

Alone with Macros

(This lesson is meant as a pre-supplement lesson before 3DRST lesson Biology 2.1: Macromolecules & Enzymes - Spitty Pudding; <https://3drst.byu.edu/bio2-1-spitty-pudding>)

Unit	Utah SEEd Standard / NGSS Performance Expectation	Estimated Lesson Time:
2.1 Part 1	Construct an explanation based on evidence that all organisms are primarily composed of carbon, hydrogen, oxygen, and nitrogen, and that the matter taken into an organism is broken down and recombined to make macromolecules necessary for life functions. Emphasize that molecules are often transformed through enzymatic processes and the atoms involved are used to make carbohydrates, proteins, fats/lipids, and nucleic acids. (LS1.C)	1 day (50-70min)

LESSON OVERVIEW

Learning Objective

Students will be able to explain how macromolecules in food provide energy and materials necessary for survival by analyzing food sources in different environments.

Anchor Phenomenon

Contestants on the TV show *Alone* often survive for weeks eating very little food, but when they finally eat a full meal, their bodies begin rebuilding strength and energy.

How does the body recover and rebuild using the food that is eaten?

Driving Question

How do the foods we eat provide the energy and molecules our bodies need to survive?

Lesson Level Performance Expectations

Students will be able to analyze how their bodies use the food they consume.



LESSON SNAPSHOT

LESSON SUMMARY:

Students investigate how the foods available in different environments provide macromolecules needed for survival. Using a survival scenario inspired by the TV show *Alone*, students research edible food sources in a specific biome, analyze the caloric and macromolecule content of those foods, and determine which foods and tools would best support survival. Students use this information to explain how the body converts food molecules into energy and materials needed for life functions.

	Estimated Time	Section Overview	How are students answering the driving question or meeting the learning objectives? (Highlight SEPs , DCIs , and CCCs)
Experience the Phenomenon	20 minutes	Students discuss how the food they eat gives their bodies energy. Students learn about macromolecules, including the energy output associated with each, and the elements in each macromolecule.	Students discuss hunger and energy. Watch the <i>Alone</i> clip
Investigate the Phenomenon	50 minutes	Modeled after the TV show <i>Alone</i> , students are assigned an area in which to survive. They research which plant and animal foods (including calorie content) are available in that location and decide which supplies and tools to take with them.	Students will learn about macromolecules Students will research food in the assigned biome, calculate caloric needs, and choose survival tools.
Model the Phenomenon	10-15 minutes	Students create a diagram to explain how the foods they selected provide macromolecules needed for survival.	Students will connect chosen foods to macromolecules.

DISCIPLINARY CORE IDEAS	SCIENCE & ENGINEERING PRACTICES	CROSSCUTTING CONCEPTS
<p>NGSS Appendix E Through cellular respiration, matter and energy flow through different organizational levels of an organism as elements are recombined to form different products and transfer energy</p>	<p>NGSS Appendix F Analyzing & Interpreting Data Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.</p>	<p>NGSS Appendix G Energy & Matter In grades 9-12, students learn that the total amount of energy and matter in closed systems is conserved. They can describe changes of energy and matter in a system in terms of energy and matter flows into, out of, and within that system. They also learn that energy cannot be created or destroyed. It only moves between one place and another place, between objects and/or fields, or between systems. Energy drives the cycling of matter within and between systems. In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved.</p>



Related knowledge and skills from prior grades		
Disciplinary Core Idea: NGSS Appendix E Within individual organisms, food is broken down through a series of chemical reactions that rearrange molecules and release energy.	Science and Engineering Practices NGSS Appendix F Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real world phenomena, examples, or events.	Crosscutting Concept: NGSS Appendix G In grades 6-8, students learn matter is conserved because atoms are conserved in physical and chemical processes. They also learn within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). The transfer of energy can be tracked as energy flows through a designed or natural system.

Materials

Link to all materials on the 3DRST website (3drst.byu.edu): <https://3drst.byu.edu/bio-2-1-macros>

Link to all materials on Canvas Commons: <https://tinyurl.com/3DRSTbiology>

Student Materials	Teacher Materials	Lab Materials/Other Resources
"Alone with Macros" Student Worksheet Survival Equipment List	Alone With Macros Teacher Slides	Video: Alone: First Meals

LESSON PREPARATION

Material Preparation:

Teachers should:

- Print student worksheets
- Prepare survival equipment list
- Pre-assign survival regions
- Check internet access for research
- Have slides ready for class

Vocabulary Definitions:

Macromolecules- Molecules that contain a high number of atoms, such as carbohydrates, lipids, proteins, and nucleic acids.

