

Lesson 6: Explaining Other Examples of Animals Growing, Moving and Functioning

Overview

Students practice explaining digestion, biosynthesis, and cellular respiration in other animals and then take the unit posttest.

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Guiding Question

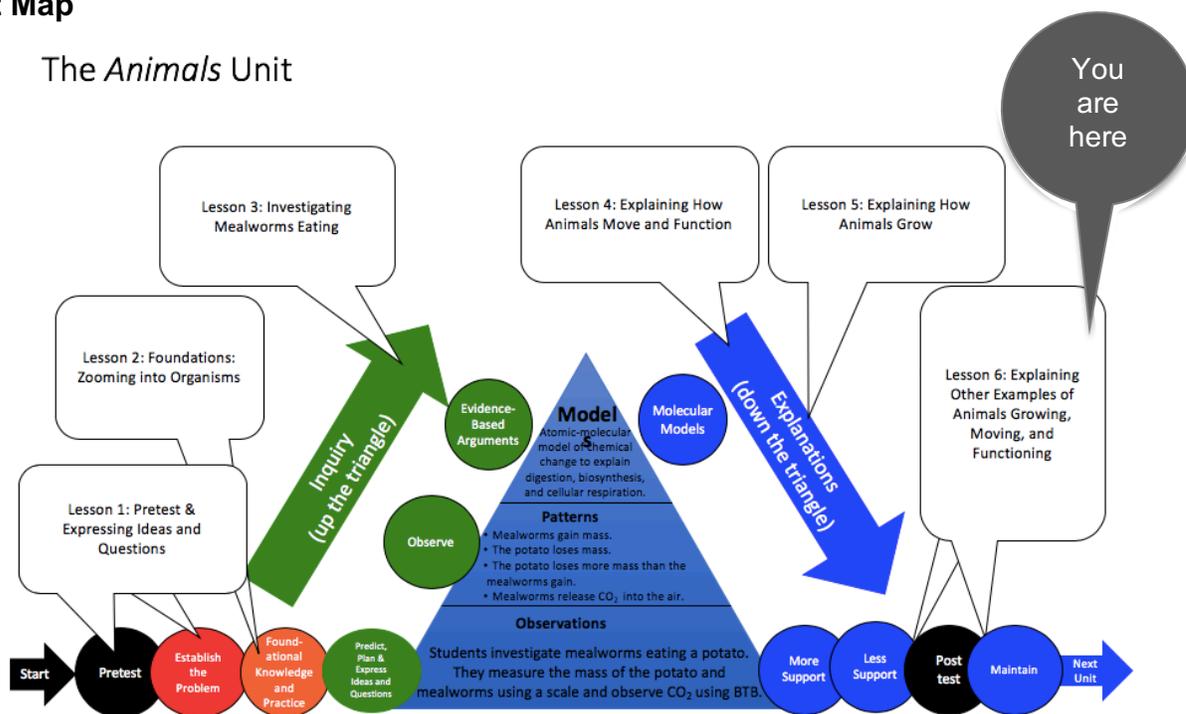
How do other animals grow, move, and function?

Activities in this Lesson

- Activity 6.1: Explaining Other Examples of Animals Growing, Moving, and Functioning (50 min)
- Activity 6.2: Comparing Animals and Flames (50 min)
- Activity 6.3: Functions of All Animals (50 min)
- Activity 6.4: Animals Unit Posttest (20 min)

Unit Map

The *Animals* Unit



Learning Goals

Target Performances

Lesson 6 – Explaining Other Examples of Animals Growing, Moving, and Functioning (students as explainers)	
Activity 6.1: Explaining Other Examples of Animals Growing, Moving, and Functioning	Students develop integrated accounts of how other animals (salmon, mealworms, dolphins) grow, move

	and function through the processes of digestion, cellular respiration, and biosynthesis.
Activity 6.2 Comparing Animals and Flames	Students compare how matter moves and changes and how energy changes in ethanol burning vs. a child growing, moving and functioning (connecting macroscopic observations with atomic-molecular models and using the principles of conservation of matter and energy).
Activity 6.3: Functions of All Animals	Students develop integrated accounts of how all animals grow, move and function through the processes of digestion, cellular respiration, and biosynthesis.
Activity 6.4: Animals Unit Posttest	Students show their end-of unit proficiencies for the overall unit goal: Questioning, investigating, and explaining how animals move and change matter and energy as they live, move, and grow.

