# **ANIMAL ADAPTATIONS**





### Animal Adaptations



It takes a very long time for evolutionary changes to develop. If the habitat changes too fast, most animals can't adapt and are either forced to move or die. But some environmental changes are so great that no animal can adapt.

Consider a deer—deers evolved for millions of years without the threat of hunters with guns. But it's possible for a deer to evolve in such a way as to outrun a bullet. There are limits to adaptations.





We all know that we can't move a polar bear into a tropical rainforest habitat. But why not? It's because this animal is not *adapted* to live in a tropical rainforest and would die if moved there. But why?

Animal adaptations are *tools* that animals have that allow them to survive in a particular habitat. These *tools* are something an animal is born with, something its species developed over millions of years of evolution. Polar bears have thick waterproof fur that keeps them warm in the cold Arctic weather even as they swim in frigid waters, from iceberg to iceberg. They are carnivores—they eat meat. It would be very difficult for a herbivore to exist on the floating ice sheets grass doesn't grow on ice. Polar bear's fur looks white—they can easily hide



among the snow and ice. And polar bears are very good swimmers. They have to be—it's the only way to move from one ice sheet to the next in the open sea.

### Visible Adaptations

Visible adaptations are those which we can see. People have two arms and two legs. It's easy to see. Having two arms and two legs is a human visible adaptation to our environment. Polar bears have four legs and no arms, that's their visible adaptation to their environment.

The number of limbs, the color and pattern of skin or fur or feathers or scales, the animal size, the presence of a tail, the existence of horns are all examples of visible adaptations. Some visible adaptations make animals almost invisible in their habitats (like the polar bear in the snow). We call this camouflage. But some visible adaptations make animals stand out—consider a peacock.

### **Internal Adaptations**

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Unlike visible adaptations, some adaptations can't be observed by just looking at an animal. A cow has four stomachs to help it digest grass. While we can observe the cow eating grass, we wouldn't know by just looking at it that it has four stomachs! The tools that an animal has on the inside that help it cope with its environment are called internal adaptations.

People have big brains that help us survive and prosper on our planet. But a cow's head is much bigger than a human's head, why aren't cows building cities, flying to the moon, and sending their children to school? It's hard to measure the size of the brain by just looking at the size of the head.

### Behavioral Adaptations

A cheetah hides in the grass, stalking its prey. And when an antelope or a gazelle strays close enough, the cheetah rears up and runs so fast that if it were a car, it would get a speeding ticket. Cheetahs are the fastest land animals on Earth! Their incredible running speed and hunting strategy are behavioral adaptations to their 'carnivorous lifestyle.



People have behavioral adaptations, too. We need to sleep at night and for at least eight hours (more, if it is a very young human). People who work at night and sleep during the day report feeling sick and unable to focus well. Our sleep needs are not just an individual preference, it's a behavioral adaptation for our entire species! But we sleep much less than chimps—chimps build nests up in the trees and have to balance carefully not to fall out. Chimps sleep fitfully and thus need to sleep longer. We sleep in comfortable beds without worrying about falling out—we need less sleep time.



### Different Animals, Different Strategies

Different animals use different survival strategies—adaptations to living in a certain environment; adaptations to food gathering, eating, and digesting; adaptations to starting a family and raising their young. You can easily see some of these adaptations in the shape, color, and texture of animals' skin. You can hear them in the sounds that animals make. You can observe them in the animals' movements and behaviors. Some adaptations are more difficult to identify through just casual observation. Scientists have to spend long hours in the field and laboratory to understand how different animals evolved to occupy the ecological niches they do.

But you don't have to be a scientist to be able to see differences between how animals look and behave. And you don't have to go far from home to study animals. Our backyards, farms, and zoos are full of interesting animals to study. All it takes is a little patience and desire to see.

