Beat the Heat!!!
Using infrared technology to explore the differences between warm and cold blooded organisms

Created by- Lindsay Watson and Kimberly Schneider

Implemented- St. Andrews Middle School, Columbia SC

School- University of South Carolina

Grade Level- Seventh

Subject- Science

South Carolina Science Standards

II. B. 2. Regulation of an organism’s internal environment involves sensing the internal environment and changing physiological activities to keep conditions within the range required to survive.

a. Contrast warm-blooded and cold-blooded animals’ mechanisms to control their internal environment.

Time Frame

120 minutes

Resources and Materials

- A great website that discusses infrared technology and has alternate lesson plans, as well as, lots of other infrared pictures: http://coolcosmos.ipac.caltech.edu/image_galleries/ir_zoo/lessons/
- A website discussing infrared technology: http://www.cocam.co.uk/CoCamWS/Infrared/INFRARED.HTM

Assessment

The teacher will assess the students' knowledge based on their answers. There are 15 questions students have to answer; the exercise is out of 30. Students will be given a full two points for answers that are insightful and demonstrate good use of the photos and information that is provided. Students who only partially answer questions will only get one point.

Assignment

This assignment focuses on the difference between warm and cold-blooded animals using infrared technology. It is a unique way for students to actually visualize the temperature differences between endotherms and ectotherms. This activity also gets students thinking about the ecology of animals.

1. Briefly discuss infrared technology, as well as, the differences between heat and temperature. The PowerPoint presentation can help get your students excited about the technology. This presentation also explains the differences between heat and temperature, which should have been covered in early years but is often a misunderstood by students.
2. Discuss the differences between cold and warm blooded organisms. Introduce the new vocabulary endotherms and ectotherms.
3. Pass out colored copies of the infrared photos. You may want to laminate the photos so you can use them in multiple classes and over multiple years.
4. Pass out the student’s assignment: Beat the Heat!!!

Background Information

What is Infrared?

The human eye detects visible light waves, also known as visible radiation. Humans, though, only see a small portion of the light on the planet. The light spectrum is referred to as the electromagnetic spectrum. You may be familiar with microwaves, ultraviolet waves, gamma rays, as well as the visible light which are the only rays that our eyes detect. Each type of light has a unique wavelength or frequency. One type of light is infrared, which can be used to measure the heat radiated by an object. Infrared waves have wavelengths that are longer than visible light and shorter than microwaves. The heat detected in infrared rays is a product of the motion of atoms and molecules. The hotter it is the more molecule motion occurs. Everything above 0°K (Kelvin) radiates infrared…even cold objects such as ice cubes. These light rays can be detected with a special thermal infrared camera which allows you to visually see the infrared energy emitted by any object. The camera converts the thermal signal into a temperature; these temperatures are what are seen in the picture and are color coded.

In this assignment students will use infrared pictures to observe different animals; these pictures will help them translate the differences between cold and warm blooded organisms. These pictures will also help students learn about the ecology of different animals.

Background on Ectotherms and Endotherms:

Endotherm/warm-blooded animals ➔ Birds and mammals.
Endotherms keep their bodies at a constant temperature. When in a cooler environment they generate their own heat, when they are in a hotter environment they cool themselves off (e.g. perspiration). To generate heat endotherms convert the food that they eat into energy through a process called metabolism. Most of the food that an endotherm eats is turned into fuel to maintain a constant body temperature.

**Metabolism** - The chemical processes occurring within a living cell or organism that are necessary for the maintenance of life. In metabolism some substances are broken down to yield energy for vital processes while other substances, necessary for life, are synthesized.

**Ectotherm/cold-blooded animals** → Reptiles, fish, invertebrates, and amphibians.

Ectotherm animals take on the temperature of their surroundings. For example, when they are in an environment that is hot they are also hot. Cold-blooded animals are much more active in warm environments and are very sluggish in cold environments. This is because their muscle activity depends on chemical reactions which run quickly when it is hot and slowly when it is cold. A cold-blooded animal can convert much more of its food into body mass compared with a warm-blooded animal. Ectotherm animals eat a lot less food than endotherms.

**Optional pre or post-activity:**

In order to explain how a cold-blooded animal warms up/cools down and survives through a day, you can have students pretend like they are a snake.

1. Have the class act out what it would be like to live like a snake.
2. When it is night time turn off the lights and the classroom and the students will get under their desk as if it was their hole so they can stay warm through the night.
3. Then once the sun comes up I will turn the lights back on and the students will have to find an area under one of the over head lights to bask and warm-up from the night.
4. Now the snake is able to hunt for food but remind the students that the snake cannot convert its food into energy.
5. Next tell the students it is in the middle of the day and the sun is really intense to they need to find shade, have them find a place in the classroom to “be in the shade” like under a table or chair.
6. When the sun cools down tell the students they can come back out into the sunlight and look for food again.
7. Finally when it is night time again they need to find their hole for the night and turn the lights back out.
8. Throughout this whole time have a big sun attached to a magnet on the chalk board and move it throughout the day so the students can see what time of day it is.