NGSS Performance Expectations

Middle School

- MS. Matter and its Interactions. MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.

High School

- HS. From Molecules to Organisms: Structures and Processes. HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
- HS. From Molecules to Organisms: Structures and Processes. HS-LS1-6. Construct and revise an explanation based on evidence for 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. From Molecules to Organisms: Structures and Processes. HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.

Background Information

Three-dimensional Learning Progression

In this final lesson of the unit, students have completed the inquiry and application sequences for animal growth and movement. The activities in the previous lessons were designed to walk students through a cognitive apprenticeship model of Establishing the Problem, Modeling, Coaching, and Fading. The results of the unit posttest will help you determine if your students are ready to move on to the final stage: Fading. After the Fading stage, students will be expected to carry forward concepts from this unit into future units. If the results from your posttest imply that a majority of your students are still struggling with certain concepts, it might be valuable to return to some of the main concepts they are struggling with before moving on to the next *Carbon TIME* unit.

Key Ideas and Practices for Each Activity

Activity 6.1 is the first part of the Fading phase of the Application Activity Sequence, which provides students with important less-scaffolded practice with digestion, biosynthesis, and cellular respiration. Students should take more responsibility for their work than in lessons 4 and 5, which included the Modeling and Coaching phases. Students answer the Three Questions for different animals growing and moving using the Explanations Tools, coordinating accounts at the macroscopic and atomic-molecular scales. Macroscopic scale accounts include these components:

- the structure of the system (the animal in this case) and the movement of materials through the system;
- the location where chemical change takes place;
- the materials involved in the chemical change: the reactants going in and the products coming out.

Atomic-molecular scale accounts include three different ways of representing chemical change:

- molecular models, with twist ties to represent units of energy, that students use to physically rearrange the atoms of the reactants into the atoms of the products;
- a chemical equation that shows how atoms are rearranged into new molecules in a compact way (but does not account for energy);
- the Explanations Tool, which provides a way for students to account for changes in matter and energy in writing but answering the Three Questions.

Activity 6.2 is the second part of the Fading phase of the Application Activity Sequence. In this activity, compare animals to flames. In 6.3, students write generalized explanations, which focus on the cellular scale, of how all animals grow, move, and function

Activity 6.4 includes summative assessment for the unit. You can track students' progress by having them take the unit posttest (identical to the unit pretest) and comparing the results of the two assessments.

Content Boundaries and Extensions

Talk and Writing

This lesson of the unit represents the fading portion of the **Explanations Phase**. This means that students are expected to develop explanations for carbon-transforming processes they studied in this unit in *new* and *novel* contexts. The table below shows specific talk and writing goals for the Explanations phase of the unit.

Talk and Writing Goals for the Explanations Phase	Teacher Talk Strategies That Support This Goal	Curriculum Components That Support This Goal
Examine student ideas and correct them when there are problems. It's ok to give the answers away during this phase! Help students practice using precise language to describe matter and energy .	<i>Let's think about what you just said: air molecules. What are air molecules? Are you talking about matter or energy? Remember: atoms can't be created. So that matter must have come from somewhere. Where did it come from? Let's look at the molecule poster again... is carbon an atom or a molecule?</i>	Molecule Poster Three Questions Poster
Focus on making sure that explanations include multiple scales .	<i>The investigation gave us evidence for what was happening to matter and energy at a macroscopic scale. But what is happening at an atomic-molecular scale?</i>	Molecular Models Molecular Modeling Worksheets Explanations Tool