Each animal has a few striking features that are easily observable as unique adaptations to its life on Earth:



- the size and shape of the animal
- the size and shape of the animal's appendages with which it manipulates the world (e.g.: feet, legs, arms, fingers, teeth, hands, trunks, snouts, tongues, wings, beaks, etc.)
- the size and shape of the animal's snout or beak (e.g.: does it use its snout or beak as we use fingers?)
- its dexterity, especially hands and feet, fingers and toes, lips, snout, and tongue
- the size and shape of its ears
- the size and location of the eyes
- the size of its nose
- the color of skin and its covering (e.g.: feathers, fur, scales, exoskeleton, etc.)
- Adaptation is a slow, evolutionary change or the process of change by which an organism or species becomes better suited to its environment.

### How are Human Bodies Adapted to Life on Earth?

umans are animals, too. We are also adapted to live on this plant. We can move around, gather food, raise families, build shelter. Consider the following:

- Our ability to walk on two legs leaves our hands free to manipulate our environment (it would be hard to open doors without hands, for example).
- We have opposable thumbs and pinkies to help us grasp and use tools (just try to use a pencil without using your thumb).
- Our eyes are high off the ground, providing us with better point of view of our environment.
- Our noses are high off the ground, too—we can't pick up scent off the ground easily.
- Both of our eyes face forward, giving us binocular vision which gives us better depth perception (we can easily judge the size and distance of different objects in our environment). We also have color vision.
- Our ears are positioned on either side of our heads, giving us surround sound capability—we can tell from which direction the sounds are coming from.
- Humans are warm-blooded—we can maintain our own internal temperature (as opposed to fish, for example, which can not). This adaptation allows us to live in a wide range of environments—we don't need to sun ourselves on rocks to heat our blood enough to go to school.
- Humans have no fur, only hair (and that only on a small percentage of the body).

Can you think of other adaptations that humans have to life on Earth?





How are Giraffe's Bodies Adapted to Life on Earth?

#### A giraffe is tall. How does that help it survive in its habitat?

Giraffe's height allows it to spot predators and to reach food high on top of a tree. This adaptation reduces giraffe's competition for food with other animals who can't reach the high leaves.

Giraffe's long legs let it run very fast to avoid predators. The legs are also good weapons—giraffes can kick very hard and would viciously strike back if attacked.

#### What changes would a giraffe need to live in a jungle?

A giraffe would get tangled in thick forest vegetation. But the okapi, a close relative of the giraffe, does live deep in a jungle. An okapi is shorter and without the giraffe's long neck and legs. Okapis are perfectly adapted to life in a dense forest.

#### How can giraffes rip leaves off the trees?

Giraffes' tongues and upper lips are prehensile—they can grasp things with them. A giraffe wraps its tongue *a* around a leaf and pulls it off the branch. It's something like what humans could do with their fingers and thumb.



#### What are giraffe's defenses against predators?

Giraffes use their great height to spot predators from far away. They have a good sense of vision, smell, and hearing. They have eyes on the side of their head for good peripheral vision. They have long legs for speed and weapons. They can run fast for a long time. A single lion can rarely get the better of an adult giraffe.



The Okapi is a close relative to the giraffe, well adapted to life in the jungle. Giraffe has the same number of bones in its neck as humans, but they are much longer.





These grasslands and lightly wooded areas are typical habitats for giraffes in the wild. Giraffes would be awkward inhabitants of dense forest habitats. But they are closely related to the Okapi who are smaller and have shorter necks. The Okapi do live successfully in a thick jungle environment. This giraffe shows its grasping, prehensile, blue tongue and upper lip to a couple of young zoo visitors.



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### Why couldn't an elephant live on a side of a mountain?

An elephant is a very large animal. It would be extremely difficult for it to hop from rock to rock as it eats grass and leaves off the alpine bushes. Elephant's feet are very delicate. They are not good at walking on ice and snow. And an elephant needs a lot to eat. It would be hard to find enough food among the sparse vegetation of a mountain peak. Can you think of other reasons?

