LEXILE®

ANIMAL SENSES

differentiated passages

760L

Name: _____ Date: _____

Echolocation

A bat flying at night.

More than 90% of bat species use echolocation. They send out a chirp. It is higher than the human ear can hear. Those chirps echo off objects around them. They bounce back to bats' ears which have special folds in them. The way the chirps bounce back depends on the size, shape, and distance of the objects they hit. Bats' brains recognize their own chirp echoing back. Their br... parts of bats... then act a... might deci... that...

AMPLITUDE

Echolocation Questions

1. Fill in the steps of echolocation for bats in the diagram below:

...le to learn about objects through echolocation?

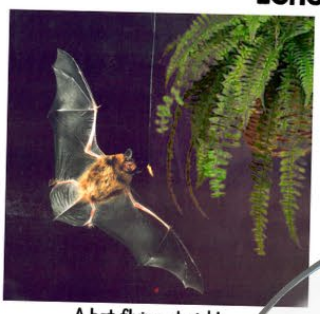
...mals described that use echolocation?

...ney couldn't

960L

Name: _____ Date: _____

Echolocation



A bat flying at night.

Echolocation is the process of using sound to sense one's surroundings. An organism **transmits** a sound, often by mouth. The sound bounces off items in the environment and is carried back to **receptors**, such as ears. The brain then processes the received information and allows the organism to make decisions on what actions to take. Many animals use this ability to navigate, avoid danger, hunt, and interact socially.

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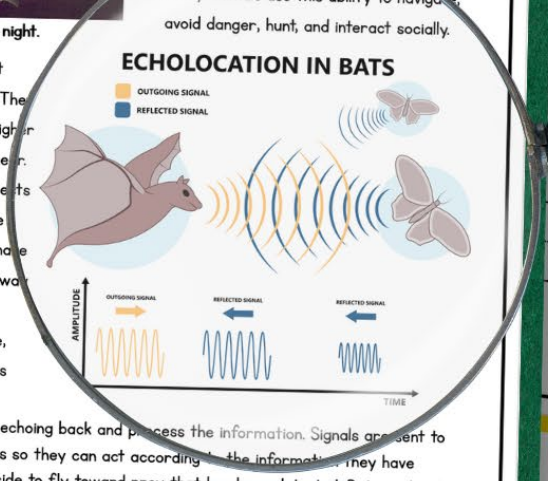


Mag CORE

4th Grade NGSS 4-LS1-2

ABOUT LEXILE LEVELS

MagiCore Learning, LLC is a certified Lexile® Partner. These texts are officially measured and approved by Lexile and MetaMetrics® to ensure appropriate rigor and differentiation for students.

The Lexile Framework® for Reading measures are scientific, quantitative text levels. When the Lexile of a text is measured, specific, measurable attributes of the text are considered, including, but not limited to, word frequency, sentence length, and text cohesion. These are difficult attributes for humans to evaluate, so a computer measures them.

Common Core State Standards uses Lexile level bands as one measure of text complexity. Text complexity ranges ensure students are college and career ready by the end of 12th grade. Lexile measures help educators scaffold and differentiate instruction as well as monitor reading growth.

Grade Band	Lexile® Bands Aligned to Common Core Expectations
K-1	N/A
2-3	420L-820L
4-5	740L-1010L
6-8	1185L-1385L

Keep in mind when using any leveled text that many students will need scaffolding and support to reach text at the high end of their grade band. According to Appendix A of the Common Core Standards, "It is important to recognize that scaffolding often is entirely appropriate. The expectation that scaffolding will occur with particularly challenging texts is built into the Standards' grade-by-grade text complexity expectations, for example. The general movement, however, should be toward decreasing scaffolding and increasing independence both within and across the text complexity bands defined in the Standards."

Sensation, Processing, and Response

4th grade

Table of Contents

Each passage set includes two differentiated passages on a fourth-grade level (one at the beginning of the band, one towards the end) and a question set geared towards comprehension and science mastery. The first question is differentiated to include a fill-in-the-blank diagram (lower complexity) or an open-ended diagram (higher complexity).

