

A close-up photograph of green leaves with water droplets, serving as the background for the slide. The leaves are vibrant green and show detailed vein patterns. Small, clear water droplets are scattered across the surface of the leaves.

Biology

Germs, Bones, Bioluminescence, &
Hearing



SS49
GRYPHON ROBOTICS

A close-up photograph of several green leaves, likely from a plant like a fern or a similar species, showing detailed vein patterns. The leaves are covered with numerous small, clear water droplets, suggesting a recent rain or mist. The lighting is bright, highlighting the texture and color of the foliage. A dark green horizontal band is overlaid across the middle of the image, containing the text.

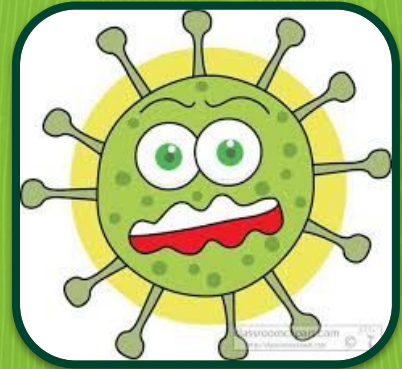
Germs and Diseases

Germs

Description: In this activity we'll be talking about the many different ways diseases and germs can spread and how to stop them!

Supplies

- Computer
- Access to Gizmo
- Pepper
- Soap
- Water
- Shallow dish



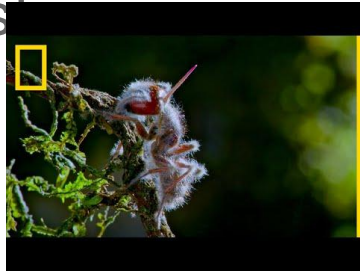
Step 1- Research

Parasites and Disease

Parasite

An organism that lives in, or on, an organism of another species (its host) and benefits by taking nutrients and harming the host.

Learn about this
real-life zombie parasite



Disease

Diseases are defined as “anything that disrupts normal body functions”

We will be focusing on disease for this activity!

Step 1- Research Continued

Types of Disease

Non-Infectious Disease

Examples include cancer or diabetes. These diseases **CAN NOT** be transferred from person to person.

Biology

DISEASE SPREAD

Infectious Disease

Examples include strep throat and chickenpox. These diseases **CAN BE** transferred from person to person, Infectious diseases are also referred to as “Pathogens.”

Step 2- Explore Disease Transmission

How can Infectious Diseases Spread?

Learn more [here](#)
and [here!](#)

Infectious diseases are primarily spread in the following ways:

- ✗ Air
- ✗ Touch
- ✗ In Mouth, Eyes, or Nose
- ✗ Unclean Water / Food
- ✗ Animals / Insects
- ✗ Dirty Hands



The primary way to prevent germs from spreading is quite simple... **washing your hands!**

Step 3- Soap Demo



How Does Soap Repel Germs?



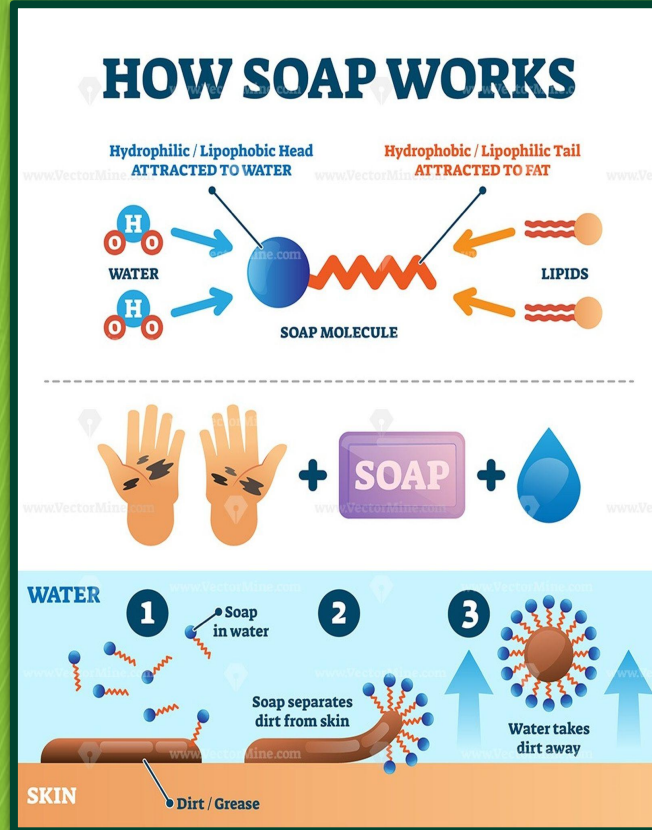
This activity will demonstrate the importance of using soap. Pepper will be acting as the germs.

