Animal Eye, Human Eye: Digital Edition

Eyes are fascinating, each adapted to help its owner survive. How do animals other than humans see? How do our eyes work during the day and night?

Next Generation Science Standards

- 4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
- 4-PS4-2 Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.
- 4-LS1-2 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.

Materials Needed

- Aluminum foil or small piece of fabric that is dark and will cover your eye
- Tape (Surgical tape or other, NOT duct tape)

Background

Eyes are very sophisticated tools, allowing us to take in light, and interpret that information to understand the world around us. Most animals have eyes that sense electromagnetic radiation in the visible light spectrum. Why might this be?

Animals have external and internal features specifically adapted to support their survival. Our star– the Sun emits energy predominately in the visible light spectrum. Did you know that hotter stars emit more light in the ultraviolet region of the spectrum? If we find life on a planet circling one of these stars, we might also find eyes that are more adapted to seeing in the ultraviolet spectrum.

Eyes are fascinating. It is fun to consider how other animals see and to theorize why. Whatever animal it is, the eye has developed a structure that makes the most sense for that animal's survival.

This lesson consists of several videos and discussion prompts that aim to help students make connections between how eyes work and how the eye is a physical structure uniquely adapted to each animal. While students learn about eyes, they will be covering one of their eyes with aluminum foil.

It takes approximately 20 minutes for the human eye to adapt to low light levels. When students take off the aluminum foil they will be able to see the difference between their day adapted and night adapted eye. Students who create an eye patch that keeps the most light out will see the greatest effect.

Directions

Remind the students about the Adapt and Survive lesson. Can they tell you:

- How physical structures help animals survive? (Physical adaptations are traits that are better adapted to the environment and aid an animals survival. Over time this leads to populations of animals having certain physical adaptations - internal and external structures - that support their survival, growth, behavior, and reproduction)

Remind the students about the Seeing with Eyes lesson. Can they tell you:

- Why do we believe certain animals developed echolocation? (They lived in environments where visible light was low or non-existent. Echolocation helped them to "see- interpret their world" in a different way that did not need visible light. This gave them an adaptive edge for survival)
- Ask students if they think all animal eyes are the same?
- Tell them that today you want to learn a bit more about animal and human eyes. First you need them to make an eye patch.
- Have the students get aluminum foil or a piece of fabric from their parents. Demonstrate how to tape the aluminum foil or fabric over one eye on yourself. Tell them you want them to create an eye patch that blocks out all of the visible light, they can squish the aluminum foil to form to their face.
- Have students tape the material over one eye, they may need to look into a mirror or get some help to do this. The eye under the patch can remain open. Students will fidget with their patch, but that is ok. Just tell them you want that eye to not receive any light. If they like, they can cover that eye with a hand as well.
- Now tell students you will watch a film to consider how other animals see. They should try to ignore their eye patch while they watch or cover it with their hand.

Note: The goal for the next 15-20 minutes is for students to have one eye in the darkness. The other eye can be in the light.

With 1 eye taped, watch the film: How Animals and People See the World Differently | National Geographic http://www.greatbasinobservatory.org/lesson-plans/animal-eye-human-eye, also on the video tab above.

Discuss:

- What type of eye is a human eye? Simple or complex? (complex)
- Did they catch the example of the simple eye? If not can they guess an animal that would only need a simple eye because of their habitat? (Worms are one example. They live in the dark, so don't need complex eyes)
- What animal would they like to be to see the world through their eyes? Discuss as long as you like.
- The biologist would like to be a mantis-shrimp. Have they heard of this animal? Let's learn more in the next video.

Directions Continued

Watch: The Amazing Ways Animals See the World– find on the video tab above, or https://www.youtube.com/watch?v=LIfKk37bkyk

Discuss:
Can students remember some ways mantis-shrimp eyes are different than ours.

Our Eyes	Mantis-shrimp Eyes
Move together / are fixed	Can move independently of each other
We see the visible light spectrum	They can see visible and ultraviolet light
We have 3 cones to see color	They have 12-16 cones

- But, despite all the ways mantis-shrimp seem to have superior eyes to us, can we really say their eyes are better than ours? (The key is to think about how or why the eye evolved)
- What about seeing in the dark. Have students list some animals that are nocturnal and whose eyes have developed to see very well in darkness.
- Ask students if they have had an experience when they can see well at night? What needs to happen for them to be able to see well in darkness? (Their eyes need to adapt. This takes the human eye about 20 minutes at low light levels, the amount of time their one eye has been covered with their homemade eye patch.)
- Ask the class if anyone knows which part of our eyes helps us to see in the dark? The pupil does, this is the dark part in the center of our eye. In bright light the pupil becomes smaller to let in less light. In darkness the pupil grows large, so lots of light can enter the eye.
- Now, tell students you want them to think of a dark space they can go to and remove their eye patch. They will go there, remove their eye patch and look around with both eyes. Tell students when they are in the dark place to hold a hand over each eye, slowly one at a time. What do they observe? How different can they see with one eye than the other?
- Have them return after a few minutes of observation to discuss. Did it work. Could they see differently with each eye? If their eye patch worked, it should have been amazing how much better one eye can see than the other.
- Discuss with students what this means for humans. Are we adapted to see at night?
  Yes, but we need time to adjust, and we need darkness for our adjustment. Fun fact: from sundown to darkness is about 30 minutes, the same amount of time it takes a human eye to fully adjust. Once our eyes adjust to darkness, they will readjust to light very quickly, within seconds. This is why you feel momentarily blinded when a bright light is shown on a dark night.