How to Use This Resource

This resource was created with the NGSS Science Standards in mind. It includes six differentiated passages aligned to the following standard:

4-LS1-2: Sensation, Processing, and Response

Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways. (Systems and System Models)

Clarification Statement: Emphasis is on systems of information transfer.

Assessment Boundary: Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.

Here are some suggestions for using these passages:

- Use as independent work after you have taught an overview of this standard. Assign the different levels based on the passage students can read and comprehend independently.
- Use as a reading center to reinforce key comprehension and science concepts at the same time!
- Use as a homework or review packet.
- Use as an intervention for students who need to revisit science concepts.

760L

Name: _____ Date: _____

Supertasters

Humans have taste buds on their tongues. These taste buds help us detect foods that are sweet, bitter, sour, salty, and savory. Taste buds tell us which foods we enjoy. They also help identify things that are safe to eat. Animals with backbones have taste buds similar to humans. Some animals, however, are **supertasters**. Supertasters have more taste buds. Some even have taste buds in places on their bodies other than the tongue. This gives such creatures a superior sense of taste. This is important to their survival.

Catfish have the most amazing sense of taste. They have about 100,000 taste **receptors** all over their bodies. Even the fins, back, and tail have these receptors. Most of the taste receptors are located on the whiskers. Catfish tend to swim in muddy waters at the murky bottom. It's hard to see in these dark waters. The large supply of taste buds on the catfish's body helps it locate food in its surroundings. Their prey naturally releases chemicals into the water. Catfish can pick up these chemicals with their taste receptors. That information then goes to a catfish's brain. It is **processed** and identified. The catfish recognizes the taste as prey. It then takes the necessary action to swim toward the prey to feed. Without being a supertaster, catfish might not survive as well.

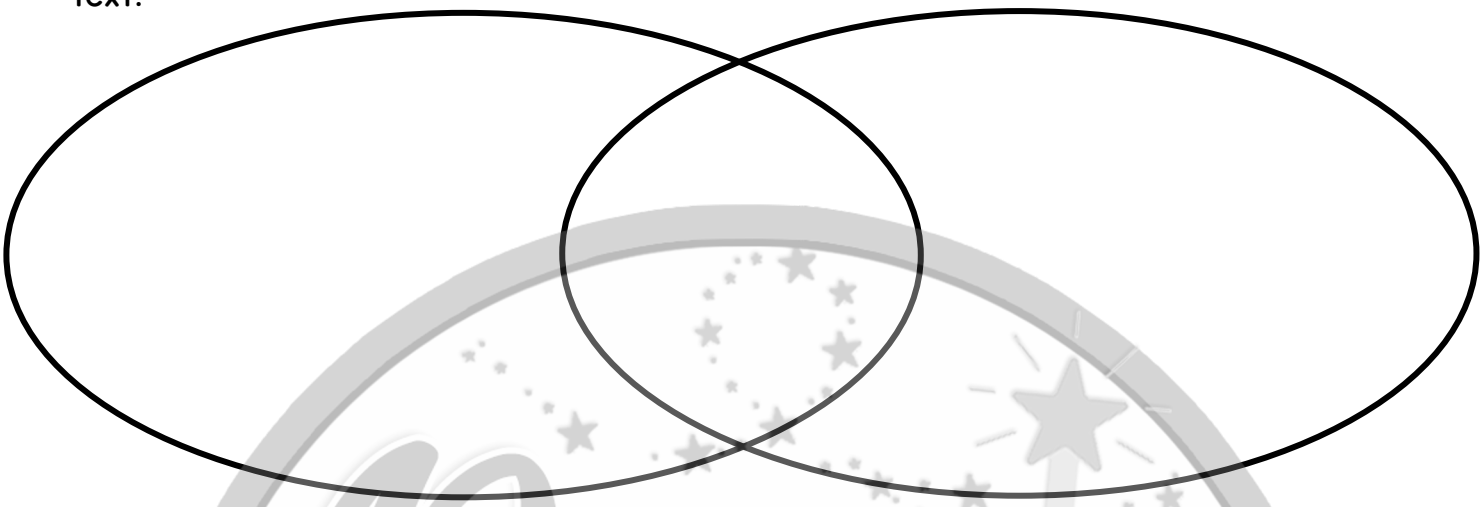
Butterflies are also supertasters. They have taste receptors on their feet. These receptors help butterflies both feed and lay eggs. The butterfly's taste receptors take in information about the plant after landing on it. That information is sent to their brains. They then process that information. They decide whether or not the plant is a good source of food. If it is good food, the butterfly releases an **enzyme** to dissolve the food. It takes the nutrients. These well-developed taste receptors also help a butterfly pick plants with the right chemicals in them for laying eggs. Butterfly growth and survival depend on these supertaster abilities.

