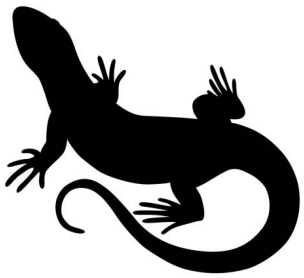
Extraordinary Ectotherms



Purpose:

Students will explore endothermy and ectothermy in order to better understand how organisms maintain homeostasis and can stay alive in extreme conditions.

Appropriate Grade Level: 2nd – 6th

Time Required: 45 minutes

NGSS and Common Core Standards:
MS-PS3-4, MS-LS1-3, MS-LS1-4

Objectives:

Students will be able to define ectotherm and endotherm and compare and contrast animals in both of these categories. They will demonstrate how both regulate their body temperatures and give examples of each.

Materials:

Provided in Kit:

- Digital thermometer gun
- 6 vials/test tubes for water
- Infrared photographs
- Powerpoint

ENVIRONMENTAL EDUCATION GRADUATE PROGRAM
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Activity:

Introduction	**Part 1 – Become an Ectotherm** 1. Ask for two volunteers that will demonstrate the difference between an ectotherm (cold-blooded) and an endotherm (warm-blooded). Have one student take their temperature using the temperature gun. Have the other student take the temperature of an object in the room. 2. Explain that an endotherm is an animal that can regulate their body temperature using heat produced from within. This is called thermoregulation. Ectotherms use heat from their environment to maintain their body temperature. 3. After the timer beeps, ask example students what their temperatures are (one should be close to 98.6°F, the other close to room temperature). 4. Take the class outside (this is best done on a sunny day), and take the temperature of both volunteers again. It may take a few minutes for the ectotherm temperature to change. What are the new temperatures? 5. Ask which student represents the ectotherm and which represents the endotherm? An endotherm's temperature stays the same almost all the time, even in extreme temperatures. 6. Have the class split into groups and give each a vial of water. Give groups three minutes to try to get their temperature as warm/cool as possible, simply by changing their location. For example, putting the water under a rock will make it cooler, and putting it on top of a dark object or pavement will make it warmer. It will take time for the water temperature to adjust, so be sure your students are prepared to be patient and watch closely for changes in their temperature. 7. Come back together as a class and discuss how both ectotherms and endotherms can regulate their body temperature. How do ectotherms change their body temperature? (sunlight, slowing body processes, being

	darker colors)What kind of things go on in the body to help regulate this temperature? (endotherms use thermoregulation: metabolism produces heat, behaviors like shivering generate heat, sweating releases heat).
Body	**Part 2 – Infrared Zoo** 1. **How to read an infrared photograph**: Infrared light shows us the heat radiated by the world around us. By viewing animals with a thermal infrared camera, we can actually "see" their temperatures. Each picture depicts an animal, sometimes with a human also in the picture. To the right of each picture, there is a temperature scale showing which colors represent warmer temperatures and which represent lower temperatures. Generally, darker blues are cold while lighter yellows and reds are warmer. On the back of each picture is the name of the animal or original picture to help in identifying the animal if needed. 2. Hand out one of the infrared pictures to each student or pair. Have each group discuss whether they think it is a picture of an ectotherm or endotherm and how they can tell. 3. Have each group share with the class their conclusion, and place the picture on the board under an 'ectotherm' or 'endotherm' category. 4. Answers: Ectotherms are the lizards, caterpillar, alligator, frog, gecko, scorpion, millipede, turtles, python, and chameleon. Amphibians, reptiles, fish, and insects are all ectotherms. Endotherms include mammals and birds, and example pictures are the dog, giraffes, cockatiels, parrots, and humans! 5. Compare and contrast the two pictures of the turtles to determine why we like to use the term 'ectotherm' over 'cold-blooded'. One picture is of two turtles crawling out of a cool pond onto the hot sand. Their body temperature remains cool against the hot sand. The other is a picture of

	a turtle sunbathing on a cold day. Therefore, it's body temperature is much warmer than a human's might be! This is why the terms warm-blooded and cold-blooded can often be misleading.
Closure	1. Lead the students in a discussion about endotherms and ectotherms (can flesh out more. Just writing down my initial thoughts right now) a. Are there different strategies that endotherms and ectotherms use to maintain homeostasis? i. What advantages do endotherms have by being able to regulate their internal body temperature? Are there any disadvantages? ii. What advantages do ectotherms have by relying on their environment to regulate their internal body temperature? Are there any disadvantages? iii. How do endotherms deal with a hot environment? How do ectotherms deal with a hot environment? iv. How do endotherms deal with a cold environment? How do ectotherms deal with a cold environment? 2. What happens when organisms are unable to maintain homeostasis?

Modifications:

- **Elementary:** Illustrate an animal not pictured in the Infrared Zoo. Discuss what the infrared picture looks like and discuss their internal temperature regulation methods

- **Middle School:** Explore the Infrared Zoo website given below and also discuss how feathers, fur, and blubber help trap heat and affect how the temperatures show up in an infrared picture.
- **High School:** Examine evidence for dinosaurs being ectothermic or endothermic and have a debate as a class or a homework assignment to allow each student to support their side.

Updated in December 2020 by Allison Barnes, William Beckett, and Laney Marcotte

Additional Information

References

Cool Cosmos. (n.d.). Infrared Zoo. Cool Cosmos. https://coolcosmos.ipac.caltech.edu/infrared_gallery/1