



pets in the
classroom

Exploring Ectothermic and Endothermic Organisms

Adapted from	Annette DeGeorge Mt. Pleasant Middle School of the Visual & Performing Arts Lesson: Cold Blooded Animals – Reptiles
Pet: Reptiles	Class: 3-5

Brief Overview: In this lesson, students will investigate the concepts of ectothermy and endothermy using lizards as a model organism. They will learn how ectothermic animals, like lizards, rely on external sources to regulate their body temperature, while endothermic animals generate heat internally. Through hands-on activities and experiments, students will explore the adaptations and strategies that allow ectothermic animals to thrive in diverse environments.	Lesson Breakdown Lesson 1: Endo and Ectothermic Organisms Lesson 2: Testing Temperatures Lesson 3: Design a habitat
Essential Question How do ectothermic and endothermic animals regulate their body temperature?	

Subjects <ul style="list-style-type: none"><input checked="" type="checkbox"/> Science<input checked="" type="checkbox"/> ELA<input checked="" type="checkbox"/> Math<input checked="" type="checkbox"/> STEM<input type="checkbox"/> Art<input type="checkbox"/> Other	Stem Connections Science: ecto and endothermic organisms Technology: 3D modeling software (optional), thermometers Engineering: design a habitat Math: measuring temperature
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Performance Expectations/ Standards

NGSS

5-LS1-1. From Molecules to Organisms: Structures and Functions

Students will investigate and understand the relationship between the structure of an organism and its function.

5-LS2-1. Interdependent Relationships in Ecosystems

Students will investigate and understand that organisms and populations of organisms are interdependent within the environment.

CCSS Standards:

ELA.5.RI.2.1 Read closely to determine the meaning of words and phrases as they are used in the text.

ELA.5.W.2.8 Recall relevant information from experiences or organize information according to its relevance to a topic or purpose.

MATH.5.MD.1.1 Use a standard unit of length and measure to estimate and measure distances.

MATH.5.MD.1.2 Convert units of length within a given measurement system.

I CAN statements

- explain the difference between ectothermic and endothermic animals.
- identify lizards as ectothermic animals and describe their adaptations for temperature regulation.
- discuss the advantages and disadvantages of ectothermic and endothermic lifestyles.
- explain how the concepts of ectothermy and endothermy influence the distribution and behavior of lizards.

Materials

Coloring supplies

Thermometers (1 per group)

[Exploring Ectothermic and Endothermic Animal Slide presentation](#)

[Reptile Temperature Cards \(Endo/Ecto Lesson\)](#)

[Exploring Ectothermic and Endothermic Organisms Student Worksheet](#)



Teacher Background

Ectothermic and endothermic animals represent two fundamental strategies for regulating body temperature. Understanding these concepts is crucial for comprehending the diverse adaptations and ecological niches of various animal groups.

Ectothermic Animals (Cold-blooded)

Ectothermic animals, often referred to as cold-blooded animals, rely on external sources to regulate their body temperature. This means that their internal body temperature fluctuates with the surrounding environment. Examples of ectothermic animals include reptiles, amphibians, fish, and invertebrates.

Adaptations of Ectothermic Animals

Ectothermic animals have developed various adaptations to cope with their dependence on external temperature regulation. These adaptations include:

- **Basking Behavior:** Ectothermic animals, like lizards, often engage in basking behavior, positioning themselves in sunlight to absorb heat and raise their body temperature.
- **Seeking Shade:** During periods of excessive heat, ectothermic animals seek shade or cooler environments to avoid overheating.
- **Color Change:** Some ectothermic animals, such as chameleons, can adjust their skin pigmentation to regulate heat absorption.
- **Behavioral Thermoregulation:** Ectothermic animals may choose their activity patterns based on temperature, being more active during warmer periods and less active during cooler times.
- **Hibernation and Estivation:** During periods of extreme temperature fluctuations, ectothermic animals may enter hibernation (cold dormancy) or estivation (hot dormancy) to conserve energy and protect themselves from harsh environmental conditions.