Procedure:

1. Fill the shallow dish with water (about 1 inch)
2. Sprinkle a lot of pepper into the water
3. Stick a finger into the pepper water and observe what happens
4. Now, coat your finger with soap
5. Stick the soapy finger back into the water and observe what happens

Step 3- Soap Demo - Explained

Soap decreases the water's surface tension and lifts all the dirt and germs from the skin. This effectively gets rid of any bacteria or germs that was on someone's hand or body. In the activity you just did, the pepper demonstrated what happened to the "germs" when you wash your hands.



Step 4- Test Your Knowledge

Disease Spread Gizmo

Test your knowledge and learn more about diseases spreading with this [gizmo](#)!

The screenshot shows the 'Disease Spread Gizmo' interface. At the top, there are tabs for 'Tools', 'SIMULATION', 'CONTROLS', 'DESCRIPTION', 'TABLE', 'BAR CHART', and 'GRAPH'. The 'SIMULATION' tab is active, displaying an 'Overhead view of room' with 20 people. The 'DESCRIPTION' tab is also visible, showing the 'Gizmo Status'.

Overhead view of room
Total number of people: 20

Gizmo Status

This simulation is not running. Press **Play** to begin. To adjust the initial parameters, select the **CONTROLS** tab.

The following diseases are active:
Foodborne

Number of infected people:
Airborne: 0
Foodborne: 0
Person to person: 0

At the bottom, there are 'Controls' (play, pause, reset buttons) and a 'hours' display set to 0.0. A legend at the bottom right shows icons for 'Healthy' (orange), 'Airborne' (light blue), 'Foodborne' (green), and 'Person to person' (purple).

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Bones and Osteology

Bones

Description: Osteology is the study of bones. This study is part of anatomy, and can be used to find out information about the deceased organism. We'll be learning about bones and identifying bones, and exploring a gizmo about human muscles and anatomy.

Supplies

- Computer
- Bone Identification Sheet (provided)
- Gizmo Access

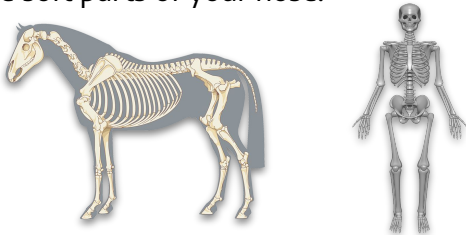


Step 1-Research

There are 3 types of Skeletons

Endoskeleton

The most familiar of all skeleton types is the endoskeleton. After all, it's the kind of skeleton YOU have! An endoskeleton exists within an animal's body. The human endoskeleton is hard because it's partially constructed of the mineral calcium. The endoskeletons of other animals may be more flexible — for example, the endoskeleton of a shark is made of cartilage, the same material that makes up the soft parts of your nose.



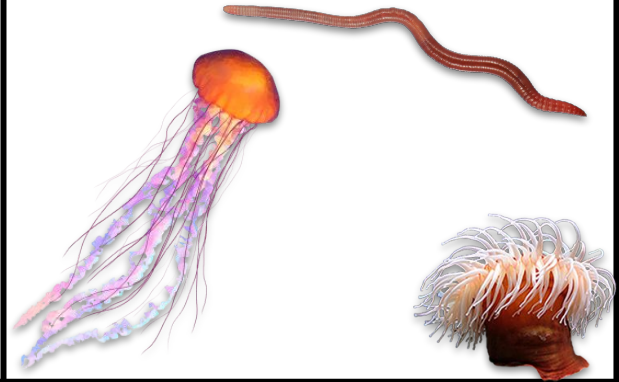
Exoskeleton

These are exactly what they sound like — skeletons on the outside of the body. You're probably quite familiar with these hard exterior coverings because they're found on crabs, lobsters, and many insects. Exoskeletons are rigid and can't expand as animals grow, so animals must molt, or shed, their exoskeletons periodically. After an animal molts, its new exoskeleton is soft — as in a soft-shelled crab.