Another supertaster is the octopus. Each sucker on each **tentacle** has about 10,000 taste receptors. With almost 200 suckers on each of an octopus' eight arms, that adds up to a taste **sensitivity** that is much better than human taste buds. Octopuses use these taste receptors along with their sense of touch. They pick up chemicals produced by other sea creatures and find food in the ocean. These taste receptors can tell the difference between food, rocks, or something that might be poisonous to the octopus. An octopus will eat the food, travel over the rocks, and avoid the poison. The octopus' brain is also developed enough to remember the tastes of foods it eats. This makes it choosy when it comes to the menu.

Taste is an important sense for these creatures. Their extra taste receptors give them special talents that benefit them. They allow them to survive in their environments.

Super Tasters Questions

1. Compare and contrast the taste buds and taste abilities of 2 of the animals from the text.



2. Describe why it is important for catfish survival to have extra taste buds all over their bodies.

3. What is unique about butterfly taste buds?

4. How do taste receptors help animals survive?

950L

Name: _____ Date: _____

Super Tasters

Humans have taste buds on their tongues. These taste buds help us detect foods that are sweet, bitter, sour, salty, and savory. Taste buds tell us which foods we enjoy. They also help identify things that are safe to eat. Animals with backbones have taste buds similar to humans, but some animals are **supertasters**. Supertasters have more taste buds. Some even have taste buds in places on their bodies other than the tongue. This gives such creatures a superior sense of taste, which is important to their survival.

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whether or not the plant is a good source of food. If it is good food, the butterfly releases an **enzyme** to dissolve the food and take the nutrients. These well-developed taste receptors also help a butterfly pick plants with the right chemicals in them for laying eggs. Butterfly growth and survival depend on these supertaster abilities.

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Taste is a critical sense for these creatures. Their unusually-placed taste receptors give them special talents that benefit them, allowing them to survive in their environments.

