

Adaptations

A Science A-Z Life Series

Word Count: 1,889



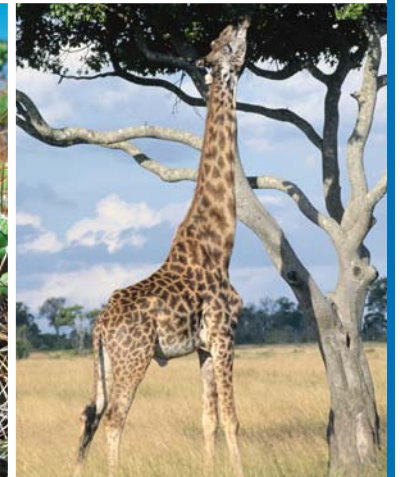
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Adaptations



Written by Ron Fridell

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inherited	passed on from parent to child (p. 15)
instinct	inherited behavior that leads an animal to act certain ways in certain situations (p. 16)
mutation	change in the basic makeup of the genes in a cell (p. 6)
naturalist	person who studies plants and animals (p. 6)
organism	a living thing (p. 6)
reflex	a purely automatic response (p. 16)
species	a group of related organisms with characteristics that distinguish it from other groups of organisms (p. 6)
survival of the fittest	a theory explaining that the organisms best suited to live in a particular environment are those most likely to survive (p. 6)

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KEY ELEMENTS USED IN THIS BOOK

The Big Idea: Plants and animals, including humans, have to adapt in response to changes in the environment. These changes can range from global to microscopic, and may include changes in the climate, the population of other species sharing the same habitat, and the availability of essential resources for survival. Physical adaptations are natural occurrences, not deliberate choices. Behavioral adaptations are usually responses to environmental conditions, and are not momentary decisions made by individuals. Some adaptations turn out to be successful, and some do not. Only those organisms with successful adaptations survive and pass on their genes to future generations. Many different adaptations to a species are often successful, which has led to incredible diversity in nature.

Key words: adapt, adaptation, animals, behavior, birds, blowhole, canopy, cell, characteristics, climate, Darwin, desert, drip tip, environment, evolution, extinct, gene, generation, habitat, humans, inherited, instinct, mutation, naturalist, organism, physical, plants, predator, rainforest, reflex, scientists, species, survival of the fittest, survive

Key comprehension skill: Main idea and details

Other suitable comprehension skills: Classify information; identify facts; compare and contrast; elements of a genre

Key reading strategy: Using a Glossary and Bold-faced Words

Other suitable reading strategies: Using a table of contents and headings; ask and answer questions; connect to prior knowledge; summarize; visualize

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Glossary

adapt	to change parts of the body and behavior to match changes in the environment (p. 6)
adaptation	a specific change to a physical feature or a behavior common to a species which helps the species survive (p. 5)
behavior	a way of reacting to a certain set of circumstances (p. 16)
blowhole	a hole at the top of a whale or dolphin's head, through which it breathes (p. 8)
characteristics	physical features that help identify an organism (p. 7)
extinct	no longer in existence (p. 9)
generation	all the organisms of a species born around the same time; the time between when a group of organisms and their offspring are born (p. 7)
habitat	the natural conditions and environment in which a plant or animal lives (p. 5)

Adaptations Everywhere

Think about adaptation. Consider physical and behavioral adaptations. What do you know about inherited and learned adaptations?

Look around your own environment. What human-made adaptations do you see? How do these adaptations help satisfy basic needs and make people's lives better?



How have these organisms adapted to their environments?



Cactus spines are an adaptation to protect the plant from being eaten.

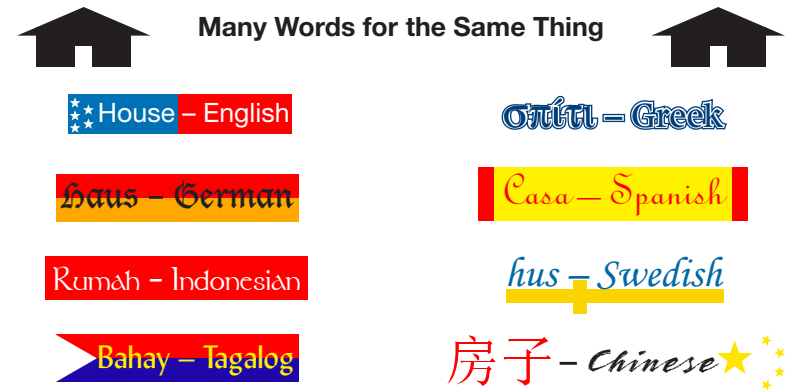
Table of Contents

Introduction	4
Survival of the Fittest.....	6
Plant Adaptation	10
Animal Physical Adaptation	13
Behavioral Adaptations.....	16
Human Adaptations	19
Adaptations Everywhere	22
Glossary	23



