Temp Probe

Diversity of Organisms

Grades: Middle School
Time: 45 Minutes
Subject: Life Science
Topics: Adaptation, Temperature Regulation

Overview

Have you ever wondered how animals survive in extreme environments? In this lesson, you will explore how the outer coverings of different animals help them adapt to their habitats. Using databot, you will simulate animal skin adaptations and analyze how they help regulate body temperature, ensuring survival in challenging conditions.

Background

Adaptation and specialization are fundamental concepts in biology, illustrating how organisms are designed to survive and thrive in their environments. Animals develop unique features over time to overcome challenges in their habitats. For example, polar bears have thick fur and fat layers to retain heat in cold climates, while desert animals like camels have reflective coats to avoid overheating.

The outer covering of an animal, such as fur, feathers, or scales, plays a critical role in maintaining its body temperature. These coverings act as insulators, heat reflectors, or protective barriers, depending on the environment. By understanding these adaptations, you can appreciate how animals are uniquely equipped to survive in diverse conditions.

What You Will Need/Prep

- Databot with two temperature probes
- IOS/Android Smart Device
- Heat source (e.g., incandescent lamp)
- Insulation materials (cotton, foil, leather, wool, or other fabrics)
- Rubber bands, glass with water
- Install Vizeey™ on your Smart device.

- Test your databot™ connection.
- You will be prompted to select and connect to databot™ each time you launch an experiment.
- If there are two or more databot™'s listed, the one closest to your device will be highlighted.
- Study the background information and terms and prepare to explore!

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In this lesson, you will investigate how different materials, mimicking animal coverings, affect temperature regulation. Through hands-on experimentation, you will learn how these adaptations work and why they are vital for survival.

Learning Objectives

By the end of this lesson, you will:

- Understand how biological adaptations enhance survival in specific environments.
- Investigate the role of animal coverings in regulating body temperature.
- Use databot's sensors to collect and analyze data on temperature changes.
- Compare the effectiveness of different materials in simulating animal adaptations.

Important Terms

- **Adaptation:** A characteristic that helps an organism survive and reproduce in its environment.
- **Insulation:** The process of reducing heat loss or gain by using materials that trap or reflect heat.
- **Temperature Regulation:** The ability of an organism to maintain a stable internal temperature despite external changes.
- **Environment:** The natural world or specific conditions in which an organism lives.

Interesting Facts

Arctic foxes have fur that changes color with the seasons: white in winter for camouflage in snow and brown in summer to blend with the tundra.

Some desert animals, like the fennec fox, have large ears that help dissipate heat and keep their bodies cool.

Feathers are not only for flight in birds but also provide insulation and waterproofing.

The scales of reptiles help prevent water loss, an essential adaptation for survival in dry environments.

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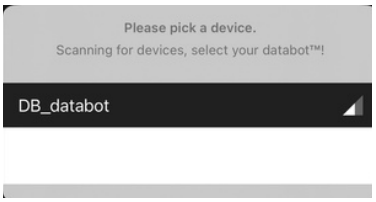
Using Vizeey

In order to work with the experiment you need to launch the Vizeey application and click on + in the upper right corner.

Then select “Add experiment from QR code” and scan the QR code prepared for this experiment. Your experiment will appear in the list.

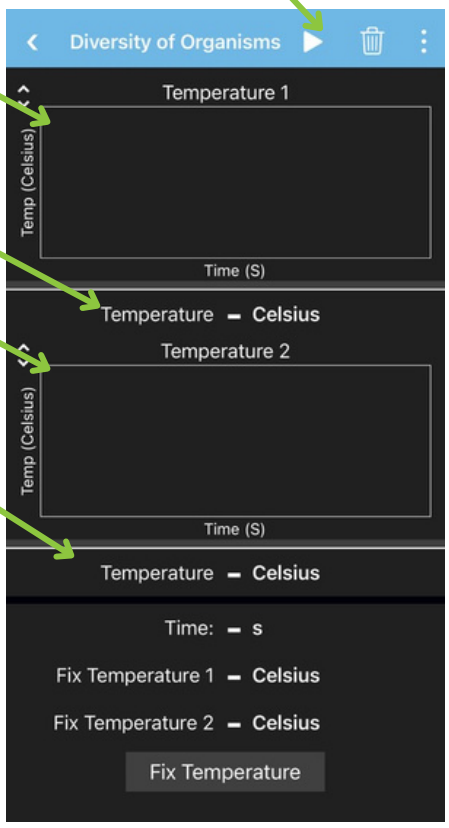


Once in the Experiment

When you start the experiment active databots show up in your connection list. Select the one with the strongest signal (blue). Make sure your databot is turned on.

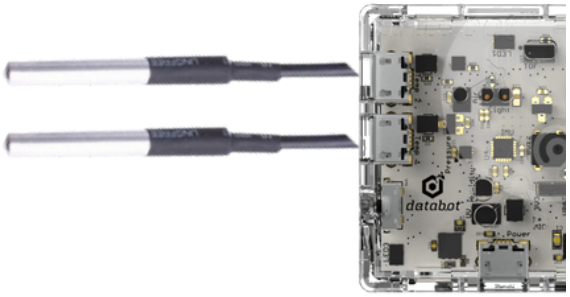
Press this button to start the experiment.