	<p><i>What is happening to molecules and atoms? How does energy interact with atoms and molecules during chemical change? Why doesn't the macroscopic investigation tell us the whole story? Let's revisit our scale poster... what is happening to matter at the molecular scale?</i></p>	<p>PPT Animation of chemical change Powers of Ten Poster</p>
<p>Encourage students to recall the investigation.</p>	<p><i>When did this chemical change happen during our investigation? How do we know that? What is our evidence? What were the macroscopic indicators that this chemical change took place?</i></p>	<p>Evidence-Based Arguments Tool Investigation Video</p>
<p>Elicit a range of student explanations. Press for details. Encourage students to examine, compare, and contrast their explanations with others'.</p>	<p><i>Who can add to that explanation? What do you mean by _____? Say more. So, I think you said _____. Is that right? Who has a different explanation? How are those explanations similar/different? Who can rephrase _____'s explanation?</i></p>	<p>Explanations Tool</p>

Activity 6.1: Explaining Other Examples of Animals Growing, Moving and Functioning (50 min)

Overview and Preparation

Target Student Performance

Students develop integrated accounts of how other animals (salmon, mealworms, dolphins) grow, move and function through the processes of digestion, cellular respiration, and biosynthesis.

Resources You Provide

- (From previous lesson) [1.2 Expressing Ideas and Questions Tool for Animals Growing](#)
- (From previous lesson) [3.2 Mealworms Eating Class Results 11 x 17 Poster](#) (or [Spreadsheet](#))
- (From previous lesson) [3.3 Evidence-Based Arguments Tool for Mealworms Eating](#)

Resources Provided

- [6.1 Explaining Other Examples of Animals Growing and Moving PPT](#)
- [6.1 Other Animals Reading: Dolphins](#)
- [6.1 Other Animals Reading: Mealworms](#)
- [6.1 Other Animals Reading: Salmon](#)
- [6.1 Dolphins Worksheet](#)
- [6.1 Mealworms Worksheet](#)
- [6.1 Salmon Worksheet](#)
- [6.1 Grading Dolphins Worksheet](#)
- [6.1 Grading Mealworms Worksheet](#)
- [6.1 Grading Salmon Worksheet](#)

Recurring Resources

- [Three Questions 11 x 17 Poster](#) (1 per class)
- [Three Questions Handout](#) (1 per student)

Setup

Prepare several copies of each version of [6.1 Other Animals Reading](#) and [6.1 Dolphins/Mealworms/Salmon Worksheet](#), so that there is one reading and the accompanying worksheet for each student. Gather the class results poster and spreadsheet from Activity 3.2, as well as their completed copies of [1.2 Expressing Ideas and Questions Tool for Animals Growing](#) and [3.3 Evidence-Based Arguments Tool for Mealworms Eating](#). Prepare a computer and a projector to display the PPT.

Directions

1. Use the instructional model to show students where they are in the course of the unit.

Display slide 2 of the [6.1 Explaining Other Examples of Animals Moving and Growing PPT](#).

2. Review the ways in which animals use food.

Use Slides 3-6 of the PPT to review what students have learned about how animals use food.

- Slide 3 reminds students that the unit is about all kinds of animals.
- Slide 4 reminds students of structures that all animals have in common at different scales: cells that are made of molecules that are made of atoms.
- Slide 5 reminds students that all animals eat food made mostly of water and large organic molecules, and that some large organic molecules leave the animals as feces.
- Slide 6 reminds students that after food is digested the molecules can either be used for growth through biosynthesis or energy through cellular respiration.
- Tell students that their explanations today will be to tell this whole story.

3. Have students complete the reading and corresponding explanation worksheet for one other animals.

Display slide 7 of the [6.1 Explaining Other Examples of Animals Moving and Growing PPT](#).

- Give each student a copy of one of the [6.1 Other Animals Readings](#). About 1/3 of the students should read about each animal.
- Have students complete the [6.1 Dolphins/Mealworms/Salmon Worksheet](#) for the animal they read about.

Modifications: Students can work in pairs or groups with those who have the animal.

4. Have students who focused on the same animal form a group.

Display slide 8 of the [6.1 Explaining Other Examples of Animals Moving and Growing PPT](#).

In their groups, have students discuss their answers and come to consensus about their explanations and answers to the questions.

5. Have students share about how their animals grows, moves, and functions.

Display slide 9 of the [6.1 Explaining Other Examples of Animals Moving and Growing PPT](#).