Introduction

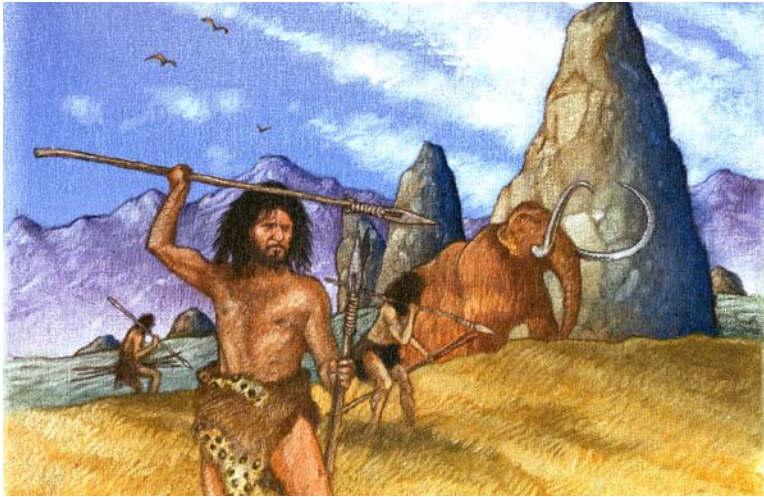
Afternoon sunlight filters through the trees in a city park. A small bird called a warbler sits on a high tree branch, singing a beautiful song. Suddenly, he stops and dives to catch an insect out of midair. The insect struggles, but it can't escape. The warbler returns to his perch to enjoy his snack. Down on the ground, a bright red cardinal cracks open seeds with his hard bill. A quick, hard, rat-tat-tat-tat sound splits the air, and splinters fly as a woodpecker drives her hard, chisel-like beak into a tree. On the hunt for grubs, she drills through the bark like a jackhammer breaks up concrete. On a pond nearby, some ducks float along lazily. Their heads dip down into the water and back up, their wide bills dripping with water.



One of the most important human adaptations is our ability to use complex language to communicate. Other animals use sounds to communicate, but the songs of birds and the cries of monkeys are simple signals. Humans have developed complex systems of sounds and symbols. There are over 6,900 languages spoken in the world today.

To survive, humans must satisfy the same basic needs as other animals. Other animals use a combination of mostly inherited physical and behavioral adaptations.

Humans, on the other hand, satisfy many of their needs through learned behaviors. To keep warm, we wear clothing, build fires, construct power plants, and live in insulated shelters. To get food, we grow fruits and vegetables and raise livestock. We learn to speak, read, and write languages. We use bikes, cars, and airplanes.



The adaptation of intelligence helped us create tools and hunt.

Humans also have behavioral adaptations that spring from our intelligence.

One of these adaptations is the ability to make tools. Early humans lived in a menacing environment. Without powerful jaws and sharp teeth and claws, they had to rely on their intelligence to survive. This led early humans to invent wood and stone tools, which they used to become even better hunters than the woolly mammoths, tigers, and lions around them.

WOWSER!

This crow bent a wire to turn it into a hook. That's the first evidence of birds making tools!



These birds are all looking for a meal, but what they eat is different. Because their food is different, their beaks have different shapes. The warbler's beak is thin and pointed like tweezers, for grabbing insects. The cardinal's beak is short, and hard, for cracking seeds. The woodpecker uses its long, strong beak to bore into wood, where insects lay their eggs. Ducks have wide bills for straining plants and small fish out of the water.

Over hundreds of thousands of years, these birds' beaks adapted to help them gather the food they need to survive. All plant and animal species have **adaptations** or changes that help them survive in their **habitat**. Why do certain adaptations develop, and how do they help each plant or animal? Let's find out.



Each bird's beak is adapted to its habitat and food source.

Survival of the Fittest

Organisms that successfully **adapt** to changes in their environment keep reproducing so that their **species** will survive. Those that do not adapt usually die out. Adaptations are at the heart of each species' survival. This notion of adaptation to survive is known as "**survival of the fittest.**" It means that the organisms that are the most fit to live in a certain environment are most likely to survive.

The person who first brought this theory to the world's attention was Charles Darwin, a British **naturalist**. He wrote about it in his book, *The Origin of Species by Means of Natural Selection*, published in 1859.