Hydrostatic Skeleton

Found in creatures such as worms and jellies, hydrostatic skeletons are basically chambers filled with water. Animals with this skeleton type move and change their shape by squeezing their water-filled chambers — just like what happens when you squeeze a water balloon.






Step 1-Research Continued

More in depth
here and here

Why Do We Care About Bones?

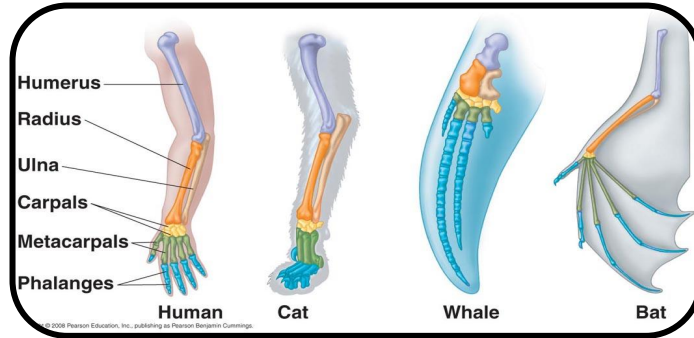
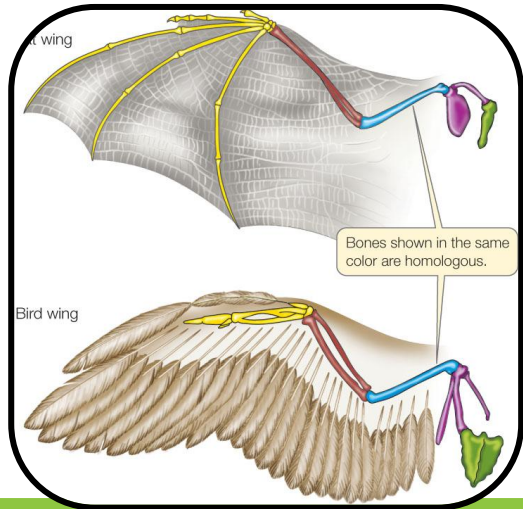
Bones can tell us so many things! Bones of a deceased person can tell researchers (called Forensic Anthropologists) the gender, age at death, race, the height, and many other things about the deceased person.

Gender	Age at Death	Race	Height	Other things
<p>The pelvic bones and skull are most commonly used to determine the gender.</p> 	<p>Teeth can be used to determine this, as well as the ends of bones (think growth plates).</p> 	<p>Bones can't determine race exactly, but bones like skulls can help identify prominent facial features which are key in identifying race.</p>	<p>By measuring the femur bone, researchers can estimate how tall the deceased person would have been.</p> 	<p>Bones, like teeth and bone tissue can help determine any diseases someone had. Bones can also help identify how they die, whether that was disease or murdered.</p>

Step 1- Research Continued

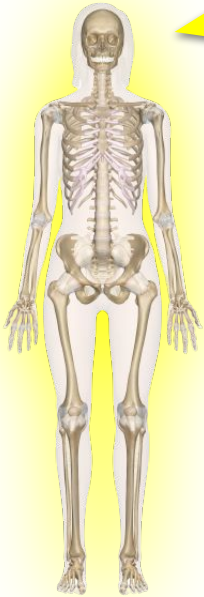
Bones can be Used to Identify Animals

While animals can have similar bone structure, Anthropologist can use identification charts to help differentiate between the animals.



