Animals Unit – Packet 3

Name: _____ Hour_____Date: _____

Date Packet is due: *after Part 5* Why late? _____
If your work was late, describe why

Score
- □ Above & Beyond
- □ Fully Complete
- □ Mostly Complete
- □ Incomplete – *fix the following pages:*

Driving Question: What happens inside animal cells?

Anchoring Phenomenon: So far we have investigated what happens when athletes, cattle, and worms consume food. We will be concluding our investigations by specifically tracing the matter and energy in food as it is digested. How is matter and energy in food molecules changed through both cellular respiration and biosynthesis?

Deeper Questions

1. How and where does cellular respiration occur?
2. How and where does biosynthesis occur?
3. How do animals acquire more cells and gain mass?

Schedule

Part 1: Introduction
- Initial Ideas – What happens inside animal cells?
- Data Dive – Thirsty Moths
- Discussion & Developing Explanations

Part 2: Core Ideas
- Core Ideas
- Revisions of Part 1 Explanations

Part 3: Investigation
- A: Molecular Modeling - Cell Respiration
- B: Molecular Modeling - Biosynthesis

Part 4: Review & Assessment
- Ranking Your Readiness
- Assessments (Formative Assessment & Mastery Check)

Part 5: Life Connections
- Life Connections - Dissections

NGSS Standards:
HS-LS1-2. How bodily systems interact to provide specific functions in multicellular organisms.
HS-LS1-6. How carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.
HS-LS1-7. In cellular respiration, bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.

Semester Schedule

Matter & Energy
Week 1: What happens when something burns?
Week 2: What happens to molecules during burning?
Week 3: Unit Assessment

Animals
Week 1: What are animal cells made from?
Week 2: What happens to food when it is consumed?
Week 3: What happens inside animal cells?
Week 4: Unit Assessment

Plants
Week 1: How do plant cells differ from animal cells?
Week 2: How do plants get their food and gain mass?
Week 3: How do plants get other needed molecules?
Week 4: Unit Assessment

Ecosystems
Week 1: Why do some places have more species than others?
Week 2: How does human activity affect living species?
Week 3: Unit Assessment

Part 1: Introduction – Thirsty Moths

Overview: In this activity, you will begin by discussing your initial ideas about what happens when we consume food. You will then analyze data and work in teams to develop your initial explanations.

Initial Ideas: Three students are trying to figure out what exactly happens to food molecules absorbed by cells from the blood. **Do you agree or disagree with each student's claim**?

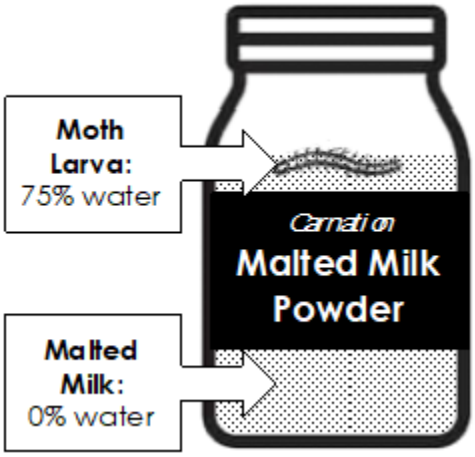
A. Avery thinks that the cellular structures assemble new macromolecules from food molecules.
B. Bristol thinks that organelles within cells convert atoms into energy.
C. Chandra thinks that structures inside the cells move chemical energy from food to the cell.

Work in your small groups to discuss your ideas. How are your ideas similar or different? Decide as a group whether each statement is correct (and why). Be prepared to present your ideas to the class.

Data Dive: Read the excerpt below. Then look at the data provided below. Use this information to answer the following questions.

In the early 1900s, a University of Wisconsin scientist named Stephen Babcock decided to have a malted milk shake. Malted milk is a dry powder consisting mostly of carbohydrates such as milk powder, barley, and wheat. It is sometimes added to milk shakes to create a richer flavor.