How do adaptations happen? Within a species, lots of individuals are born with differences called **mutations**. These mutations may change the way an animal or plant grows and what it can do. Sometimes a mutation can help an organism adapt to a change in its environment.



Charles Darwin

Human Adaptations

People adapt too. Humans have developed the ability to sweat, for example. When it is hot, the evaporating perspiration cools our skin. In cold climates, we shiver, which produces enough heat to warm us up for a short while.



Sweating is an adaptation to help stay cool.



Shivering is an adaptation to help stay warm.

DO YOU KNOW?

Only mammals sweat. Primates sweat all over their bodies. Dogs and cats only sweat on their feet.

One group of scientists set out to explore whether bird songs are inherited or learned behaviors.

They studied the songs of birds raised in normal conditions, in a group with parents. These birds' songs sounded just like their parents' songs.



Birds sing simple songs by instinct, but they learn complex songs from others.

The scientists compared their songs with the songs of birds that lived in isolation. These isolated birds grew up knowing how to sing, but their songs were crude and simple.

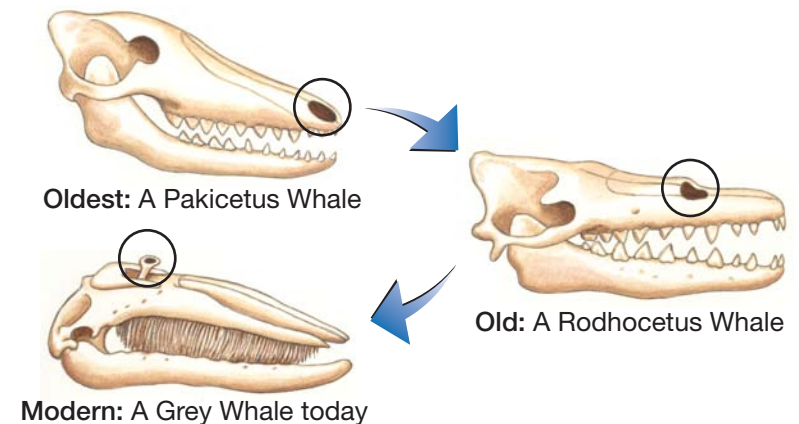
The scientists concluded that singing is partly an inherited behavior, since the isolated birds were born knowing how to sing. Since normal birds adjust their songs to sound like their parents' songs, singing must also be partly learned.

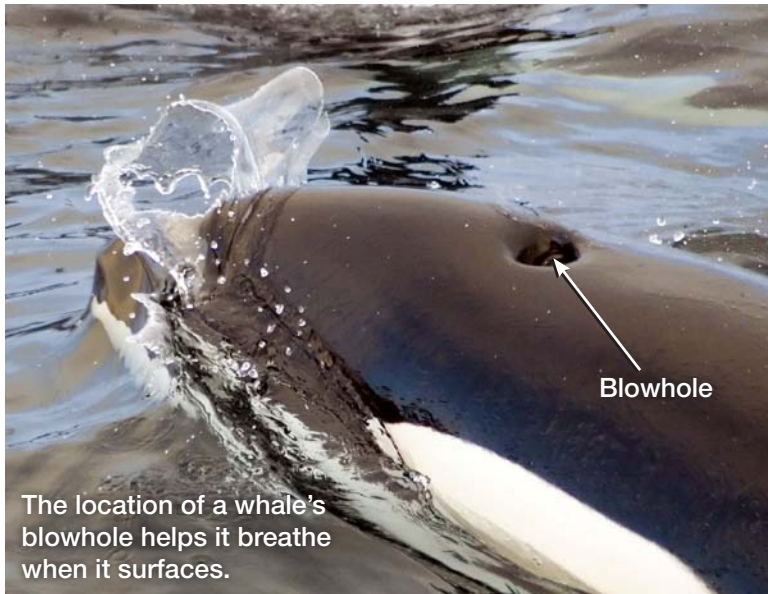
Scientists have found that many behavioral adaptations are like the songs of birds. They inherit part of the behavior and learn part of it from their parents and the other animals around them.

If the mutation helps an organism survive, that organism will pass on the mutation to the next generation. As more and more organisms are born with that change, the change becomes an adaptation.

For instance, millions of years ago, all whales had teeth and breathed out of holes at the end of their snout. Over many generations, some whales developed a breathing hole further up their head. These whales could breathe more easily in deep water. They could rise to the water's surface and take a breath without sticking their snouts above the water. As whales began to spend more time far out in the ocean, away from shore, the whales with higher breathing holes survived better. Their babies also had breathing holes high on their heads. The high breathing hole became a **characteristic** of, or a feature that people use to identify, a whale.