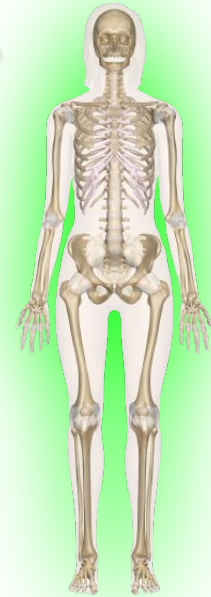
Step 2- Test Your Knowledge

Let's Practice Identifying Human Bones!



Click on the skeleton to the LEFT to LEARN about the human bones

Click on the skeleton to the RIGHT to practice LABELING the bones.



Step 2 - Test Your Knowledge Continued

Practice Animal Classification

Try to classify the animals commonly found in [owl pellets](#) using the [bone identification chart](#)!

Bone Identification Chart

The Cornell Lab
K-12 Education

Teeth

Incisors (short teeth)

Cheek Teeth

Cheek Teeth Types

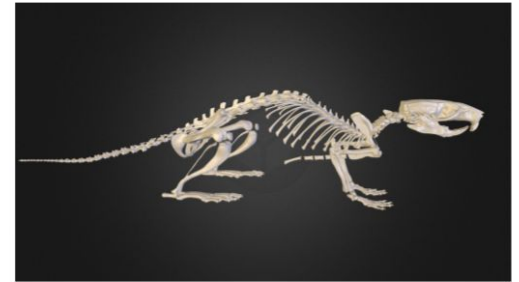
Lobed Angled Pointed

Bones

	Rat	Vole	Mouse	Shrew	Mole	Bird
Skull & Mandible (jaw)						
Tooth Type	Lobed	Angled	Lobed	Pointed	Pointed	None
Scapula (Shoulder blades)						
Pelvis (hips)						
Humerus (upper front leg)						
Radius/Ulna (lower front leg)						
Femur (upper hind leg)						
Tibia/Fibula (lower hind leg)						
Ribs						
Vertebrae (bones of back and tail)						

Using the bone identification chart to the left - determine what is the below organism!

Type what type of animal here




Step 3- Extension

Anatomy Extension

Try out this [anatomy gizmo](#) and see if you can lift the heaviest weight!

The screenshot shows an interactive anatomy simulation interface. At the top, there are three tabs: "ANATOMY", "DESIGN", and "TEST". The "TEST" tab is active. The main area displays a 3D model of a human arm with the biceps (labeled 'B') and triceps (labeled 'T') muscles highlighted in red. A black dumbbell is attached to the hand. To the right of the model is a control panel with a slider for "Mass of dumbbell (kg)" set to 10. Below the slider are radio buttons for "Data": "Summary" (selected) and "Graph". A note states: "Data will be collected after **Play** is pressed." Below this are several data points: "Was the arm able to lift the weight? Yes", "Input force from biceps: 1,395 N", "Change in length of biceps: 0 m", "Output force: 196 N", "Load: 107 N", "Net force: 89 N", and "Vertical lift distance: 0.07 m". At the bottom left of the interface are playback controls (play, pause, reset) and "Repetitions" radio buttons for "Single" (selected) and "Multiple". Below the playback controls are "Challenge" radio buttons for "Lift" (selected) and "Throw", and "Contracting muscle" radio buttons for "Biceps" (selected) and "Triceps". A final instruction reads: "Adjust the mass of the dumbbell using the slider. Press **Play** to see if the arm can lift the dumbbell."

A close-up photograph of several green leaves, likely from a plant like a fern or a similar species, showing detailed vein patterns. The leaves are covered with numerous small, clear water droplets, suggesting a recent rain or dew. The lighting is bright, highlighting the texture and color of the foliage.

Bioluminescence and Glow

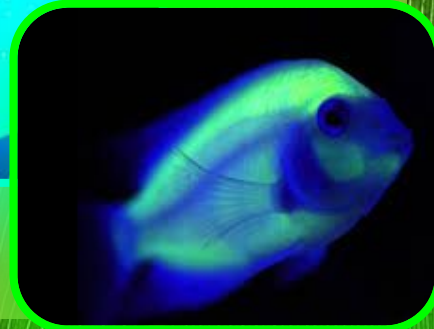
Glowing in the Dark

Description: Some animals and plants have to produce their own natural light to see, to do this they glow. Let's recreate this by creating a black light and some glowing water!