Endothermic Animals (Warm-blooded)

In contrast to ectothermic animals, endothermic animals, also known as warm-blooded animals, generate heat internally through metabolic processes. This allows them to maintain a relatively constant body temperature regardless of external environmental conditions. Examples of endothermic animals include mammals and birds.

Adaptations of Endothermic Animals

Endothermic animals have evolved several adaptations to support their internal heat generation, including:

- **Insulation:** Endothermic animals have insulating layers, such as fur, feathers, or blubber, to minimize heat loss.



- **Metabolic Regulation:** Endothermic animals can adjust their metabolic rate to generate more or less heat depending on their environmental needs.
- **Cardiovascular System:** Endothermic animals have an efficient cardiovascular system that distributes heat throughout their bodies.
- **Behavioral Thermoregulation:** Endothermic animals can also engage in behavioral thermoregulation, such as seeking shade or huddling together for warmth.

Lizards as Ectothermic Models

Lizards are excellent examples of ectothermic animals, exhibiting a wide range of adaptations for regulating their body temperature. Their ability to bask in the sun for warmth and seek shade to avoid overheating highlights their dependence on external temperature regulation.

Implications of Ectothermy and Endothermy

The distinction between ectothermic and endothermic animals has profound implications for their distribution, behavior, and energy expenditure. Ectothermic animals are generally more abundant in tropical regions, where temperatures are more stable, while endothermic animals are better suited for temperate and polar environments. Additionally, ectothermic animals tend to have lower energy demands compared to endothermic animals, allowing them to occupy ecological niches where food resources may be scarce.

Conclusion


Understanding the concepts of ectothermy and endothermy is essential for appreciating the diversity and adaptability of the animal kingdom. Lizards, as prime examples of ectothermic animals, provide valuable insights into the mechanisms and implications of external temperature regulation. By comprehending these concepts, educators can foster a deeper understanding of the ecological balance and the remarkable adaptations that enable animals to thrive in diverse environments.

Lesson 1: Endo and Ectothermic Organisms

Time	Materials	Activity
10 mins		<p>Introduce the topic by asking the students what happens when they feel hot- what does their body do? (sweat, pant) What behaviors do they do?(go swimming, move to a shady spot)</p> <p>How about when it is cold? What do their bodies do</p>



		<p>(shiver)? What behaviors might they do?(put on more clothes, turn the heat up)</p> <p>Ask if they have ever heard of the terms endothermic and exothermic. Explain that the word endothermic comes from the Greek prefix endo-, meaning “inside” and the Greek suffix –thermic, meaning “to heat”.</p> <p>Ectothermic comes from the Greek prefix ecto-, meaning “outside” and the Greek suffix –thermic, meaning “to heat”. Ask the students to think about what that might mean when describing different organisms.</p>
15 mins	Exploring Ectothermic and Endothermic Animal Slide presentation	Show students the slide presentation, reminding them of the origins of the words endothermic and exothermic.
15 mins	Exploring Ectothermic and Endothermic Organisms Student Worksheet Coloring supplies	Have the students complete the Identification Game on their worksheet

Lesson 2: Testing Temperatures		
Time	Materials	Activity
Prior to class	Reptile Temperature Cards (Endo/Ecto Lesson)	<p>Set-Up: A variety of pictures of various reptiles (enough for pairs of students to have one) that indicate the temperature ranges to the pictures. Attach the thermometers to the reptile pictures. (The worksheet has 6 different reptiles - feel free to use</p> 



		<p>these, make your own or do a combination !)</p> <p><i>Note: If you are not able to reach high temperatures outdoors, set up some areas in your classroom with different intensities of light, some places in the shade, near a fan. etc.</i></p>
35 mins	<p>Exploring Ectothermic and Endothermic Organisms Student Worksheet</p> <p>Reptile pictures with thermometers</p>	<p>Pass out a reptile thermometer to each pair of students. Make sure they see and understand the temperature range for that animal.</p> <p>Instruct students to lay their reptile on (reptiles do not hover in the air) at least 5 surfaces and record the surface and the temperature. (Remember to keep thermometer on the surface for at least a minute to get an accurate reading).</p> <p>Determine if that surface at that time of day is within the reptile's temperature range. Encourage the students to consider locations a reptile might be seen and put their thermometers in those types of places.</p> <p>Students should try to find at least 5 safe places for their reptile, given the surface temperatures.</p>
10 mins		<p>Have the students share their results and identify any locations that their reptile would be comfortable and those that would not be suitable. Encourage the students to back up their claims with evidence from their data.</p>