Evolution of the Whale's Nose





The location of a whale's blowhole helps it breathe when it surfaces.

Today, the whale's nose is a hole atop its head, called a **blowhole**. The blowhole makes it much easier for the whale to breathe. A whale arches its body so the blowhole breaks the water's surface briefly so the whale can take a breath, then, with its lungs filled with a fresh supply of air, it flexes its tail and returns to the ocean's depths.



This skull is from a very ancient whale. Its breathing hole was further forward than a modern whale's.

Some behaviors help animals attract a mate—a male peacock fanning its colorful feathers, for instance.



Male peacocks display their tails to attract females.

Or there's the deep-sea anglerfish's method. The males have large nostrils and a highly developed sense of smell, which they use to locate females, who cooperate by releasing a scented chemical for the males to follow.

Some behaviors help protect against predators. That's why many animals, such as flamingoes and wildebeests, live and move about in large groups.

Other behaviors include bird migration, the digging behavior of rodents and the honey making of bees.



A pufferfish inflates its body to look bigger to its predators.

Some behavioral adaptations puzzle scientists. They can't decide whether the behavior is inherited at birth or was learned later from parents.

Behavioral Adaptations

In addition to physical adaptations, animals have behavioral adaptations. **Behavior** describes how an animal acts and reacts to its environment. The simplest form of inherited behavior is a **reflex**, such as a frog jumping when it's touched. A reflex is a purely automatic reaction.

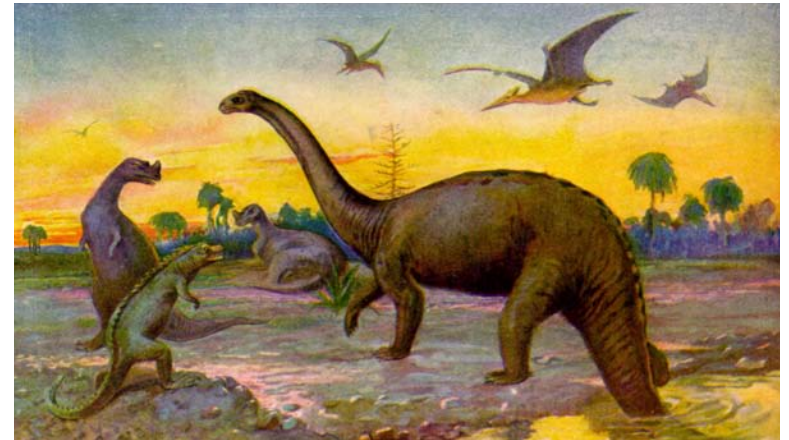


An **instinct** is a more complex inherited behavior. A sea turtle digging a hole in the sand to lay its eggs, or birds migrating south for the winter are both acting by instinct. These are behaviors that an animal just naturally knows it should do, without being taught.

Other behaviors are learned. Learned behavior is behavior that has changed because of an experience. For example, you can train a dog to obey commands, and a goldfish can learn to swim to the surface when it sees a light. Reading is a learned behavior you acquire from experience at home and school.

Do You Know?

What becomes of plants and animals that cannot adapt to their changing environments? They become **extinct**, forever wiped off the face of the Earth. For every species alive today, perhaps a thousand more became extinct before humans existed. We know of these extinct species only through fossil records.



Maybe dinosaurs could not adapt to a changing environment.

Dinosaurs became extinct 65 million years ago after living on Earth for about 165 million years. No one can be sure why. Some scientists say a giant meteor may have hit Earth, creating so much dust that it blocked the sun, killing the dinosaur's food supply. Others believe dinosaurs became extinct because they could not adapt quickly enough to changes in Earth's climate.



Desert plants are spaced wide apart.

Plant Adaptations

To reproduce and survive, plants must adapt to different elements of their environment. For instance, they must have enough water and sunlight to make their own food.

Let's compare how desert plants and rainforest plants adapt to the need for water and sunlight. For desert plants, water is a scarce and precious resource. That is why plants in deserts are spaced wide apart, so they can share their environment's limited supply of water.

Australia's koala bears are well suited to their environment. They spend much of their time in eucalyptus trees eating the leaves. A large gap separates their first and second fingers, and their big toe is set at a wide angle from the foot. These physical features help make the koala a skilled tree climber.

The camel's eyelids and the koala bear's hands and feet are **inherited** adaptations, based on physical characteristics inherited from parents at birth.