Supplies

- Black light
OR
- Flashlight/phone light
- Clear tape
- Purple marker
- Black marker
- A dark room
- Water
- Scissors
- Clear Container
- Non-toxic highlighter pen OR a glowstick
OR
- Tonic Water

Optional: gloves, tweezers



Step 1-Research

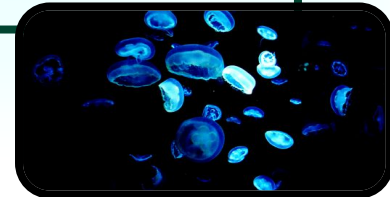
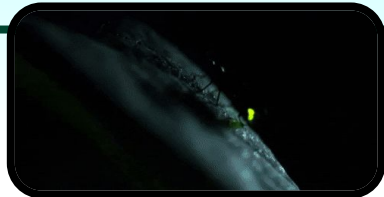
How do Things Glow in the Dark

You can read more about bioluminescence [here](#) and [here](#)!

Bioluminescence is light produced by a chemical reaction. This reaction occurs when two chemicals, luciferin and oxygen or luciferase, react with each other. This creates a new chemical, and during this chemical reaction, it gives off light!

Bioluminescent light is a “cold light” meaning it gives off almost no heat. This allows more of the energy to produce light.

Most bioluminescence is found in the deep sea, there it glows blueish-greenish, but in other places, organisms can glow other colors.



Step 1-Research Continued

What Types of Things Glow?

Animals

Lots of deep sea animals like squids, octopuses, jellyfish and fish have bioluminescence. Whenever you see glowing water, that's probably plankton or shrimp! On land, bioluminescence most notably occurs in fireflies and railroad worms.



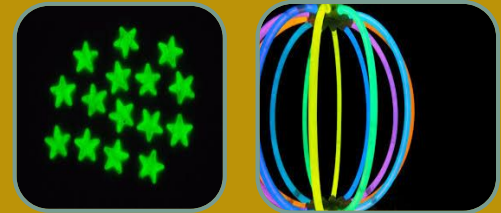
Plants

Bioluminescence is extremely rare in naturally plants. However, Scientist have found ways to replicate bioluminescence in artificial plants. Fungi, however, can be naturally bioluminescent.



Other objects

There are also man-made objects that “have” bioluminescence or can just glow in the dark. Things like glow sticks or glow-in-the-dark stars can glow for a short period of time due to chemical reactions.



Step 2 - Create

[More instructions here](#)

Create the Black Light and Glow in the Dark Water

If needed → Making A DIY Black Light

1. Using your phone light or a flashlight... Cover the light with a strip of tape
2. Color the tape blue
3. Stick another piece of tape over the now blue tape color the new strip of tape purple
4. Repeat X2

[More detailed instructions here](#)

Option 1 - Highlighter/glow stick

1. Pour water into a clear container
2. Open up a highlighter pen and remove the ink pouch.
 - If you're using a glow stick, cut that open.
 - *You may want to put on gloves
3. Drop the ink into the water and stir slightly
4. Let sit for about 5 minutes

[More detailed instructions here](#)

Option 2 - Tonic Water

1. Pour tonic water into a clear container

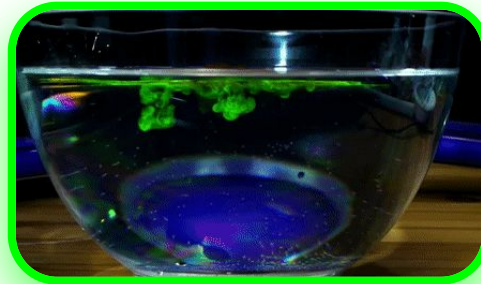


Step 3- Test it Out

Now...

1. Go into a room with little to no light
2. Turn on your blacklight and aim it at your Glowing Water

What do you see?!



Other ways
to make
things
glow!