### Why do elephants need such big ears?

Elephants live in hot climates. There is a large network of blood vessels inside of elephants' ears. As blood flows through the ears, it cools. By flapping their ears, elephants can cool themselves faster when the temperature in their habitat gets too hot to be comfortable.

### Why do polar bears have black skin?

Polar bears look white—they have white looking fur. But each strand is actually a hallow tube growing out of black skin. Polar bears live in a habitat of extreme cold and need adaptations that help them survive in that environment. Black skin absorbs more of the sun heat and warms the air trapped inside the hallow tubes of the fur strands. The thick coat gives an overall appearance of whiteness serving as a good camouflage in the ice and snow. The thickness of the fur also helps the polar bears keep warm and stay dry when they go swimming in the arctic waters—the fur serves as a barrier, keeping the icy water from the bear's skin.

Each polar bear's hair is a transparent tube that locks in the heat and keeps away the moisture from the bear's black-colored skin, keeping it warm and dry even through the bitter arctic winters.











### Why do some animals have such busy patterns of skin and fur?

Many animals have very colorful fur and skin patterns. Zebras have strips. Cheetahs have spots. Giraffes have patches. The stripes and spots help camouflage these animals—make them hard to spot in their habitats.

### Why wouldn't it be better for a zebra to have green fur?

Zebras live in large herds. When they bunch together, their stripes make it difficult for the predators to tell where one animal end and the next begins (i.e. confusing predator's visual field). While green fur might be an advantage during the rain season when the grass is green, during other times it would make zebras an easy target to spot—green stands out against gold.

Some animals use the seasonal color change to enhance their camouflage. Foxes, rabbits, and some owls change from gray to white in the winter months.















Giraffes' brown patches and zebras' black and white stripes help confuse predators by breaking up the outline of a particular animal when it runs with its herd. Do you think flies are predators, too?







Animals Adapted to Live in Their Environment







Alligator's nostrils are on the top of its snout. This allows it to lurk just under the surface of the water, hiding from its prey. The many sharp teeth act like hooks to grab and hold of the unlucky animal. Gators keep their dinner underwater until it dies.





Polar bears are the color of ice and snow. Only their noses are black. They often use their paws to cover their noses while fishing and hunting at the water holes in the ice sheets.



Polar bears have front set eye sockets, sharp cutting teeth, and large sinuses—they have good depth perception, ripping instruments, and an excellent sense of smell.







### Why Do Animals Look the Way They Do?



The long necks, long webbed feet, and spoon-shaped beaks allow flamingos to catch little shrimps from the shallow waters—a diet responsible for the beautiful pink coloration of their feathers.



#### What are the advantages of white fur in a winter habitat?

Polar bears are white. It makes them difficult to spot in the snow and ice of their polar habitats. The white color makes them better hunters—they can catch more and eat better. The actual color of the fur is not white but transparent, but the effect is a white color.

### Would green fur serve lions better in their habitat?

Lions live on the African savanna—long stretches of grassland. In the summer, lions' fur is the color of the dried grass making them very difficult to spot when they are crouched and trying to be stealthy.

### Why is Marabou Stork bold?

Marabou Stork is a scavenger. It eats carrion—meat of the dead animals it finds lying around. By the time the stork gets to the meat, it has been picked over by many different animals—a lion that killed it in the first place; a group of hyenas that got to the carcass after the lion was done with it; and perhaps a few other animals might have dined on it as well prior to stork's arrival. To get some goodness from the carcass, a Marabou Stork has to really dig in there. Feathers on its head would get filthy and damaged when this bird rams and squeezes them through the bones and skin of a dead animal. So this stork's bold head is an adaptation to eating long dead and picked over carcasses.