Super Tasters Questions

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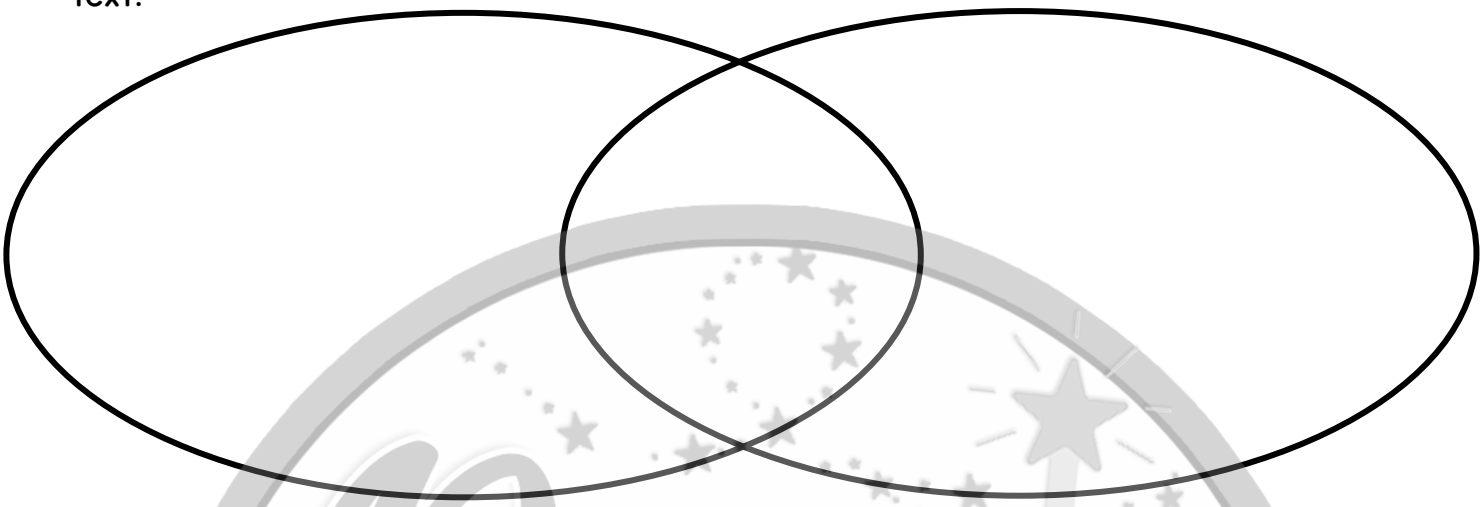

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960L

Name: _____ Date: _____

Echolocation

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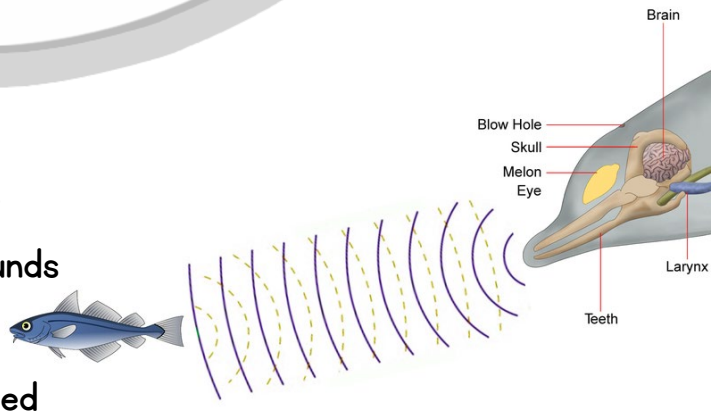
More than 90% of bat species use echolocation. They send out a chirp that is higher than the human ear can hear. Those chirps echo off objects around them. They bounce back to bats' ears which have special folds in them. The way the chirps bounce back depends on the size, shape, and distance of the objects they hit. Bats' brains recognize their own chirp echoing back and process the information. Signals are sent to other parts of bats' brains so they can act according to the information they have processed. They might decide to fly toward prey that has been detected. Bats might also flee if danger has been **perceived** instead. Scientists believe bats developed the ability to use echolocation because their ancestors had such poor eyesight.

Another animal that uses echolocation is the dolphin. Dolphins are known for being vocal with different chirps, whistles, and clicks. Some sounds such as whistles are at lower **frequencies** and are used for interacting with other dolphins. Other sounds such as high-frequency clicks are sent out from dolphins' foreheads. These clicks aren't just received



by dolphins' ears, though. Receptors in their jawbones pick up the vibrations. Those vibrations then pass on to the ears. Dolphin brains process the reflected sounds to determine the distance, size, shape, speed, and even texture of objects in their environment. This ability is important to dolphins because they only see about 150 feet in front of them. Echolocation makes up for what their vision lacks.