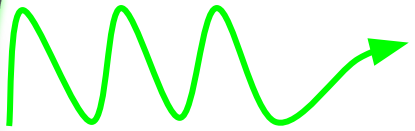
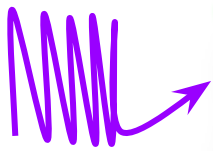
Step 4- Science Behind the Glow



While this isn't *technically* bioilluminescence, it mimics pretty well. The ultraviolet light from the black light causes a chemical called “phosphors” from the highlighter dye and “quinine” in tonic water to emit light. This type of illuminance is called fluorescence.

In general, something fluoresces because it has absorbed light energy, which makes it excited, and then it releases (or emits) light as it returns to its normal, unexcited state. Part of why we find things that glow under ultraviolet lights—such as some minerals, fish and tonic water—to be fascinating is because we cannot see the (ultraviolet) light they absorb but can see the visible light they emit.

High energy light waves are emitted with UV light from a black light



Lower energy light waves are emitted through the material - visible

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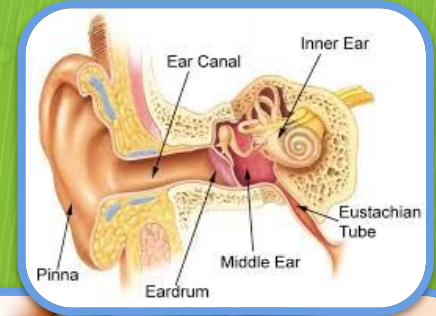
Hearing and Ears

Hearing

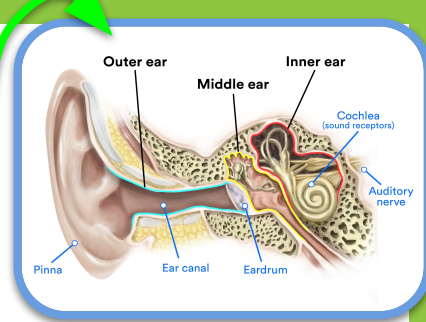
Description: Hearing is one of the five senses humans have. This activity will go over how hearing works and compare human hearing to other animals hearing.

Supplies

- Computer
- Gizmo Access



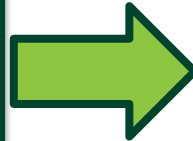
Step 1-Research



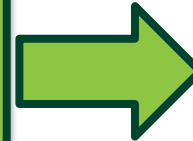
How do Humans Hear?

Humans use ears to hear, our ears are divided into three parts, the outer ear, inner ear, and the middle ear.

Sound vibrations travel from the outer ear and strikes the eardrum, causing it to vibrate.



The middle ear is then connected to the eardrum and takes those vibrations and uses them to vibrate three bones called ossicles. These vibrations cause the fluid to move into the ear.

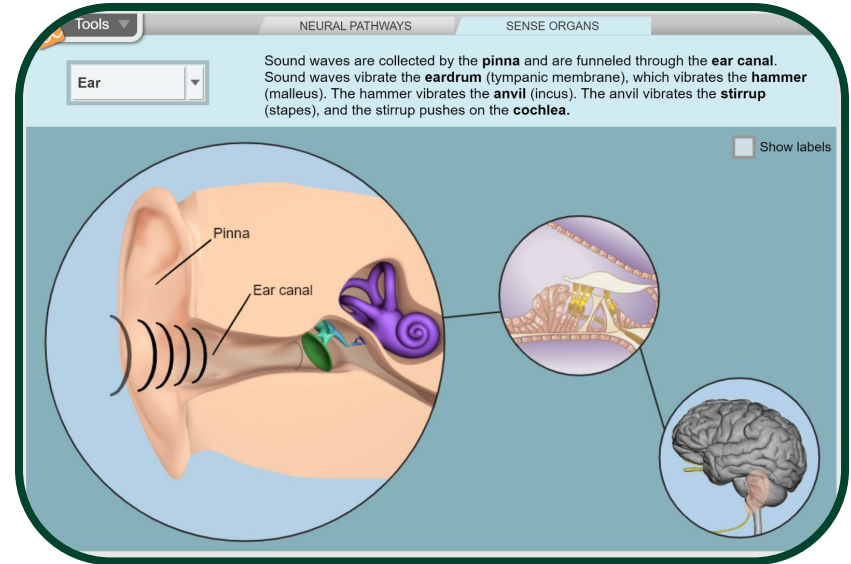


This fluid leads to the inner ear and causes tiny hair cells to move. These movements send electrical signals to the auditory nerve in the brain. The brain then uses this to interpret the sound.