### What is the value of a trunk?

Elephants don't have hands and their long trunks make it very difficult for them to graze on ground vegetation as cows do or drink from a pond, for that matter. Elephants can't even reach the ground with their lips unless they bend their knees and sit or lie down. But elephants like to eat grass. What can they do? They could use their trunks—the most handy adaptation for grasping, ripping, and manipulating objects. And elephants

can use their trunks to suck in water or to breathe through like a snorkel when they swim under water!

Elephants use their trunks as hands to gather up grass and deliver it straight into a waiting mouth.



### What does flamingo's beak remind vou of?

If you observe closely, flamingos' beaks look like up side down spoons. And, in fact, that's how they use it—they lower their heads into the water, up side down, and sift the bottom of the pond with their spoonshaped upper beak. You wouldn't catch a duck performing this maneuver!



LEARN S Different Diets, Different Strategies All animals are adapted to eat a particular diet. Eating meat or plants is not a personal lifestyle choice.

### But what if a lion is very very hungry? Couldn't he eat a salad then?

Humans tend to have a very self-centered perspective on the world—if we can eat a salad when we are hungry (even if we hate it), then other creatures can, too. This is a perspective of an omnivore—an animal adapted to eat most kinds of food. The idea that a cow not just wouldn't but *couldn't* eat a hamburger is something we rarely think about. But the

*choice* of food an animal eats depends on what that animal can physically process into energy. For example, a herbivore has to have the right anatomical tools (e.g. a cow has four stomachs and special molars to chew grass) to consume grass. And carrion-eaters are immune to certain bacteria found in decomposing meat that would kill other animals if they ate it.

Animals can't just change their eating habits because they want to!





### What are Some of the Strategies People Use to Get Food?

Most of the people living in a city never have to kill their own dinner or sow and harvest (and then process and bake) their own bread. We go to a supermarket to gather our food. Or we go out to dinner in a restaurant and avoid even the preparing part of the creating a meal. But we still have strategies for getting dinner: we look for sales and cheap produce; we clip coupons; we rely on our friends to tell us where to find good produce or to give a recommendation for a nice restaurant; we watch cooking shows and read recipe books; we try to buy produce that is in season (to insure the highest freshness and the best quality and price); we try to make healthy choices; etc. In short, we have many strategies to procure the right quantity and quality of food for ourselves and our families.

Of course other cultures have other food strategies: in rural Russia, people store produce in underground volts so they have enough food in a winter; in China a fresh chicken is only fresh when it was killed minutes before cooking; in India people use spices to preserve their food from spoiling during hot days of summer; etc. Is there something special your family does to get food?

### What are your family's strategies for getting dinner on the table?

Humans are omnivorous—we are biologically able to eat almost any kind of food available. This ability to eat both plants and meat gives are a huge advantage when it comes to food selection—we won't starve in a vegetable garden even if we don't really like to eat carrots.

For thousands of years, people lived in a hunter/gatherer societies—in small groups that hunted animals to get meat and gathered berries, roots, and fruits that they found growing in the wild. With the invention of agriculture, people learned to grow their own food. This allowed us to live in larger groups and have many different professions (other than just hunters and gatherers).

Today, as a society, we have many strategies relating to food:

- we grow fruits, vegetables, and grains
- we grow meat: cows, pigs, sheep, chickens, geese, fish
- we milk cows and collect eggs from chickens
- we store large quantities of food for the future
- we export and import seasonal fruits and vegetables
- we make long lasting food products: cans of soups, juices
- we have refrigeration to keep perishable foods longer: milk







### Animals and Food



Fishing cats live on the riverbanks of Southeast Asia. They use their claws to catch fish. Their sharp claws never fully retract like the claws of other cats this is an adaptation to getting food.



It's not only the giraffe's neck that is extra long. Giraffe's height is greatly increased by the length of its stiltlike legs. They give an extra boost that allows this animal to eat the leaves of some of the tallest trees in its neighborhood.



