

Nighttime Science

Fading Colors

Materials needed: washable markers

- **Nocturnal animals' eyes are designed different than animals that are diurnal.**
- Eyes have cells called rods and cones.
- **Cones help us see color (cones and color both begin with "C"), and rods help us see well in the dark.**
- We have lots of cones in our eyes because we are diurnal. Nocturnal animals have mostly rods; therefore they are usually color blind.
- You actually need light to be able to see colors, so seeing in color is not important **when you're a nocturnal animal.**
- To illustrate this, have each person pick out a marker from the box.
- Have them guess what the color is, and then write the name of the color on their arm.
- Remind them they cannot use flashlights to look at the marker.
- This activity should be done towards the end of the walk when it is as dark as possible. At the end of the walk when you are back at the parking lot, bring out a flashlight and hold it close **to the ground (so that you don't wreck everyone's night vision).**
- Have everyone place their arm under the light to see if they guessed their color correctly.
- Have them imagine how much better nocturnal animals must see in the dark than us since they have all those extra rods!

Listening for night sounds: Why are some animals active at night and not during the day?

- Discuss competition for resources and predator-prey relationships; many animals rely on the dark for protection from predators and have adapted a better sense of hearing to avoid danger.
- Likewise, nocturnal predators like owls and bats have a highly developed sense of hearing for hunting their prey.
- Many of these animals also use sound to communicate at night to find a mate, defend territory or find their young.
 - Deer Ears: Ask the students to think of nocturnal animals with big ears.

- **Bats and deer are common. Have students make “deer ears” by placing cupped hands behind their ears.**
- Have the students alternate between deer ears and people ears. Which gives us better hearing, big ears or small ears?
- Sound Twins: This activity will allow students to communicate in the dark by using their ears.
 - What animals communicate at night? Frogs, insects and birds all call to attract a mate. The cicada is one type of insect that buzzes in summer to its mate.
 - Ask the students to imagine themselves as different insects with specific calls.
 - They should find a partner and make up a short, distinctive call together.
 - Everyone spreads out, then each student must find his/her mate by making their sound call and searching for a match.
 - What were some difficulties you experienced in finding your mate?
 - The night is full of sounds, but not all insects communicate this way. Moths use scents or pheromones to attract mates while lightning bugs flash light patterns.

Why do pirates wear patches?

Materials: Candle & Lighter

- The answer is simple; the pirates cover one eye until they capture a boat.
- Then as they head into the dark black hull of the ship, they uncover their eye and search for hiding enemies or hidden loot.
- The story below gives students a chance to play with their night vision.
- Have the students sit in a circle and cover one eye with a hand. This is the patch that blocks out all light.
- Now light a candle and don your best pirate accent.
 - Once upon a time, there lived two rival pirates, Captain RedBeard and Captain BlackBeard. Both traveled far and wide throughout the Great Lakes in search of the lost treasure, but only one had the treasure map. Captain RedBeard took great care to protect the treasure map from Captain BlackBeard so that he might be the first to find the hidden treasure. On a night much like tonight, Captain RedBeard went below deck to study his charts and treasure map, **believing he was now only a few days’ journey away from the treasure. What Captain RedBeard did not realize was that Captain BlackBeard’s ship had been following him in the dark night, plotting to take over Captain RedBeard’s**

ship and steal the treasure map. At that very moment, Captain BlackBeard's crew attacked, coming aboard the ship. Captain RedBeard heard the commotion above deck, quickly hid the map and waited for Captain BlackBeard below. As soon as Captain BlackBeard came into the light, Captain RedBeard blew out the candle, switched his eye patch to the other eye and used his night vision to fight poor Captain BlackBeard who was surprised by the candlelight and immediately lost his night vision. And that is why pirates wear patches.

- Blow out the candle and have the students switch their eye patch.
- Look around. Now switch from eye to eye. Which eye has better night vision, the eye with the patch or the eye that sees by candlelight?
- It takes people about 45 minutes to fully gain their night vision, so pirates keep one eye in the dark, under a patch.

Precautionary Prey: A great game for early evening hikes.