Step 2-Explore

Explore This Gizmo

Use this [Gizmo](#) to help explore more about hearing! While it talks about all 5 senses, focus on the hearing parts!

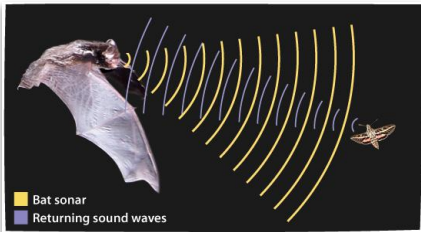


Step 3- Expand Your Knowledge

How Do Other Animals Hear? - Echolocation

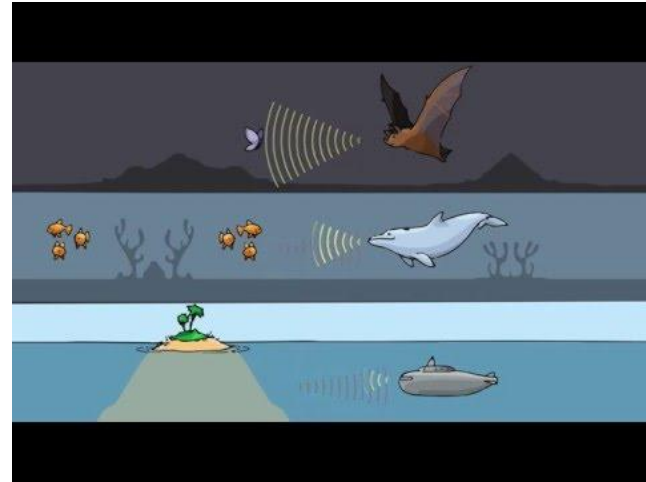
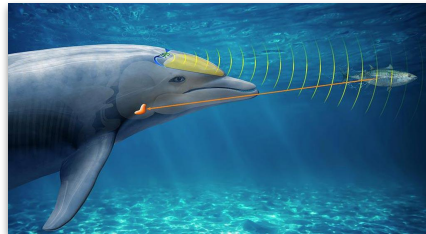
Bats

Bats use echolocation to hear. They produce a high pitched sound which bounces off objects around them and then returns to their ears. They use that sound to figure out their surroundings.



Whales/Dolphins

Whales and dolphins use echolocation to navigate and communicate. They have ear canals, but it doesn't have an opening to the outside, instead it connects through their jaw bones.

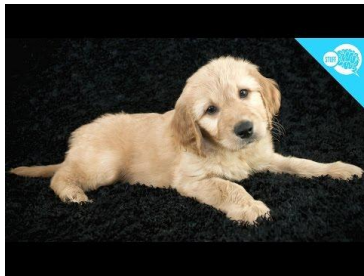


Step 3- Expand Your Knowledge Continued

How Do Other Animals Hear?

Dogs

Dogs hearing is almost 4 times better than human hearing, this is because dogs can have up to 18 muscles in their ear. These muscles allow dogs to focus their ears in a particular way to amplify the sound.



Birds

Birds do not have external ears, however they are still able to determine where sound is coming from by using a combination of their eyes and whatever eardrum the sound hits first. Once they register the sound, they use their eyes to locate the source of it.



Snakes

Snakes actually don't have eardrums! They still have the inner ear structures that are connected to their left and right jaws. They then use their tongues to sense vibrations and move their jaws to determine if it's coming from the left or right.



Step 4- Compare What You Know

Comparison Using a Venn Diagram

Use this [Venn Diagram](#) to compare and contrast how a human hears and how another animal hears (it doesn't need to be one we talked about)!

