Food Webs
Lesson 3a: Matter for Growth

Grade 5	**Length of lesson:** 48 minutes	**Placement of lesson in unit:** 3a of 7 two-part lessons on food webs
Unit central question: How do living things depend on one another to get the food (matter and energy) they need to live and grow?		**Lesson focus question:** How do plants grow bigger?
Main learning goal: Plants use the food molecules they make to build new body structures and grow bigger.		
Science content storyline: Plants take non-energy-supplying matter from the air (carbon-dioxide molecules) and soil (water molecules) and use energy from the Sun to change this matter into energy-supplying food matter (molecules). Plants use these food molecules to build body structures and grow bigger.		
Ideal student response to the focus question: Plants need food matter to grow bigger. They take in matter from the air (carbon dioxide) and soil (water), but this matter isn't their food. To get their food, producers use energy from sunlight to change carbon-dioxide and water matter into energy-supplying food matter. Plants then use these food molecules to build body structures and grow bigger.		

Preparation

Materials Needed
- Science notebooks
- Time-lapse video showing growth:
  - Tomato seedlings http://www.youtube.com/watch?v=LICDb8nM5rs
- For each group of 4 students:
  - 10 linking-cube water molecules (1 H_2O = 2 blues, 1 white)
  - 20 linking-cube carbon-dioxide molecules (1 CO_2 = 2 whites, 1 red)
  - 4 linking-cube food/sugar molecules (sugar = 1 red, 1 white, 1 blue)
  - 3 gallon-sized plastic bags to store the linking cubes
- Straight pin
- *Optional:* examples of models that represent big things (globe, map, toy car) and small things (cell model, large plastic insect, large model of a body part, such as the eye).
- *Optional:* **c**hart paper, markers

Student Handouts
- 3.1 Organism Tree Poster (laminated 11" × 17" mat) (1 for each group of 4 students)

Ahead of Time
- Review the Food Webs Content Background Document: Introduction to Part 2 (pp. 5-6), Section 2.3, Section 2.4, and Section 2.6 (focus on 2nd bullet in the summary of key points).
- Review the PowerPoint slides and modify them as you wish.
- View the time-lapse video of tomato seedlings—http://www.youtube.com/watch?v=LICDb8nM5rs.
- Experiment with linking cubes and a laminated tree poster (mat) to show how a tree gets the matter it needs to grow.

Lesson 3a General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
10 min	**Link to previous lesson:** Students share and discuss the sentences they wrote at the end of the previous lesson to answer the focus question, *What is food for plants?* The teacher highlights key science ideas from the previous lesson.	• Plants are producers that can take matter from the air (carbon dioxide), matter from the soil (water), and energy in the form of sunlight and make their own energy-supplying food.
10 min	**Lesson focus question:** Students write and talk about their ideas regarding today's focus question, *How do plants grow bigger?*	
10 min	**Setup for activity:** The teacher announces that students will use linking cubes to create a model showing how plants make food. Students practice using the linking cubes to make food (sugar) molecules.	• Models are never exactly like the real thing, but they can help us visualize and think about the real thing. • All matter is made up of tiny pieces of matter called *molecules*.
10 min	**Activity:** The teacher guides small groups of students in using linking cubes (representing atoms and molecules) and a tree poster (place mat) to show that plants grow bigger by creating sugar molecules out of the water and carbon-dioxide molecules they get from their environment. The activity highlights that trees use matter from many, many tiny molecules to build body structures and grow.	• Plants take non-energy-supplying matter from the air (carbon-dioxide molecules) and soil (water molecules) and use energy from the Sun to change this matter into food molecules, which are then used to build body structures so the plants will grow bigger.
5 min	**Follow-up to activity:** As a group, students add words and pictures to a tree diagram to show how the tree grows bigger.	
2 min	**Synthesize/summarize today's lesson:** The teacher summarizes key science ideas from the lesson.	
1 min	**Link to next lesson:** The teacher shares the focus question for the next lesson: *How do animals grow bigger?*	