Materials: a blindfold and small stuffed toy.

- Have the students form a circle and remain as quiet as possible.
- The toy is the prey and one student is the parent in charge of protecting the prey. A parent is chosen and stands blindfolded in the middle of the circle with the toy at his/her feet.
- Another student from the circle is silently selected as the predator and must move quietly into the circle and try to capture the prey.
- The object of the game: the parent must listen and point at the predator before the predator captures the prey.
- If the parent successfully points, the predator is out and another predator is silently chosen.
- If the predator can capture the prey without being pointed at, the predator becomes the new blindfolded parent.
- Discuss nocturnal adaptations among predators and prey.
 - How do nocturnal animals sense danger in the dark aside from sound?
 - How would the prey react in the wild to a predator approaching?
 - What would happen if everyone were noisy during this game?

Citrus Flame-Thrower

Materials: Orange, lighter, small knife, and a candle

- Bend a piece of orange peel to create a spray of orange oily stuff coming out.
- Direct this spray upwards into the side of a candle flame.
 - Be careful, this can be more effective than you expect. Make sure that your hands and anything else easily damaged by flame is below the candle flame!
- You should be able to produce an impressive fireball as the spray hits the flame.

Explanation

- Oranges have a peel which includes little compartments full of oily substances.
- When you bend the peel the outer layer of skin is stretched, and these compartments are flattened. This squashes them until they eventually fail squirting out their contents in the form of a spray.
- The oils which spray out are hydrocarbons - a bit like gasoline - and are highly flammable, and you have sprayed them out of the orange, so they are very well mixed with air.
- This means that the oxygen from the air can get to the oil in many places at the same time, so it burns very quickly in a fireball.
- Why do oranges have such flammable skins?
 - Oranges are a fruit, and they are designed to get a large animal to eat them, then move somewhere else and to defecate the undigested seeds in a nice blob of fertilizer somewhere distant from the parent plant where it won't be competing for resources.
 - So an orange tree wants its fruit to be eaten by large animals, but not by insects and fungi.
 - Even plants have adaptations that help them to survive!
 - Over time, insects and fungi would kill an orange tree, but an animal that eats oranges would not.
 - The oily skin is waterproof, so it is difficult for fungi to get a hold, and the oils are both poisonous and repellant to insects - this is why citronella is such a good mosquito repellent.

Triboluminescence (Sparkle-Farkle)

Materials: Wintergreen Mints

- Have everyone grab a partner and a wintergreen mint.
 - Everyone should bite down on the mint, and chew with their mouth wide open for their partner. Ideally, the partners should see sparks in one **another's mouths as the wintergreens are crushed.**

- All hard sugar-based candies emit some degree of light when you bite them, but most of the time, that light is very faint.
- This effect is called triboluminescence, which is similar to the electrical charge build-up that produces lightning, only much less grand.
- Triboluminescence is the emission of light resulting from something being smashed or torn.
 - Triboluminescence occurs when molecules, in this case crystalline sugars, are crushed, forcing some electrons out of their atomic fields.
 - These free electrons bump into nitrogen molecules in the air. When they collide, the electrons impart energy to the nitrogen molecules, causing them to vibrate.
 - In this excited state, and in order to get rid of the excess energy, these nitrogen molecules emit light -- mostly ultraviolet (nonvisible) light, but they do emit a small amount of visible light as well. This is why all hard, sugary candies will produce a faint glow when cracked.
- But when you bite into a Wint-O-Green Life Saver, a much greater amount of visible light can be seen.
 - This brighter light is produced by the wintergreen flavoring.
 - Methyl salicylate, or oil of wintergreen, is fluorescent, meaning it absorbs light of a shorter wavelength and then emits it as light of a longer wavelength.
 - Ultraviolet light has a shorter wavelength than visible light.
 - So when a Wint-O-Green Life Saver is crushed between your teeth, the methyl salicylate molecules absorb the ultraviolet, shorter wavelength light produced by the excited nitrogen, and re-emit it as light of the visible spectrum, specifically as blue light -- thus the blue sparks that jump out of your mouth when you crunch on a Wint-O-Green Life Saver.