BIRDEE Unit 1 Lesson Plans

Unit 1 Module 4: Design Challenge Heat Transfer & Thermal Regulation	Materials
Module 4 Overview: 1.4.1 Understanding Thermal Regulation Systems in Nature with SFM 1.4.2 Conceptual Design 1 1.4.3 Thermal Regulation Experiment Part 1: Introduction and Setup 1.4.4 Thermal Regulation Experiment Part 2: Analyze Data 1.4.5 Thermal Regulation Experiment Part 3: Additional Data &BID Analogy	1.4.0. EDPL Map

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1.4.1. Understanding Thermoregulation Systems in Nature with SFM

In 1.3.4. and 1.3.5, students looked at existing food thermal regulation solutions/systems and brainstormed structures in biology that perform similar functions. In this lesson, students will look to nature for thermoregulation systems and will practice guided SFM on these systems.

Engage: 5 min

View: 1.4.1. BID WOW!
- What can anthills and termite mounds inspire?
- **Class Discussion** on what students think
- **Play video:** Termite Mounds and Air Conditioning (in ppt)
- **(Optional) Play video:** Termite Mounds and AC (in ppt)

Explain: 10 min *(Presentation)*

We are going to learn about how to use the SFM tool with thermoregulation systems. Thermoregulation systems are similar to thermal regulation systems, but are biological thermal regulation systems instead of man-made thermal regulation systems. We will practice SFM with polar bear fur. *(**Teacher Note:** NGSS crosscutting concept)*

View: 1.4.1. Polar Bear Fur: SFM

View: BIDI Graphic

Now, we are going to start Biologically Inspired Design Ideation. First, we are going to do our biological search in nature by looking at organisms in nature that thermoregulate. Then, we will understand the biological mechanism of the relevant biology we find using the SFM tool, like we just did with the polar bear.

Explore: 25 min *(Individual)*

Digital Gallery
We have narrowed down your biological search by selecting some biological thermoregulation systems for you to analyze using a guided version of SFM. We are in the Ideate stage of the EDP!

Teacher Note: There are 6 posters: Western Honey Bee, Whale, Jack Rabbit, Arctic Hare, Camel, and Emperor Penguin. Students may view the color posters by sharing the link. Alternatively, you may choose to print out 3-4 of each poster and create stations for students. We have provided printable versions in both color and Black & White.

View: 1.4.1. Thermoregulation Posters Color

Student Handouts:

1.4.1. SFM Analysis Thermoregulation Digital Gallery Notes

Student Materials:

1.4.1. Thermoregulation Posters Color

1.4.1. Thermoregulation Posters B&W

Instructional PPT's & Materials:

1.4.1. BID WOW!

1.4.1. Polar Bear Fur: SFM

Teacher Resources:

1.4.1. BID Thermoregulation System SFM Examples Teacher Guide

1.4.1. SFM Analysis Digital Gallery Notes TEACHER KEY

Web Resources:

BIDI Graphic

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1.4.1. Thermoregulation Posters B&W ● You will peruse the poster collection of thermoregulation systems from nature and choose 1-2 (depending on time) systems to analyze using the guided SFM worksheet **1.4.1 SFM Analysis Thermoregulation Digital Gallery Notes**. ● After completing your analysis on your two systems, find a classmate who chose the same examples as you and compare your analysis to their SFM analysis. ● You will add any notes from what you learned from your classmate to your worksheet. **Extend: 5 min** *(Group)* **EDPL:** Update Research Notes as needed based on what you learned today.	