EXPERIENCE THE PHENOMENON/PROBLEM (ENGAGE)

What Students Are Doing	Teacher Tips
<p>*Students will follow along on the Student Worksheet*</p> <p>Students answer the first two questions before watching the video.</p> <p>While watching the short clip, have the students answer the questions:</p> <ul style="list-style-type: none"> • What do you notice about the contestants when they finally ate real food? • What do you wonder about how the body uses food during survival? <p>Students will complete worksheets defining the types of macromolecules, including examples.</p>	<p>While students are working on the worksheet, ensure you bring their focus back to Macros.</p>
What Teachers Are Doing	Teacher Tips
<ul style="list-style-type: none"> • Slide 2 – Start a conversation with students by asking if they have ever had to skip a meal. • Slide 3 – Students answer the questions on their worksheet. <ul style="list-style-type: none"> • How does our body convert the food we eat into energy? • How does the body survive when food is limited for long periods of time? • Slide 4 - Teachers show a video clip about the TV show ALONE. This clip shows the first meals of contestants who have finished the show, taken 20 to 60 days after the challenge began. <ul style="list-style-type: none"> • Explain: Contestants on the show sometimes survive for weeks with very little food. When they finally eat again, their bodies start rebuilding strength and energy. • Notice: What did you observe in the video? • Wonder: What questions do you have about how the body uses food? • Allow several students to share their “wonder” questions and record them on the board before introducing macromolecules. • Introduce driving question: How do the foods we eat provide the energy and molecules our bodies need to survive? • Teachers may also ask the following probing questions: <ul style="list-style-type: none"> • What elements are food mostly made of? • How does the body break food down into simpler molecules? • How are those molecules recombined into the macromolecules our cells need? 	<p>Be familiar with the TV show ALONE. This will help you better explain the video's background to students.</p>



- Why does eating after a long time without food affect the body differently than eating when you're already well-fed?
- How is energy from food stored and released at the molecular level?
- Teachers will then advance through **slides 5-9**, highlighting the Macro Nutrients and prompting students to define them. Also, remind them to provide 2 examples of each macronutrient.

INVESTIGATE THE PHENOMENON (EXPLORE)

What Students Are Doing	Teacher Tips
<ul style="list-style-type: none"> • Slide 10 - Students will begin the <i>Alone with Macros</i> survival investigation. • Slide 11 - Students are placed into groups (mountains, rainforest, desert, or tundra) and estimate the number of calories needed to maintain their body weight. • Slide 12 - Students research edible plant and animal food sources found in their assigned environment. Students complete a table identifying: <ul style="list-style-type: none"> ○ Food source ○ Plant or animal ○ Estimated calories ○ Primary macromolecule (carbohydrate, lipid, or protein) ○ How that food could help survival • Students then identify the best three survival foods based on macromolecule content and caloric value • Slide 13 - Students select 10 survival items from the provided list. Students justify three of their items by explaining how those tools help them obtain foods that provide important macromolecules. • Students complete survival scenario questions that require them to apply their understanding of macromolecules to survival situations. 	<p>Students enjoy justifying their items and choosing animals, but sometimes spend too much time searching for animals and items to take.</p> <ul style="list-style-type: none"> - Take the time to talk to the students about why they are taking those items, their justifications for edible items, and the usable tools are interesting.
What Teachers Are Doing	Teacher Tips
<ul style="list-style-type: none"> • Slide 10 - The student activity starts on slide 8. Introduce the concept of the activity, students will be “simulating” an experience similar to the TV show “Alone”. • Slide 11 - Split class into groups of 2-3 students and assign each group an area they will be “surviving” in (Siberian Tundra, Sonoran Desert, Canadian Mountains, Brazilian Rainforest). 	<p>You may use any method to create the groups. To create a little discomfort as they would feel in the wilderness, don't let them choose their own groups.</p>



<ul style="list-style-type: none"> • Slide 12 - Students will use internet resources to identify edible plant and animal food sources in their assigned environment. • Students should research 5-6 possible food sources in their biome and complete the food research table on their worksheet. • Encourage students to include both plant and animal foods when possible. • Teachers should remind students that they must identify: <ul style="list-style-type: none"> ○ The calories provided by the food ○ The main macromolecule it contains ○ How that macromolecule helps survival • Encourage students to include both plant and animal food sources when possible • Slide 13 - Students will now choose 10 survival items as they do on the show from the provided list. Be sure the items they choose come from the provided list. • While students are answering the questions, monitor the room and be available to help answer any questions. 	<p>*For added discomfort of survival following suit of “ALONE”, try numbering students off by themselves*</p> <p>Limit the research portion to about 15-20 minutes so students have enough time to complete the survival questions and final explanation.</p>
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MODEL THE PHENOMENON (EXPLAIN)

What Students Are Doing	Teacher Tips
<ul style="list-style-type: none"> • Students synthesize their research and survival planning to explain how the foods they selected provide macromolecules needed for survival. • Students use their survival food choices and worksheet responses to explain: <ul style="list-style-type: none"> ○ Which macromolecules does their food provide? ○ How those macromolecules supply energy ○ How those molecules support body functions such as muscle repair and long-term energy storage. 	
What Teachers Are Doing	Teacher Tips
<ul style="list-style-type: none"> • The teacher facilitates a short discussion where groups share their survival food strategies and explain how their food choices provide energy and essential molecules for survival. • Discussion prompts include: <ul style="list-style-type: none"> ○ Which foods provide the most long-term energy? ○ Which foods would be most important for repairing body tissues? 	



- How do these foods help your body survive over time?

Assessment

Student assessment is assessed through:

- Completion of the survival food research table
- Responses to survival scenario questions
- Justification of survival equipment based on food acquisition
- Explanation of how selected foods provide macromolecules and energy for survival

Teachers may also use classroom discussion responses as a formative assessment of student understanding.

This lesson was created by Jens Andreasen and Bryan Holder



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