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
10 min	**Link to Previous Lesson** **Synopsis:** Students share and discuss the sentences they wrote at the end of the previous lesson to answer the focus question, *What is food for plants?* The teacher highlights key science ideas from the previous lesson. **Main science idea(s):** • Plants are producers that can take matter from the air (carbon dioxide), matter from the soil (water), and energy in the form of sunlight and make their own energy-supplying food.	Link science ideas to other science ideas.	**Show slides 1 and 2.** Get out your science notebooks and look at the sentence you wrote at the end of our last lesson to answer the focus question, *What is food for plants?* **Show slide 3.** **Pairs:** Share your sentences with a partner and help each other improve them. 1. Make sure your partner used all of these words: *carbon dioxide*, *matter*, *sunlight*, *energy*, *food*, *water*, *producers.* 2. Then ask one clarification question: • What do you mean when you say …? • Can you say more about …? • Are you saying that …? **Whole-class share-out:** Have students share out some of their sentences. **NOTE TO TEACHER:** *In response to students' sentences, follow these steps:* *1. Ask probe questions (or have students come up with their own questions) to see if students can provide more-detailed responses.* *2. If students' responses have inaccuracies or gaps, ask challenge questions to get them to make more connections.*	*Examples of student responses to probe or challenge questions:* Plants use matter and energy to make	*Probe and challenge questions:* Can you give more

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				food. Plants make food out of water, carbon dioxide, and energy from the Sun.	details about the matter and energy plants use to make food? Look back at our definition of *food*. How might you add the word *matter* to your idea?
			NOTE TO TEACHER: *Decide whether you'll refer to the class evidence chart or to slide 4 here.* **Show slide 4** (or the class evidence chart). Let's look at this slide [*or our class evidence chart*] on how plants get their food. Yesterday we learned that some of these things are **not** food for plants, at least not by themselves. As I read this list, give me a thumbs-up if it IS food for plants, and a thumbs-down if it is NOT food for plants:	*Students should give a thumbs-down for all except the last item.*	*If you don't see the expected response, ask students for their evidence/reasoning, and ask if other students can provide stronger evidence to convince them to change their minds.*

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		Highlight key science ideas and focus question throughout.	Water Carbon dioxide Sunlight Soil Minerals in the soil ("plant food") Food/sugar molecules made in the leaves of plants   We learned yesterday that plants can do this amazing thing: They can take water, carbon dioxide, and sunlight and turn them into energy-supplying food in the form of sugars. Water has no Calories, and carbon dioxide has no Calories, but they get turned into sugar which **does** have Calories, or energy. **CONTENT NOTE TO TEACHER:** *Sugar is formed at first in this process. Later, these sugars are turned into other forms, such as starches, proteins, and fats. To create proteins, plants need minerals from the soil, such as nitrogen, that help them grow but don't get used in making food during photosynthesis. But students at this grade level don't need this information!* **Show slide 5.** Now let's see if you can use these ideas to explain the diagram on this slide. **Turn and Talk:** Turn to an elbow partner and talk		*If not, you can provide the stronger evidence.* What does this arrow

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			about this question: *Can you explain what each arrow in this diagram is showing? How would you label each arrow?* **Whole-class discussion:** Who can come up and tell us what the diagram is showing? Make sure you point to what you're describing. Listeners: Can you add on to what you're hearing? **ELL support:** You could set a shared goal of formulating a class answer to this question. **NOTE TO TEACHER**: *Make sure that students explain every arrow on the diagram.*		tell us? Who can add on?
10 min	**Lesson Focus Question** **Synopsis:** Students write and talk about their ideas regarding today's focus question, *How do plants grow bigger?*	Set the purpose with a focus question or goal statement.	**Show slide 6.** Today we're going to build on this idea as we think about what happens to make plants grow bigger. Our focus question for this lesson is, *How do plants grow bigger?* To help us answer this question, we'll look at a time-lapse video and some pictures that show living things as they grow. **Show slides 7 and 8.** **NOTE TO TEACHER:** • *First, show the time-lapse video of tomato seedlings growing. Access video at http:// www.youtube.com/watch?v=LICDb8nM5rs.* • *Then show the picture of an acorn sprouting and*		

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			a full grown tree (slide 8). Write the focus question in your science notebooks and draw a box around it. Then write one sentence you think might be an answer—or part of an answer—to the focus question. I'm going to use equity sticks and call on a few individuals to share their ideas. Everyone else, listen and see if you have a different idea or can add any more details to the ideas you've heard. **NOTE TO TEACHER:** *Students will likely say that living things use food to grow. But can they say **how** this happens? The goal here is for students to realize they're not really sure how food is used to make living things grow.* Today we'll learn more about how the food that living things—like you!—eat is used to make them grow. We'll start with plants, and then we'll turn to other living things.	*Sample student responses to the focus question:* Plants use food to grow. As plants make more and more food, they get bigger like we get bigger and fatter when we eat. I don't know. Maybe the food just piles up and up?	How does food make living things get bigger? Do you have any ideas about how the food plants make (or the food you eat) makes the plants (or your body) get bigger?

