperatures. For many years after these things (which scientists now call "hydrothermal vents") were discovered, scientists were sure that nothing could live anywhere near them.

They had lots of reasons to think this. For one, there was absolutely no sunlight. In one way or another, sunlight is the source of almost all life on the surface of earth. Plants use it to make food in a process called photosynthesis, some animals eat those plants, and other animals eat the plant-eaters. Without sunlight, the whole system falls apart, so how could there be any life somewhere that is so deep in the ocean that no light makes it down?

Secondly, the minerals in the smoke, mostly sulfur, were thought for a long time to be poisonous to most living things on Earth. With so much sulfur coming out of the ground at such high temperatures, for many years scientists were pretty confident that nothing could live around these vents.

After studying them for a long time, however, scientists made a shocking discovery. There was life around the vents. Tiny bacteria used the sulfur from the vents to make food - a process called "chemosynthesis." Other animals, like worms and shrimp, then ate this bacteria.  A whole ecosystem exists there.

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Finding this life made scientists reconsider the power of evolution. They had thought for almost a hundred years that while life was adaptable to a certain extent, there were some things it simply couldn't do without: sunlight and oxygen being two. However, as the animals around the hydrothermal vents proved, life was much more adaptable than they had believed. Now, scientists think that life, just like it does around the vents, could exist right now on Europa, one of Jupiter's moons. Europa has long been known to have vast oceans, but scientists thought that being so far from the sun and having an atmosphere so thin that it can't hold in much air, life would not be possible there. Now, it seems like those factors might not matter as much as previously thought. Some scientists also think that Mars may have once had life on its surface.

As the undersea vents example shows, life is extremely adaptable. All different kinds of places on Earth have animals and plants that have adapted over many years to thrive in the particular places where they live. Some animals that live in places where it is very snowy, like high in the mountains or in the arctic, end up white so that they fit in better. Animals and plants that live in the desert, like cacti and camels, have evolved so that they need only the very little water that they get living there. Now think of fish. They are able to swim and breathe perfectly in the water. But a fish would not do very well living in the middle of the desert. Similarly, if you took a big black bear from the forest and dropped it down in the middle of the ocean, it would not last long at all.

This is because a process called natural selection has been at work since not long after the earth first formed many billions of years ago. Natural selection allows animals that have traits suited to a particular environment to survive and produce offspring. Animals who are unable to adapt to changes in their environments die off. With this process constantly at work, nature produces all sorts of animals well-suited to where they are: giraffes with long necks to reach the leaves on the trees in Africa, bears that sleep through long winters where there's no food, and on and on.

The process of natural selection helps us to understand how many plants and animals became the way they are. Many times, life finds a way, no matter how harsh the environment.

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**Name:** _____ **Date:** _____

**Use the article "Life Finds a Way" to answer questions 1 to 3.**

**1.** What did the animals around hydrothermal vents prove about life?

**2.** The first half of this article discusses the discovery of life around hydrothermal vents. What idea does the second half of the article discuss?

**3.** Explain how the discovery of life around hydrothermal vents is connected to the idea in the second half of the article. Use evidence from the text to support your answer.

**Use the article "Naturally Selected to Survive" to answer questions 4 to 6.**

**4.** Describe the peppered moth. Include at least two details from the article in your description.

**5.** The first half of this article discusses the ideas of adaptation and natural selection. What specific example of these ideas does the second half of the article discuss?

**6.** How does the example from the article help readers understand the ideas of adaptation and natural selection?

**Use the articles "Life Finds a Way" and "Naturally Selected to Survive" to answer questions 7 to 9.**

**7.** Compare the structure of these two articles. Use information from both articles to support your comparison.

**8.** Contrast the structure of these two articles. Support your answer with information from both articles.

**9.** Do the differences in the structure of these two articles make one article easier to understand than the other? Support your answer with evidence from both articles.

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