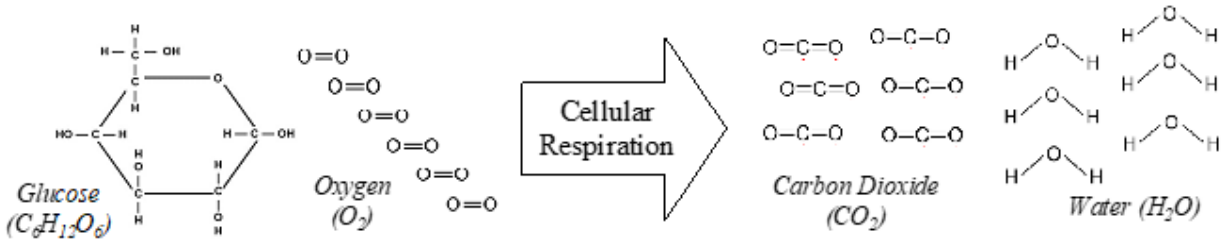
When Babcock opened the jar of malted milk, he was surprised to find a moth larva. This was puzzling, because a moth larva's body is 75% water, and the sealed jar of malted milk has no moisture at all. How could an organism with a body that is mostly water survive in an environment that was completely lacking water?



1. **As a group, develop an initial hypothesis to explain how this moth larva was able to survive in this environment. How do you think the larva acquired the water in its body?** Note: If you're unsure, that's ok! Just provide your best ideas. You can always change your ideas as you gain more evidence.

2. **Provide a rationale for your ideas.** How do you know that these ideas make sense? What evidence or logic supports your ideas?

3. The image below shows how atoms in glucose and oxygen change during cellular respiration. **How does this information relate to how the moth larva could survive inside the jar of malted milk**?



Discuss the following questions as a group and prepare to present your ideas.

4. A nutrition label for malted milk is shown here. **Summarize how the moth larva's cells will use the a) fat, b) carb's, and c) protein.**

Nutrition Facts

Serving Size: 2 Tbsp. (23g)
Servings Per Container: Approx. 20

Amount Per Serving	
Calories 90	
Calories from fat 10	
	% Daily Value*
Total Fat 1.0g	**2%**
Saturated fat 0.5g	**3%**
Trans fat 0g	
Cholesterol <5mg	**0%**
Sodium 65mg	**3%**
Total Carbohydrate 19g	**6%**
Dietary Fiber 0g	**0%**
Sugars 15g	
Protein 2g	
Vitamin A 0%	**Vitamin C 0%**
Calcium 4%	**Iron 0%**

* Percent Daily Values based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calories needed:

5. **How would fat, carbohydrates, and protein change as they go through the digestive tract of the moth?**

6. **How do molecules contained in fat, carbohydrates, and protein travel from the digestive tract to the cells?**

7. As the moth larva grew larger, it gained more mass and more cells. **How did the moth larva acquire more cells? Develop a hypothesis.**

8. If the moth consumed 100 g of malted milk, **how many grams of these atoms do you think will stay inside its body**?

<u>Discussion & Developing Ideas</u>

9. As a class, discuss your ideas about this data. What are ideas that most agreed on? Where did your ideas differ as a class?

We all agree that…

We disagreed or are unsure about…

10. **How are food molecules (carb's, fat & protein) changed once they are absorbed by cells?** *It's ok if you aren't completely sure! You will repeatedly revise this explanation as you gain more information.*

Part 2: Core Ideas

Overview: In this activity, you will begin with a short slideshow presentation. This will provide you with core ideas that will help you clarify your initial ideas. Your instructor will decide on how to implement this portion depending on your previous experience and capabilities with this content.