Koalas have big gaps between their toes so that they can grab branches.



These camels are traveling in a caravan across the desert sand.

Do You Know?

Before four-wheel-drive vehicles came along, camels were the chief means of transport in deserts. With their transparent eyelids and tall legs, they are well adapted for desert travel. In long lines known as caravans, they can carry goods across desert sands where there are no roads or towns. This accounts for the camel's nickname: "ship of the desert."

Camels are another example. Camels have an extra set of eyelids that are transparent. Camels live in deserts where sandstorms can be fierce. They lower their transparent eyelids in these storms. The see-through lids protect the camel's eyes from the stinging sands while still allowing it to journey through the desert. They can still find food and avoid predators, even through the blowing sand.



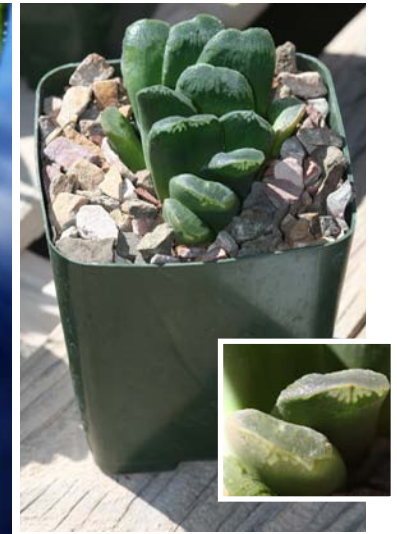
A camel eye has a clear eyelid.

Rainforest plants, on the other hand, get more than enough water. On average, a rainforest gets 200 centimeters (80 inches) of rain per year, compared to less than 25 centimeters (10 in.) in a desert. This heavy rainfall is why the leaves of some rainforest plants have developed sharp points known as drip tips, which help the plants shed water quickly. Too much water can kill a plant.

In the desert, water is scarce, but there is plenty of sunlight—too much sunlight. That is why the desert haworthia grows almost entirely underground, where things are cooler. However, it must collect some sunlight to manufacture food, so the tips of its leaves have clear "windows," which peek from the sand to admit light.



Drip tips help plants to shed water quickly.



"Windows" in the haworthia's leaves let light in.

For many rainforest plants growing near the ground, the problem is too little sunlight. The tall trees form a thick canopy overhead to capture sunlight, which leave the forest floor in shade. Woody vines called *lianas* have successfully adapted to these conditions. Some climb the tallest trees to get to the available light above the canopy. Other vines start life high up in the canopy and then send their roots earthward.



This vine is climbing a tree in the rainforest to reach sunlight.

Do You Know?

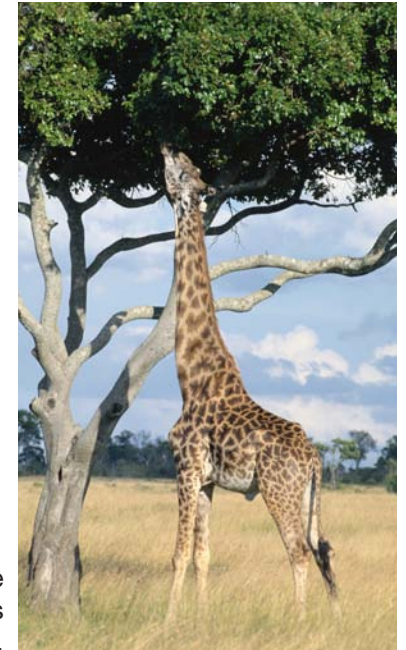
Plants cannot see or hear, but they can still sense changes in their environment. The keys are chemical substances within plant cells. These chemicals react to heat, light, moisture, temperature, or other factors, which affect seed germination or plant growth. Depending on conditions, the chemicals signal the plant to grow taller, to flower, or perhaps to hold back growth and wait for a better time.

Animal Physical Adaptations

Plants make their own food, but animals must hunt for theirs. Over millions of years, animals evolve or change and develop adaptations that help them find food and escape the animals that hunt them.

The giraffe's neck is a good example. Giraffes born with longer necks were able to reach higher into trees to gather more food than their shorter-necked relatives were. They also had a better view of approaching predators. These long-necked advantages helped them survive. Therefore, gradually, more and more giraffes with longer and longer necks were born.

The giraffe's neck is an example of a physical, or structural, adaptation. Physical adaptations help animals adjust to their climate and landscape in all sorts of interesting ways.



Giraffes use their long necks to reach food.