### What are Some of the Strategies Animals Use to Get Food?

A nimals have strategies for getting and storing food as well. These strategies fall into four categories: visible anatomical features, invisible anatomical features, group behaviors, and individual strategies. Depending on the type of food an animal needs to survive, it will have a set of anatomical and behavioral strategies to get it.

- Some strategies are based on the visible anatomical characteristics of an animal: teeth, eyes, ears, size, muscles, horns, type of limbs, color of skin and fur, long necks, etc.
- Some strategies are based on the anatomical characteristics that are hard to observe: multiple stomachs, poison sacks, bacterial-resistance, slow metabolism, excellent sense of smell and hearing, etc.
- Some strategies are behavioral: running down the prey, hunting in packs, covering the nose during fishing, migrating to better pastures, making stores of food (like squirrels and mice), eating more when there is plenty of food available (developing stores of fat to survive the times when there's not enough food), growing food (e.g.: leaf cutting ants), etc. And just as humans need to learn food gathering strategies to survive, animals need to learn them as well—a polar bear covering his black nose while fishing learned that trick from its mother.











This is a Koala's skull and lower jaw bone. Notice the nice row of molars—they grind up the tough eucalyptus leaves. The front top and bottom teeth are shaped tweezers—they are designed to strip off the leaves from a tree brunch.

This is a skull of a herbivore.







Gorillas have many adaptations to life in their habitat. They have forward facing eyes—to better judge the distance between trees. They have large jaw muscles to help them chew through rough plant food. And several varieties of teeth: molars for chewing, canines (big sharp ones) for cutting, and incisors (front teeth) for biting.



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### Form and **Function:** Birds, Beaks, and Feet

Beaks and feet are the tools birds use to get food. Depending on the type of food the bird eats, the tools it needs are either sharp, spoonlike, long, or hooked.

What do you think these birds eat? Consider the appearance of both beaks and feet.





### The Right Tool for the Job



Parent Helpers

Birds don't go to stores to buy their tools. They have to make do with what they've got—their beaks and their claws, although some birds are so clever that they figured out how to use twigs and rocks and ropes to get the food they like. But most birds use their feet and their beaks to gather their food. And those beaks and feet are wonderfully adapted to gather the food a particular bird eats.

Lets do an experiment! Get a spoon, a hammer, a small pair of tweezers, and a set of chopsticks. These will be your equivalent of bird's beak.



O n a table, place the following *foods*: a rubber band (you can cut it to make it more like a worm); a cereal bowl filled with an inch of water and some cereal; a tall glass with a few raisins on the bottom; and a couple of nuts.

Now if you are a bird that likes soggy cereal, which beak would get you the most food the fastest?



What if you liked raisins? What beak would you need to get them out of the bottom of the tall glass?

If you were a bird that liked rubber bands for dinner, what's the best tool to pick up the most?



And if it's nuts you fancied, how would you get them out of their hard shells?



### LEARN S Feet & Legs for the Job





Grooming is important to all primates, and red ruffed lemurs are no exception. But it is hard to brush one's fur if you can't move your thumbs well. So instead of thumbs, these lemurs have a specialized claw on the second toe of their hind legs just for straightening the rough spots on their coat. And their bottom teeth are used as a comb for brushing fur—one's own and that of friends.





A bald eagle has powerful talons to grab and hold its prey.



## How are the feet of a flamingo differ from the feet of a eagle?

Flamingos and bald eagles are both birds that like to eat animals that live in the water (little shrimps and fish, respectively). That makes both of these animals predators they prey on other animals. But each have a very different set adaptations (strategies) for getting food. Aside from body size, shape of beaks, quality of eye sight, and shape and color of feathers, among the most obvious differences are size and shape of feet. Flamingos have long legs and webbed feet that allow them to wade through shallow waters to capture their prey. Bald eagles have talons like hooks—they swoop down on their prey and grab them with their feet (a feat impossible with flamingo's feet).



Flamingo's legs and feet are built for wading in shallow waters. How can you tell?