Chinese pygmy dormice are rodents who use high-pitched squeaking to echolocate. These squeaks are so soft that humans can't hear them. The squeaks don't need to be loud because dormice aren't trying to locate objects that are far away like bats are. What's really impressive is that these dormice are **arboreal**, meaning they live in trees, but they are basically blind. Navigating tree branches is tricky but done at a fast pace through echolocation. With such limited vision, the dormouse depends on this unique ability to survive.

Echolocation helps some creatures make sense of their environments. They have special body structures that allow them to use this talent to gather information. Their brains use that information to help them make wise decisions about how to behave.

Echolocation Questions

1. What is echolocation?

2. What type of information are animals able to learn about objects through echolocation?

3. Choose one of the animals you read about and describe specifically how they use echolocation.

4. How does echolocation help animals survive? What would happen if they couldn't echolocate?

760L

Name: _____ Date: _____

Electroreception

Some animals have the ability to detect electrical currents. This skill is called **electroreception**. Sensitive organs in the skin of certain organisms make this possible. The ability is most often found in **aquatic** or **amphibious** animals. Water is a much better conductor of electricity than air. Animals in water-based environments can make the most use of the ability. Electroreception is used to find prey and other objects. It is also used as a form of social communication.

Sharks are the most well-known users of electroreception. They have pores on their heads near the snout and lower jaw. These pores have cells filled with a jelly-like material. This material is sensitive to electrical currents. The cells are called **ampullae of Lorenzini**. Each of the cells is lined with hair cells, called **cilia**. The cilia can sense electricity. They signal the shark's brain to figure out the source of the currents they pick up. Information collected through a shark's electroreceptors helps it navigate through the water. The information also indicates other living things in the area. Electroreception makes sharks skilled hunters. Great white sharks actually roll their eyes back into their heads for protection when they get close to prey. They then rely on electroreception to travel the rest of the way and attack.

Another animal that uses electroreception is the platypus. The platypus closes its eyes, nose, and ears while hunting. Its bill is the tool it uses instead. The platypus bill is covered with about 40,000 special receptor cells. They pick up movement and electrical fields made by prey. These receptors sense changes in pressure and motion. Information about the direction and distance of prey is sent through these receptors to the brain. The platypus can then make decisions about the best approach to catch the prey.

Bees are also capable of electroreception. Bee bodies are positively charged. This happens because air **molecules** hit bees as they fly. Electrons get knocked off bees by the air. Plants, on the other hand, are negatively charged. These opposite charges cause pollen from the flower to jump to the bee and stick to it. Scientists believe bees sense the electrical charge. They then use it to search for pollen. Experiments have also suggested that bees use their antennae to detect electrical patterns from bees that have successfully found pollen. Electroreception is being used to communicate among bees in this way.

Electroreception is like having a sixth sense that organisms use to survive in their environments. This unique ability is a natural superpower that adds to the variety found on planet Earth.

Electroreception Questions

1. What is electroreception?

2. How do ampullae of Lorenzini help sharks use electroreception?

3. Explain how bees are capable of electroreception.

4. How does electroreception help animals survive? What would happen if they couldn't use it?

950L

Name: _____ Date: _____

Electroreception

Some animals have the ability to detect electrical currents that occur naturally. This skill is called **electroreception**. Sensitive organs in the skin of certain organisms make electroreception possible. The capability is most often found in **aquatic** or **amphibious** animals. Water is a much better conductor of electricity than air so animals in water-based environments can make the most use of the ability. Electroreception is used to detect prey and other objects and as a form of social communication.

Sharks are the most well-known users of electroreception. They have pores on their heads near the snout and lower jaw. These pores have cells filled with a jelly-like substance that is sensitive to electrical currents. These cells are called **ampullae of Lorenzini**. They are named after an Italian scientist who discovered them in 1678. Each of the ampullae is lined with hair cells, called **cilia**, that can sense electricity. When they pick up electrical currents, they signal the shark's brain to interpret the source of the current. Information collected through a shark's electroreceptors helps it navigate through its watery habitat. The information also indicates other living things in the area. Electroreception makes sharks incredible hunters. When they get in close range of prey, great white sharks actually roll their eyes back into their heads for protection. They then rely solely on electroreception to travel the rest of the way and attack.