Lesson 3: Design a Habitat

Time	Materials	Activity
5 mins		<p>With this new understanding of the class pet being cold blooded and needing a specific range of temperature, have students brainstorm ways to achieve that for the pet's health and safety in a small group</p>



Lesson 3: Design a Habitat

10 mins	Coloring supplies Exploring Ectothermic and Endothermic Organisms Student Worksheet	After brainstorming, have the students individually draw their design. Students may use a 3D modeling software to design the habitat (optional)
10 mins	Exploring Ectothermic and Endothermic Organisms Student Worksheet	Have the students complete the reflection questions on the worksheet.
20 mins	Exploring Ectothermic and Endothermic Organisms Student Worksheet	Assign this writing assignment: <i>If you had to spend time out in the natural environment of our class pet, so it could visit its family, what would it be like for you? You would have to eat what it eats, sleep where it sleeps, etc. Explain why you feel this way</i>

Differentiation

For students who need additional support:

provide additional visuals, such as diagrams or videos, to help them understand the concepts of ectothermy and endothermy.

For students who need additional challenges:

- have them research and compare the temperature regulation mechanisms of different ectothermic and endothermic animals.
- Have them design experiments to investigate the effects of temperature on lizard activity levels or lizard physiology, such as heart rate or respiration.



Assessment

Students can be assessed on their participation in the project using this rubric:

Criteria	4 points	3 points	2 points	1 point
Contribution to Discussions	Actively participates in discussions, shares ideas thoughtfully, and listens respectfully to others.	Participates in discussions, shares ideas, and listens to others.	Occasionally participates in discussions and may interrupt others.	Rarely participates in discussions and may be disruptive
Completion of Assigned Tasks	Consistently completes assigned tasks on time and to a high standard.	Completes most assigned tasks on time and to a satisfactory standard.	Completes some assigned tasks, but may miss deadlines or produce work of lower quality.	Does not complete assigned tasks or produces work of consistently poor quality.
Collaboration and Teamwork	Works effectively with others, shares responsibilities, and resolves conflicts constructively	Collaborates with others and shares responsibilities.	May have difficulty collaborating with others or sharing responsibilities	Does not collaborate with others or may create conflicts.
Design	Design is complete, labeled and includes a list of materials. It is written so that anyone could reproduce the design.	Design is mostly well done, but is missing some materials and/or detail in the directions or labels	Design is incomplete, missing labels and/or the procedure is insufficient.	Design is impractical, does not meet the needs of the crested gecko.

This is a rubric for the story writing.



Criteria	4 Points	3 Points	2 Points	1 Point
Creativity	The story is original and imaginative..	The story is generally creative and shows some originality.	The story is somewhat creative but could use more development.	The story is not very creative and lacks originality.
Accuracy and Completeness	All of the important facts are included in the story, and they are accurate.	Most of the important facts are included, but there may be some minor inaccuracies.	Some of the important facts are included, but there are several inaccuracies.	Few of the important facts are included, and there are numerous inaccuracies.
Grammar and Mechanics	The story is free of grammatical errors and shows strong command of language mechanics.	The story has few grammatical errors and shows a good understanding of language mechanics.	The story has several grammatical errors and shows some understanding of language mechanics.	The story has numerous grammatical errors and shows a weak understanding of language mechanics.

**Extension**

Have students create a model or diagram to illustrate the relationship between an ectothermic animal's environment and its body temperature.

Invite a local herpetologist or reptile expert to visit the classroom and share their knowledge about lizards and other ectothermic animals.

Have students design and conduct experiments to investigate the effect of temperature on the activity levels of ectothermic and endothermic organisms.

Encourage students to research and report on the adaptations of ectothermic animals that live in extreme environments, such as deserts or polar regions.