- Decide how to have students share the explanation for their animal.
 - Students who focused on the same animal can present to the whole class. They could make a poster to share.
 - Students can form groups of three with students who focused on each of three materials.

6. Have students discuss the similarities and differences between the organic materials.

Display slide 10 of the [6.1 Explaining Other Examples of Animals Moving and Growing PPT](#).

- Have a class discussion about the similarities and differences between the three animals. Students should recognize that the chemical changes are similar in each case and that the rules about atoms and energy always apply.

7. Have students revisit their initial ideas from Lesson 1.

Display slide 11. Have students look back at their initial ideas on [1.2 Expressing Ideas and Questions Tool about Animals Growing](#).

- Ask them to share some of their initial ideas, their thinking about how their ideas have changed, and what their initial questions were.
- Ask them how they would now answer their initial questions.

8. Have students revisit their data and unanswered questions from the Mealworms Eating Investigation from Lesson 3.

Display slide 12. Have students review their data from [3.2 Mealworms Eating Class Results 11 x 17 Poster](#) (or [Spreadsheet](#)).

- Have students review their evidence-based arguments and unanswered questions from their [3.3 Evidence-Based Arguments Tool for Mealworms Eating](#).
- Have them consider how they would now answer their unanswered questions.

9. Have students complete an exit ticket.

Show slide 13 of the [6.1 Explaining Other Examples of Animals Moving and Growing PPT](#).

- Conclusions: What is the same about how all animals move, grow, and function?
- Predictions and Planning: How is how the animal you studied moves, grows, and functions different from other animals?
- On a sheet of paper or a sticky note, have students individually answer the exit ticket questions. Depending on time, you may have students answer both questions, assign students to answer a particular question, or let students choose one question to answer. Collect and review the answers.
- The conclusions question will provide you with information about what your students are taking away from the activity. Student answers to the conclusions question can be used on the [Driving Question Board](#) (if you are using one). The Predictions and Planning question allows students to begin thinking about the next activity and allows you to assess their current ideas as you prepare for the next activity. Student answers to the Predictions and Planning question can be used as a lead in to the next activity.

Assessment

Use [6.1 Grading Dolphins/Mealworms/Salmon Worksheet](#) to grade the explanation tools. Although the animals are different, the answers should be similar across all the animals.

Tips

Emphasize the similarities among the explanations of all animals. There are different animals, but many of the chemical changes at the atomic-molecular scale are the same. The same rules apply to all examples of animals.

Differentiation & Extending the Learning

Differentiation

- Hand out Other Animals readings strategically to form strong groups
- Give readings to all groups so that students can read along as groups present their results
- Students should highlight important information individually
- Have groups present their findings orally to the whole class, rather than using the Jigsaw model
- Use Other Animals worksheets as a review for the test. All students complete all three before the test.

Modifications

Extending the Learning

Have students read the articles and/or watch the videos listed in the Digging Deeper section of the [6.1 Other Animals Readings](#).

Activity 6.2: Comparing Animals and Flames (50 min)

Overview and Preparation

Target Student Performance

Students compare how matter moves and changes and how energy changes in ethanol burning vs. a child growing, moving and functioning (connecting macroscopic observations with atomic-molecular models and using the principles of conservation of matter and energy).

Resources Provided

- [6.2 Comparing Animals and Flames PPT](#)
- [6.2 Comparing Animals and Flames Worksheet](#) (1 per student)
- [6.2 Grading the Comparing Animals and Flames Worksheet](#)

Recurring Resources

- (Optional) [Big Idea Probe: What Happens to the Fat?](#) (1 per student)
- (Optional) [Assessing the Big Idea Probe: What Happens to the Fat?](#)

Setup

Prepare one copy of [6.2 Comparing Animals and Flames Worksheet](#) for each student. Prepare a computer and a projector to display the PPT.

Directions

- 1. Use the instructional model to show students where they are in the course of the unit.**

Display slide 2 of the [6.2 Comparing Animals and Flames PPT](#).

- 2. Have students try explaining new examples.**

Display slides 3-5. Have students work to explain the scenarios on the slides about animal growth, movement, and function.