Another animal that uses electroreception is the platypus. With a duck-like bill, limbs that are similar to flippers, and a tail like a beaver's, the platypus is an unusual mammal. When hunting, the

platypus closes its eyes, nose, and ears. Its bill is the tool it uses instead to find food. The platypus bill is covered with about 40,000 special receptor cells that detect movement and electrical fields made by prey. These receptors pick up changes in pressure and motion as the platypus moves its head from side to side. Information about the direction and distance of prey is sent through these receptors to the brain. The platypus can then make decisions about the best approach to catch the prey.

Bees are also capable of electroreception. Bee bodies are positively charged by air **molecules** colliding with bees as they fly. This knocks electrons off bees. Plants, on the other hand, are negatively charged because they are connected to the ground. These opposite charges cause pollen from the flower to jump to the bee and stick to it. Scientists believe bees sense the electrical charge and use it to search for pollen. Experiments have also suggested that bees use their antennae to detect electrical patterns from bees that have successfully found pollen. In this way, electroreception is being used to communicate among bees.

Electroreception is like having a sixth sense that organisms use to survive in their environments. This unique ability is a natural superpower that adds to the diversity found on planet Earth.

Electroreception Questions

1. What is electroreception?

2. How do ampullae of Lorenzini help sharks use electroreception?

3. Explain how bees are capable of electroreception.

4. How does electroreception help animals survive? What would happen if they couldn't use it?

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Name: _____ Date: _____

Thermoreception

Humans can sense temperature and determine how hot or cold something is. Some organisms, however, have added abilities when it comes to processing such information. **Thermoreception** is the ability to sense heat energy in the environment or in the bodies of other organisms. Basic thermoreception involves sensing temperature. Then decisions are made based on comfort or discomfort. More advanced thermoreception allows some creatures to "see" temperature.

Thermoreception in most mammals starts with the skin and deep tissues of the body. Receptors here are sensitive to temperature changes. This information is sent to the brain. Behaviors such as sweating, panting, or shivering then occur as a reaction. These behaviors help mammals keep a constant body temperature. They can be comfortable and survive in their surroundings. Thermoreceptors in mammals also prevent harm. They alert the brain to extreme temperatures.

Insects have thermoreceptors, as well. These sense organs are usually located in the antennae. Cockroaches, for example, have two whip-like antennae. Each antenna has about 20 cold receptors. Delicate, hair-like structures called **sensillum** are located in each cold receptor. The activity of these cold receptors changes based on temperature. Insects that feed on blood such as mosquitoes also use thermoreception. This is how they find warm-blooded prey.

Snakes are the most impressive users of thermoreception. Pit vipers have a pair of organs located in pits between their eyes and nostrils. These organs can sense heat. They are forward-facing and connected to pit vipers' brains at the optic nerve. Pit vipers can see **infrared waves,** unlike humans. Such waves are given off by warm objects. Pit vipers use thermoreception to figure out the direction and distance of warm-blooded prey that give off infrared waves. They can do this even in total darkness. This makes them excellent hunters. Pit vipers' thermoreceptors are so sensitive that they feel the heat from a mouse from 6 inches away.

Sensing temperature is important to the survival of many organisms. Thermoreception helps keep a body at the proper temperature. It is also used to find prey and avoid danger.

Thermoreception Questions

1. What is thermoreception?

2. Explain how pit vipers hunt.

3. Thermoreception is only good for finding things that give off heat. Give 2 examples of things which could be found and things which could not be found using thermoreception.