You will then work in small teams to answer the questions listed below. You should take notes in a notebook, on a dry erase board, or on scratch paper so that you are prepared to deliver your responses during the class discussion that will follow. *Note: your instructor may assign specific questions to your group if time is limited.*

Core Ideas Presentation: https://bit.ly/WUHS-Bio-AnimalsW3

Driving Questions:

1. Which macromolecules are primarily used for cellular respiration? Which are primarily used for biosynthesis?
2. Where does cellular respiration occur? What happens during cellular respiration?
3. What molecule(s) besides glucose is frequently used for cellular respiration?
4. What happens to the atoms in glucose and fatty acids after cellular respiration?
5. When you see your breath on a cold day, where are these atoms in the water vapor coming from?
6. Where does protein biosynthesis occur? What happens during protein biosynthesis?
7. Where does fat biosynthesis occur? What happens during fat biosynthesis?
8. True or false: all fat molecules are formed from fatty acids consumed in the diet. Explain.
9. If an animal consumes more chemical energy in food than is needed by their cells, what happens to some of the matter and energy in this food?
10. As cells assemble more proteins and fat from food molecules, what happens to the size of the cell?
11. What is mitosis? Why is mitosis important for the bodies of animals?
12. A baby calf will grow from 100 lbs. to over 1000 lbs. in less than two years. As it does so, it increases in mass and gains more and more cells. Where do these additional atoms and additional cells come from?
13. **Revising Explanations**: Return to your original explanation that you created at the end of Part 1. Based on this new information, how would you now respond to this question?

How are food molecules (carb's, fat & protein) changed once they are absorbed by cells? *Include and underline the following terms in your response: cellular respiration, biosynthesis.*

Throughout this packet, you will be updating this explanation as you gain more information and more experience. When you complete this packet, compare your early versions to your final version. You should see distinct improvement with each revision.

Part 3A: Molecular Modeling (Cell Respiration)

Overview: In this investigation, you will use modeling clay to create physical models to explain how matter and energy change to food molecules during cellular respiration.

Materials Needed (per group): modeling clay (such as Playdoh), toothpicks, tape or twist ties, paper towel.

Pre-Investigation Questions: Work as a group to determine the best response to each question. Be prepared to provide verbal responses for these questions for your instructor before you complete the investigation.

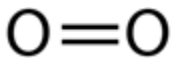
1. *Where does cellular respiration occur? What happens during cellular respiration?*
2. *Where does protein biosynthesis occur? What happens during protein biosynthesis?*
3. *Where does fat biosynthesis occur? What happens during fat biosynthesis?*
4. *What is mitosis? Why is it important for animal bodies?*

When you think you are ready, **raise your hand**. Your instructor will listen to your verbal responses.

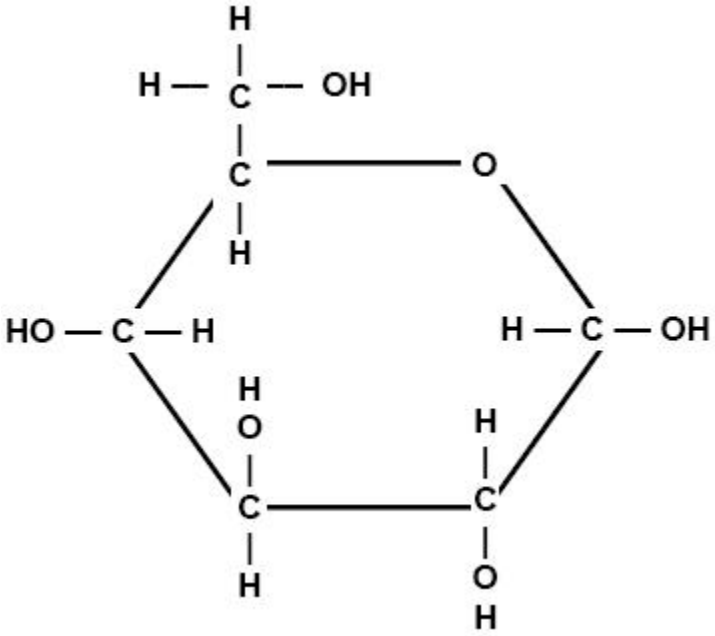
This activity was completed _____ (*instructor signature*)

Methods: In this investigation, you will create molecular molecules to explore what happens to matter and energy during cellular respiration. Scientific models are tools that help us clarify our thinking and make more accurate predictions. Use the following instructions to create each of your molecules.