- Have students discuss the scenarios with a partner and then discuss each as a class.
- At this point in the unit, you will want to point out places where their explanations do not align with scientific explanations.

- 3. Have students compare flames and animals.**

Display slide 6 of the [6.2 Comparing Animals and Flames PPT](#). Tell students they will be comparing what they learned about in Systems and Scale with what they have learned about animals.

- Pass out the [6.2 Comparing Animals and Flames Worksheet](#) to each student.
- Have students complete the comparison individually or in pairs.
- Students may need to look back at their Process Tools from Systems and Scale.

Display slide 7 of the PPT and remind students that good answers to questions about both animal and flames should address each of the four numbered questions of the [Three Questions Poster](#) (or [Handout](#)).

- 4. Allow students to share their explanations with the class.**

Display slide 8 of the [6.2 Comparing Animals and Flames PPT](#).

- Go through the worksheet with the class and have students share their ideas. At this point in the unit, students should have scientifically explanations. Check that they are following the rules about matter and energy.

5. Lead a discussion about how student ideas have changed over time.

Display slide 9 of the PPT. Have students consider how their ideas changed with regard to scale, movement, and carbon. What do they know about how animals grow and move now that they didn't know before this unit?

6. (Optional) Have students complete the Big Idea Probe: What Happens to the Fat? for the final time.

If you decided to use the [Big Idea Probe: What Happens to the Fat?](#) have students complete it and share their ideas again. Have students discuss how their ideas have changed throughout the unit. See [Assessing the Big Idea Probe: What Happens to the Fat?](#) for suggestions about how to use the Big Idea Probe.

Assessment

Use the [6.2 Grading the Comparing Animals and Flames Worksheet](#) to grade students' work.

Differentiation & Extending the Learning

Differentiation

Modifications

Extending the Learning

Activity 6.3: Functions of All Animals (50 min)

Overview and Preparation

Target Student Performance

Students develop integrated accounts of how all animals grow, move and function through the processes of digestion, cellular respiration, and biosynthesis.

Resources Provided

- [6.3 Functions of All Animals PPT](#)
- [6.3 Functions of All Animals Worksheet](#) (1 per student for option 1 in step 3)
- [6.3 Grading the Functions of All Animals Worksheet](#)

Recurring Resources

- [Learning Tracking Tool for Animals](#)
- [Assessing the Learning Tracking Tool for Animals](#)
- (Optional) [Big Idea Probe: What Happens to the Fat?](#) (1 per student)
- (Optional) [Assessing the Big Idea Probe: What Happens to the Fat?](#)

Setup

Decide how students will construct their explanations (see options in step 3 of the directions). If students will use the worksheet, prepare one copy of [6.3 Functions of All Animals Worksheet](#) for each student. If students will create a PowerPoint, check that computers or tablets are working and ready. If students will make a poster, get one poster for each pair of students or small group. Decide how you will have students present their explanations (see step 4 of the directions). Prepare a computer and a projector to display the PPT.

Directions

- 1. Use the instructional model to show students where they are in the course of the unit.**

Display slide 2 of the [6.3 Functions of All Animals PPT](#).

- 2. Have students try explaining new examples.**

Display slides 3-5. Have students work to explain the scenarios on the slides about animal growth, movement, and function.

- Have students discuss the scenarios with a partner and then discuss each as a class.
- At this point in the unit, you will want to point out places where their explanations do not align with scientific explanations.

- 3. Have students explain the primary functions that animals have in common.**

Display slide 6 of the [6.3 Functions of All Animals PPT](#). Tell students they will be constructing explanations that answer three questions about the functions of animals that are shared by all animals.

Option 1: Have students construct their explanations on [6.3 Functions of All Animals Worksheet](#) in pairs. Students' explanations can include words, illustrations, diagrams, and/or charts. Students may need additional sheets to answer each of the questions.

Option 2: Have students construct their explanations in a PowerPoint presentation in pairs for each of the questions.

Option 3: Have students construct their explanations on a poster in pairs or small groups.