   Things you can find using thermoreception:

   Thins you could not find using thermoreception:

960L

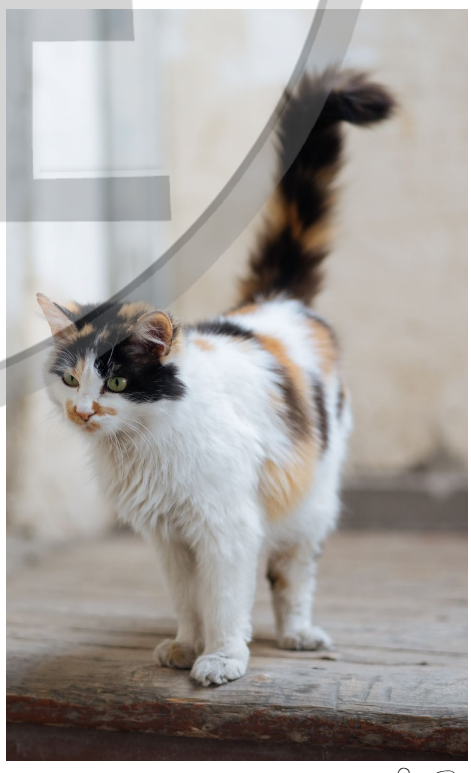
Name: _____ Date: _____

Hypersensitive Whiskers

Many mammals have whiskers, which are **hypersensitive** hairs that stand out on an animal's body. Unlike regular hair or fur, whiskers are coarser and thicker. Their roots go deeper, as well, and they don't cover the entire body. Typically, whiskers are located above the eyes, near the ears, above the upper lip, on the chin, and on the back legs. Whiskers are full of blood vessels and nerves, making them more sensitive than regular hairs. Animals with whiskers use them to aid in their sense of touch.

Whiskers don't actually feel anything. Instead, when they touch something, **irregularities** on the surface create vibrations that travel along the whiskers. The nerve cells inside the whiskers are **activated**. This sends valuable information to the animal's brain. That information may include details about the location, size, and texture of an object that the whisker has touched.

Cats are the animal most people think of first when it comes to whiskers. Their whiskers help them move around in their environment and make decisions. For example, whiskers can tell a cat about the size of an opening. This helps it decide whether or not its body can fit. Whiskers also sense tall grass or other obstacles that might be in a cat's path, causing it to change its route. Balancing is affected by whiskers, as well. They send messages to the cat's brain to let it know what the body is doing. Whiskers also protect cat eyes by sensing dust or other substances and signaling a cat to blink.



Animals such as seals use whiskers to locate food. They often live in waters that are near the coast and get churned up by storms and tides. This leaves the water murky, making it hard for seals to use their vision to hunt. Seals shift their whiskers forward when hunting to give themselves the advantage. This allows them to better sense the vibrating trails in the water left behind by swimming fish. Their whiskers are so sensitive that seals can determine the size of the prey and which direction the prey went even if the prey is already gone from the area.

Rats use their whiskers to make maps of their environments. Their whiskers move very rapidly, vibrating up to 25 times per second. They will first sweep a large area with their whiskers to get a general lay of the land. If a rat makes contact with something, it will turn its head and use the whiskers on both sides of its face to gather more details about the object. Finally, the rat will examine the object more closely by moving its nose toward the object to use whiskers on its chin and lips. This method allows the rat to get the most information it can. When that **input** is processed in the brain, the rat has a clear picture of the area. It chooses how it will act in relation to the discovered object. If the object is found to be simply something in its path, it will redirect itself. If the object is food, the rat will eat it. If it's a predator, the rat will flee.

We often think of whiskers as a feature that makes animals cute. Whiskers are, however, much more important than that. They allow animals to make sense of their surroundings and **alter** their behavior.

Hypersensitive Whiskers Questions

1. Describe 3 ways whiskers are different than regular hair:
   1. _____
   _____
   2. _____
   _____
   3. _____
   _____

2. Describe how whiskers transmit information and what animals can learn about objects with them.

_____

_____

_____

_____

3. Choose one of the animals you read about and describe how they use whiskers. Include things they do that are unique and different from other animals with whiskers.