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			NOTE TO TEACHER: *You can refer to "organisms" instead of "living things" if you want your students to learn that word. Then you can substitute "organisms" wherever you see "living things" in the lesson plans.*		
10 min	**Setup for Activity** **Synopsis:** The teacher announces that students will use linking cubes to create a model showing how plants make food. Students practice using the linking cubes to make food (sugar) molecules. **Main science idea(s):** • Models are never exactly like the real thing, but they can help us visualize and think about the real thing. • All matter is made up of tiny pieces of matter called *molecules*.		In our last science lesson, you pretended to be plants using matter from the air (carbon dioxide) and matter from the soil (water) and energy from sunlight to make your food. This role-play was one kind of model that showed what's going on inside plants. Today we're going to create a different kind of model. **NOTE TO TEACHER:** *As an optional activity, you could have a group discussion about models, asking these questions: What do we mean by the word* model*? Can you give some examples of models?* *You also might want to have some examples of models ready to show students. Include models that represent big things (globe, map, toy car) and small things (cell model, large plastic insect, large model of a body part, such as the eye). If you don't have access to these kinds of models, you could use pictures.* An important thing to remember about models is that they're never exactly like the real thing. They just help us imagine and think about the real thing. Today we're going to create a model of things that are very tiny. Everything is made up of tiny pieces of	*Possible response to optional questions:* A model is a miniature version of what something is like. A doll house is a small version of a real house. *Examples of models:* • A model train. • Our science teacher last year showed us a plastic model of a heart.	Sometimes a model is a miniature example that helps us imagine something very big, like a globe as a model of Earth. But sometimes a model helps us imagine things that are very small by making them bigger.

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		Make explicit links between science ideas and activities **before** the activity. Highlight key science ideas and focus question throughout.	matter that we can't see, even under a microscope. Can anyone think of a word you've heard before that might describe these tiny pieces of matter? The word is *molecules*. Everything you can see around you is made of tiny, tiny pieces of matter called *molecules*. To give you an idea of just how tiny molecules are, think about this: If you put a tiny drop of water on the head of a straight pin, there will be more than 300 trillion water molecules in that tiny drop of water. That's 300 followed by twelve zeros! *[Show straight pin.]* Next we're going to make a model of what happens to make living things grow bigger. Our model is going to show molecules. By making the molecules in our model **huge**, it will help us imagine what is happening on a much smaller scale inside living things. At your tables, you have a bag of linking cubes that are shaped to represent water molecules and carbon-dioxide molecules. To help us answer our focus question, we'll use those cubes to build models of food molecules. **Show slide 9.** Before we get started, I want you to practice using the linking cubes, so each of you pull out of the bag one water molecule, one carbon-dioxide molecule,	Molecules? Atoms?	

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			and one food molecule. How many pieces are each of these molecules made of? Each of these molecules has three pieces called *atoms*. When you take a water molecule apart, you no longer have water! You just have three atoms—two atoms of hydrogen and one atom of oxygen. Now we're going to practice taking molecules apart and putting them back together again. Let's try a few challenges. **Challenge 1:** See if you can make another food molecule. **Challenge 2:** How many carbon-dioxide molecules can you make? **Challenge 3:** How many water molecules can you make? So now we're going to use the linking-cube molecules to answer our focus question, *How do plants grow bigger?* **ELL support:** Display the molecules in the room with pictures, definitions, and usage.	Three. Two. Just one.	
10 min	**Activity** **Synopsis:** The teacher	Select content representations and models	**NOTE TO TEACHER:** *Organize students in groups of four. Each group needs 10 H_2O linking-cube molecules, 20 CO_2 linking-cube molecules, four*		

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	guides small groups of students in using linking cubes (representing atoms and molecules) and a tree poster (place mat) to show that plants get the matter they need to grow by making it themselves. The activity highlights that trees use matter from many, many tiny molecules to build body structures and grow. **Main science idea(s):** • Plants take non-energy-supplying matter from the air (carbon-dioxide molecules) and soil (water molecules) and use energy from the Sun to change this matter into food molecules, which are then used to build body structures so the plants will grow bigger.	matched to the learning goal and engage students in their use.	*food (sugar) linking-cube molecules, and a tree place mat (handout 3.1). During this activity, you'll lead small groups through the process of building food/sugar molecules and showing how the food molecules the tree produces are used to help it grow bigger. Groups should work quietly so they can hear your instructions and copy what you're modeling with the linking cubes.* [*Distribute the tree mat (handout 3.1).*] **Show slide 10.** **NOTE TO TEACHER: Steps for Modeling Plant Growth** *Demonstrate what the three types of molecules look like.*  *Food in the form of sugar (made of carbon, hydrogen, and oxygen atoms)*  1. *First, have students place one food molecule on the tree poster/place mat. Say, "This baby tree is made up of food molecules, but not a lot of them."* 2. *Direct students to place the CO_2 molecules in the air surrounding the tree.*		