For all options, display slide 7 of the PPT and remind students that good answers to questions about animal cells should address each of the four numbered questions of the [Three Questions Poster](#) (or [Handout](#)).

4. Allow students to share their explanations with the class.

Display slide 8 of the [6.3 Functions of All Animals PPT](#). Provide students an opportunity to share their explanations with the class.

- Decide how you will have students present depending on the option you chose in step 6 and the needs of your students and classroom.
 - If students did option 1, they could verbally share their explanations or share them with the class using a document camera.
 - If student did option 2, they could present their PPT to the class.
 - If students did option 3, they could share their posters with the whole class or you could organize a gallery walk in which students circulate the classroom and view the posters.
- Have students share feedback on their classmates' explanations as to if the explanations addressed each of the Three Questions.

5. Lead a discussion about how student ideas have changed over time.

Display slide 9 of the PPT. Have students consider how their ideas changed with regard to scale, movement, and carbon. What do they know about how animals grow and move now that they didn't know before this unit?

6. (Optional) Have students complete the Big Idea Probe: What Happens to the Fat? for the final time.

If you decided to use the [Big Idea Probe: What Happens to the Fat?](#) have students complete it and share their ideas again. Have students discuss how their ideas have changed throughout the unit. See [Assessing the Big Idea Probe: What Happens to the Fat?](#) for suggestions about how to use the Big Idea Probe.

7. Have a discussion to complete the Learning Tracking Tool for this activity.

Show slide 10 of the [6.3 Functions of All Animals PPT](#).

- Pass out a [Learning Tracking Tool](#) to each student.
- Explain that students will add to the tool after activities to keep track of what they have figured out that will help them to answer the unit driving question.
- Have students write the activity name in the first column, "6.3 Functions of All Animals" and their role, Explainer.
- Have a class discussion about what students did during the activity. When you come to consensus as a class, have students record the answer in the second column of the tool.
- Have a class discussion about what students figured out during the activity that will help them in answering the unit driving question. When you come to consensus as a class, have students record the answer in the third column of the tool.
- Have a class discussion about what students are wondering now that will help them move towards answering the unit driving question. Have students record the questions in the fourth column of the tool.
- Have students keep their Learning Tracking Tool for future activities.

- Example Learning Tracking Tool

Activity Chunk	What Did We Do?	What Did We Figure Out?	What Are We Asking Now?
Explaining Other Examples Explainer	Practice explaining digestion, biosynthesis, and cellular respiration in other animals, and take the unit posttest.	All animals use the same carbon-transforming processes (digestion, biosynthesis, and cellular respiration) to move, grow, and function.	How do plants grow, move, and function?

Assessment

Use the [6.3 Grading the Functions of All Animals Worksheet](#) to grade students' explanations. Regardless of how students constructed their explanations, they should include similar information.

Differentiation & Extending the Learning

Differentiation

- Provide sentence stems for explanations of each process.

Modifications

Extending the Learning

Activity 6.4 Animals Unit Posttest (20 min)

Overview and Preparation

Target Student Performance

Students show their end-of unit proficiencies for the overall unit goal: Questioning, investigating, and explaining how animals move and change matter and energy as they live, move, and grow.

Resources You Provide

- pencils (1 per student)

Resources Provided

- [Grading the Animals Unit Posttest](#)
- [Animals Unit Posttest](#)

Setup

Print one copy of the [Animals Unit Posttest](#) for each student.

Directions

1. Describe the unit posttest.

Explain the purpose of the unit posttest to students:

- It will help you as a teacher understand how students think about what happens when animals move, grow, and function.
- It will help them think about what they learned and how their ideas changed over time.

2. Have students take the unit posttest.

Distribute copies of [Animals Unit Posttest](#) to be completed with paper and pencil.

Assessment

Students should be able to answer the questions correctly, so it is reasonable to grade them at this point. Use [Grading the Animals Unit Posttest](#) to check student answers.

Differentiation & Extending the Learning

Differentiation

- Read the questions aloud to the class. Reframe or reword questions for clarity.
- Provide sentence stems for written responses.
- Provide visual aids for any examples of animals that are not provided.

Modifications

Extending the Learning