- Here you will see a graph of temperature 1 change over time.
- Current temperature 1
- Here you will see a graph of temperature 2 change over time.
- Current temperature 2.



You can connect 2 temperature sensors to the databot and use them. Connect them to the correct port.

If you see the sensor value -127, it means that the sensor is not connected.



- When you press the Fix Temperature button, the current temperature is recorded in the fields.
- When you press the button again, the previous data is lost.

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Part 1: Initial Observations and Questions

How do different animals adapt to survive in hot or cold environments?

What materials in your daily life remind you of animal coverings, such as fur, feathers, or scales?

How do you think insulation materials, like cotton or foil, mimic these natural adaptations?

Part 2: Hypothesis

Based on your initial observations, make a hypothesis about the experiment:
(Write down your hypotheses and be prepared to test them during the experiment.)

Prediction 1: Will materials like fur-like fabric will be better at retaining heat compared to reflective materials like foil.

Prediction 2: Will reflective materials perform better at keeping databot cool in warm environments.

Part 3: Experiment Procedure

Materials Needed:

- Databot with two temperature sensors
- Heat source (e.g., incandescent lamp)
- Insulation materials: cotton, foil, leather, wool, or other fabrics
- Rubber bands or make pockets out of test fabrics to attach the temperature sensors
- Water glass for temperature equalization (if desired)

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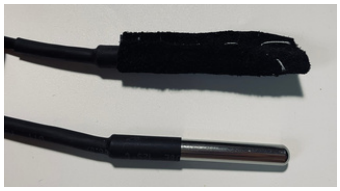
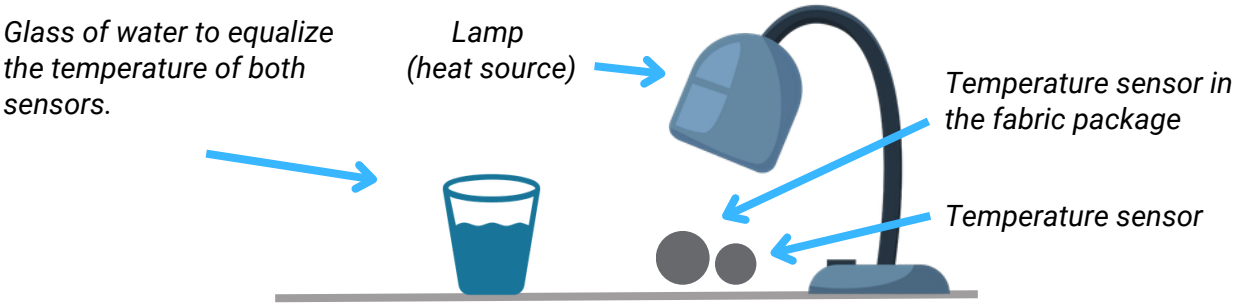
Experiment Steps:



- Ensure the temperature sensors are in close contact with the fabric for accurate readings. Create fabric pockets or secure the sensors using rubber bands.
- Turn on databot and connect both temperature sensors.
- Tap on **"Diversity of Organisms"** in Vizeey to load the experiment.
- You will be prompted to connect to databot.
  - Hint- if there is more than one databot in use, the one closest to you will be in blue!
  - A solid blue light on databot means you are connected.
- Start your experiment using: ▶
- Use these icons ▶ ⏸ at the top of the screen in Vizeey to start and to pause the experiment.
- Equalize the temperature of both sensors by immersing them in a glass of water for 1 minute.
- Prepare the heat source and turn it on. Ensure it is stable and ready for the experiment.
- Attach one temperature sensor to the prepared fabric materials (e.g., cotton to represent fur, foil for a heat-reflecting structure, fabric for feathers).
  - Avoid touching the sensor directly with your hands to prevent heat interference.
- Start the experiment by placing both sensors under the heat source. One sensor should remain exposed, while the other is covered by the insulation material.



Side view

- During the experiment, you need to record the temperature values every 30 seconds for 5 minutes
  - Press the "Fix Temperature" button every 30 seconds to capture the next values for your data table.
- Once you have captured the values, write them down in the table to avoid losing any information and prepare to capture the values at the next 30 second mark. Be fast and accurate!
- Repeat the experiment using different materials to cover the sensor.

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Part 4: Data Analysis

Complete a table to document your results:

Material_____

Time	Uncovered Sensor (°C)	Covered Sensor (°C)
0		
30		
60		
90		
120		
150		
180		
210		
240		
270		
300		

Material_____

Time	Uncovered Sensor (°C)	Covered Sensor (°C)
0		
30		
60		
90		
120		
150		
180		
210		
240		
270		
300		

Material_____

Time	Uncovered Sensor (°C)	Covered Sensor (°C)
0		
30		
60		
90		
120		
150		
180		
210		
240		
270		
300		

Consider which animal coverings might correspond to each material based on its performance.

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Identify which material provided the best insulation by comparing the temperature changes.

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Create a graph below to visualize the data and interpret the results.

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Part 5: Concept Questions

- Which material was the most effective at maintaining a stable temperature? Why?

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- How does this experiment mimic the natural adaptations of animals in different environments? _____

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- What factors might influence the effectiveness of insulation materials in real-world applications? _____

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Part 6: Reflection

1. What was the most surprising result from the experiment?

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2. If you were to design a protective covering for extreme environments, which material would you choose based on the results? Why?

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3. What questions do you have after completing this experiment

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