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			3. Have students place water molecules in the soil on the poster/place mat. *4. Direct students to take one CO_2 molecule and one water molecule and hold them together up toward the light (the Sun) to get energy. With this energy from the Sun, tell them to take the CO_2 and H_2O molecules apart and then rearrange the cubes to build sugar molecules.* ***Emphasize*** *that energy is now stored in the links between each of the cubes. The food molecules have stored energy.* *5. As students build food molecules, they should place them on the tree poster/mat. Say, "The tree gets bigger by making more and more food molecules and using them as building blocks for its body structures."* *6. Students keep going through this process of building food molecules and growing the tree until they run out of linking cubes.* *After the activity, have groups put their linking-cube sugar molecules back into the large plastic bags. They will need these molecules for the next lesson.*		
5 min	**Follow-Up to Activity** **Synopsis:** As a group, students add words and pictures to a tree diagram to show how the tree grows bigger. **Main science idea(s):** • Plants take non-energy-supplying matter from the air	Make explicit links between science ideas and activities **after** the activity.	**Show slide 11.** So how do living plants get bigger? How do they grow? We just used linking cubes to create a model of how plants grow. Now let's create a different kind of model to show how plants grow **bigger**. To show how this tree can grow bigger, we'll add words, arrows, and pictures to the diagram. Let's think and talk about what we should add. **Think-Pair-Share:** What would you add to this	Add CO_2 and H_2O going into the tree.	

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	(carbon-dioxide molecules) and soil (water molecules) and use energy from the Sun to change this matter into food molecules, which are then used to build body structures so the plants will grow bigger.		diagram to show how the tree can grow bigger? Think about this question for a moment; then pair up with an elbow partner and share your ideas. **Whole-class discussion:** What should we add to this diagram to show how the tree grows bigger? **NOTE TO TEACHER:** *As students give suggestions that are acceptable to the class, you could have them come to the board (or Smart Board) and add their ideas to the diagram, or you can make the additions for them.* *Check to make sure the following words are included in student suggestions:* • *Water* • *Carbon dioxide* • *Sunlight* • *Food or sugar molecules* • *Producer* • *Make or produce* ***Emphasize** that the whole tree is made of molecules, just as a sand castle is made of grains of sand.*	Draw food molecules all over the tree to show it getting bigger. Water and carbon dioxide make food molecules, and the tree uses them to grow bigger. It's not just water and carbon dioxide that make the food. You have to have sunlight, too. I want to add that the food molecules (matter) become part of the tree. The more molecules the tree makes, the bigger it gets.	How do food molecules make the tree grow bigger? Can you tell me more about that? Does anyone want to agree, disagree, or add on?
2 min	**Synthesize/Summarize Today's Lesson** **Synopsis:** The teacher	Highlight key	**Show slide 12.** Our focus question today was *How do plants grow*		

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	summarizes key science ideas from the lesson. **Main science idea(s):** • Plants take non-energy-supplying matter from the air (carbon-dioxide molecules) and soil (water molecules) and use energy from the Sun to change this matter into food molecules, which are then used to build body structures so the plants will grow bigger.	science ideas and focus question throughout. Summarize key science ideas.	*bigger?* We found out that plants are producers that make food molecules by taking in carbon dioxide and water from their environment. When combined with light energy from the Sun, these two kinds of matter are changed into matter that can provide energy for living things. That energy is **food**! The smallest pieces of this food are called *molecules* or sugar molecules. As plants make food molecules, they use them to get bigger and bigger. The food molecules are like building blocks that plants are made of.		
1 min	**Link to Next Lesson** **Synopsis:** The teacher shares the focus question for the next lesson: *How do animals grow bigger?*	Link science ideas to other science ideas.	**Show slide 13.** Tomorrow we'll explore what happens to make animals grow bigger. Do you think animals grow bigger in the same way plants do? Or do they grow bigger in a different way?		