5. ☐ **Using the modeling clay provided, create six molecules of oxygen gas (O_2).**
   a. You will need 12 balls of one color to represent oxygen atoms.
   b. Using this image as a guide, connect two oxygen atoms using two toothpicks.
   c. Repeat these instructions until you have six molecules of oxygen (O_2).



6. ☐ **Using the modeling clay provided, create one molecule of glucose ($C_6H_{12}O_6$).**
   a. Using the same color as you used previously for oxygen, create six balls of that color for the oxygen atoms.
   b. Using a different color, create six balls of that color for the carbon atoms.
   c. Using a third color, create 12 balls of that color for the hydrogen atoms.
   d. Connect these atoms using the image as a guide (1 toothpick between each atom).
   e. Mark any high energy bonds (C-C and C-H) with a twist tie or other physical marker that your instructor has provided.

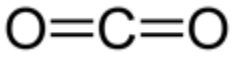


7. ☐ **When you think you are finished, raise your hand and show your instructor.**

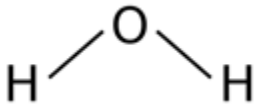
This activity was completed _____(*instructor signature*)

8. ☐ **Disassemble your O_2 and glucose molecules. Using the same clay atoms you used to create the oxygen gas and glucose molecules, create CO_2 and H_2O using the following instructions.**

9. ☐ **Create six molecules of carbon dioxide (CO_2).**
   a. Using the image at the right as a guide, connect a carbon atom to two oxygen atoms using four toothpicks (two toothpicks for each oxygen atom).
   b. Repeat to create six CO_2 molecules.



10. ☐ **Create six molecules of water vapor (H_2O).**
    a. Using the image at the right as a guide, connect an oxygen atom to two hydrogen atoms using two toothpicks.
    b. Repeat to create six H_2O molecules.



11. ☐ **Mark any high energy bonds (C-C and C-H) with a twist tie or other physical marker that your instructor has provided.** Make a separate pile for any unused high energy bonds.

12. ☐ **When you think you are finished, raise your hand and show your instructor. Be prepared to explain how each of these molecules relates to what happens during cellular respiration.** While you are waiting for their approval and after they give their approval, complete the post-investigation questions on the next page. Disassemble your molecules only *after* you get approval.

This activity was completed _____(*instructor signature*)

Post-Investigation Questions:

1. How do the atoms in glucose and oxygen that an animal consumes/breathes relate to the atoms in the carbon dioxide and water vapor that an animal exhales?

_____

_____

2. **Are there any high-energy bonds (C-C or C-H) in glucose ($C_6H_{12}O_6$) and/or oxygen (O_2)?_____**
3. **Are there any high-energy bonds (C-C or C-H) in carbon dioxide (CO_2) or water (H_2O)?_____**

   How do you think that this relates to how animals get energy from the food that they consume? (*Note: your thinking may still be developing. That's ok – provide the best answer you can).*

_____

_____

4. **What do you think happens to the atoms and energy in glucose molecules when consumed?**

   Atoms: _____

_____

   Energy: _____

_____

Part 3B: Molecular Modeling (Biosynthesis)

Overview: In this investigation, you will use modeling clay to create physical models to explain how matter and energy change to food molecules during biosynthesis.

Materials Needed (per group): modeling clay (such as Playdoh), toothpicks, tape or twist ties, paper towel.

Methods: In this investigation, you will create molecular molecules to explore what happens to matter and energy during biosynthesis. Scientific models are tools that help us clarify our thinking and make more accurate predictions. Use the following instructions to create each of your molecules.

In this example, you will develop your own protocol to use modeling clay to convey your understanding of biosynthesis. You will first need to work with your team to ensure you fully understand what occurs during biosynthesis. You will then need to decide how to convey this understanding using your modeling clay.