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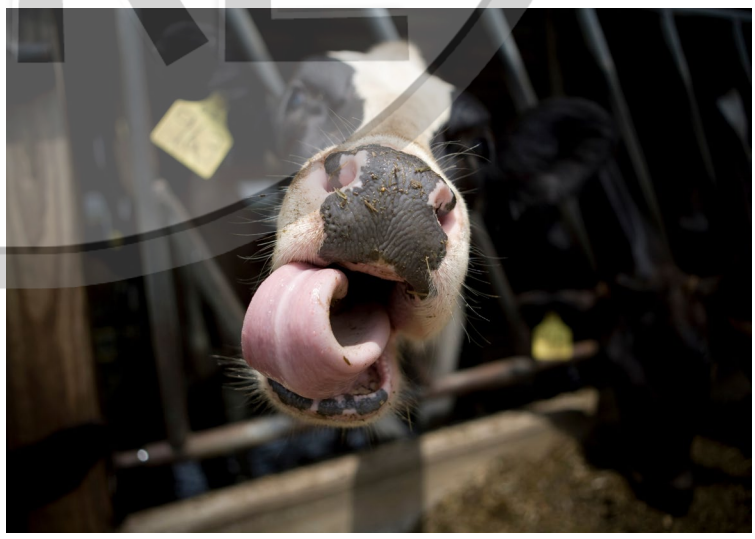
950L

Name: _____ Date: _____

Super Smellers

When it comes to smell, many animals have a superior sense in comparison to humans. Some animals have larger noses which allows them to have more **olfactory** nerve cells. This makes them more sensitive to odors than humans are. The part of the brain that processes scents is often larger in some animals than in humans, too. This means their brains are capable of doing a better job of analyzing information it receives from smelling things. Additionally, some animals have a special scent organ in the roof of their mouths. This is known as the **Jacobson's organ**, and it is used in recognizing odors. It has a direct line to a part of the brain that humans don't even have.

Elephants have an amazing sense of smell which is in constant use. They possess nearly 2,000 special **genes** that detect odors. Nostrils are located at the tip of the trunk. Trunks sweep back and forth to detect new scents. A scent is drawn into the nostrils. Inside, a series of curls of bone called **turbinals** with millions of olfactory receptor cells on them receive the scent. Information collected here is passed onto the elephant's brain for processing. If the elephant needs more details, it may further probe with the trunk. It will use its Jacobson's organ to explore more deeply. Elephants use their heightened sense of smell to locate food and water. They are actually able to smell water sources that are up to 12 miles away. Smell is also used to identify other elephants and communicate **reproductive** status and health.



Another animal with a powerful sniffer is the cow. With 1,186 smell genes, cows can detect odors from as far away as six miles.

Their noses are large, and their **sinus cavities** are long and wide. This allows for more surface area for olfactory receptors that can process scent information. Cows use their noses to select the grass that is the most nutritious. Male cows depend on scent to know when a female is ready to mate. A cow's sense of scent also helps it detect danger that might be coming its way.

Dogs are exceptional smellers, too. Their 811 genes dedicated to scent aren't as impressive as the amounts found in elephants and cows. A dog's sense of smell is still more developed than a human's sense, though. The part of the dog's brain that is responsible for processing scent is about 40 times larger than that of humans. It's because of dogs' smelling abilities that they are often trained to be used with police and in the military. They detect explosives, drugs, and even missing people. Dogs often satisfy their curiosity by using their noses to investigate new smells they encounter. Scent is used to navigate and find food. Dogs can also use smell to determine another dog's gender, health, and mood. These pups are able to remember smells of other dogs, too, even if they haven't seen that dog for some time.

A superior sense of smell helps many animals interact with their environments. Smell is used for a variety of reasons, including locating food, finding the way around a place, and detecting other animals.

Super Smellers Questions

1. Describe an elephant's sense of smell.

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2. What 3 things do cows use their sense of smell for?

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3. Describe how a dog's sense of smell has helped humans.

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4. Would you want to be a super smeller? If you were, what would you use your sense of smell for?

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