Planning:

1. **What is biosynthesis?** Briefly summarize this concept in the space below:

   _____

   _____

2. **How could you use your modeling clay to demonstrate your understanding of this idea?** Briefly outline your plan below.

   _____

   _____

3. **When you think you are ready to demonstrate your understanding, raise your hand and show your instructor. Be prepared to show your understanding of biosynthesis using your modeling clay.** While you are waiting for their approval and after they give their approval, complete the remaining questions. Disassemble your molecules only *after* you get approval.

   This activity was completed _____(*instructor signature*)

Revising Explanations: Return to your original explanation from Parts 1 & 2. Based on this new information, how would you now respond to this question?

1. **How are food molecules (carb's, fat & protein) changed once they are absorbed by cells?** *Include and underline the following terms in your response: cellular respiration, biosynthesis.*

   _____

   _____

   _____

Part 4: Review & Assessment

Overview: Rank each Driving Question in Part 2 as a 1 (*completely unsure*), 2 (*somewhat unsure*), or 3 (*completely sure*) based on your comprehension. Then work in teams to review each item and prepare a response. Next, write a final explanation below. You will conclude by completing a formative assessment.

How are food molecules (carb's, fat & protein) changed once they are absorbed by cells? *Include and underline the following terms in your response: cellular respiration, biosynthesis.*

_____

_____

_____

Go back and compare your early versions of your explanation to your final version above. You should see distinct improvement compared to your first attempts.

Part 5: Life Connections – Dissections

Overview: In this activity, you will use a dissection (live or use a simulation for a pig or grasshopper) to demonstrate your comprehension of how animal cells enable bodies to function. Your instructor will provide you with needed materials and specific instructions for how to complete this activity. As a team, you should be prepared to use your dissection to address the following questions:

1. **Use your specimen to explain the relationship between the following:** *atoms, molecules, macromolecules, organelles, cells, tissues, organs, systems, and organisms.*
2. This organism initially began as one cell. Now it has many more cells. **Where did the additional cells come from? How did the organism's cells acquire more matter (atoms)?**
3. **How did this organism's cells acquire the chemical energy needed to function?**
4. **What kind of food did this organism consume?** (*Use an internet search engine if needed*). **How did the molecules in the food change as it passed through its digestive tract?**
5. **How did this organism move food molecules from the digestive tract to its cells?**
6. **How did food molecules (fat, protein, & carbs) change once absorbed by the organism's cells?**
7. **Did most of the atoms found in the food molecules remain within the organism?** Explain.
8. This organism is no longer alive. **What do you think will happen to the matter & energy in its cells?**

Animals Unit, Packet 3 Formative Assessment

Name: _____Hour____Date:_____Score:_____

Directions: A 3x5 notecard with *handwritten* notes can be used to guide your answers. Your instructor may allow you to work in assigned groups. If so, have a different person write each response while others assist.

1. Three students are trying to figure out what exactly happens to food molecules absorbed by cells from the blood. **Do you agree or disagree with each student's claim**?

A. Avery: cellular structures assemble new macromolecules from food molecules. AGREE/DISAGREE
B. Bristol: organelles within cells convert atoms into energy. AGREE/DISAGREE
C. Chandra: structures inside the cells move chemical energy from food to the cell. AGREE/DISAGREE

2. Provide an explanation. Why did you agree or disagree with each student's claim?

a) _____

b) _____

c) _____

Writer:

3. Where do the processes of cell respiration and biosynthesis take place? Include and underline the following: *mitochondria, ribosomes, cytoplasm.*

_____

_____

_____

Writer:

4. What happens if more carbohydrates are consumed than are needed to recharge ATP? **What happens to excess carbohydrates in the diet? Include and underline the following:** *enzymes, glucose, fatty acids.*

_____

_____

_____

Writer:

5. How are food molecules (carb's, fat & protein) changed once they are absorbed by cells? ? Include and underline the following: *cellular respiration, ATP, biosynthesis.*

_____

_____

_____

Writer: