

Mystery of Decomposition

Sustainability

The process of decomposition is happening all around us all of the time: it reduces waste and creates compost, which replenishes soil. This is part of the cycle of matter and is visible when we investigate compost row and much of the world around us.

Communication

Students practice public speaking in large and small groups and collaborate with a partner to link inferences to observations.



Nourishment

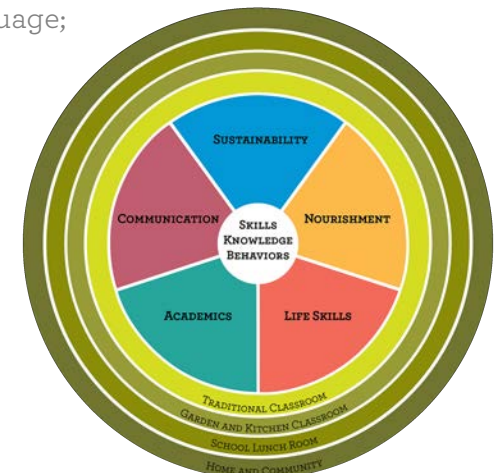
Soil fertility is important to human health. Fertile soil grows nutritious plants which we eat to stay healthy.

Life Skills

Students explore the garden independently to sharpen their observation skills. A visual aid from the previous two lessons remains to remind them of behavioral expectations in the garden.

Academics

This lesson fulfills Next Generation Science Standards for Interdependent Relationships in Ecosystems; Cycle of Matter and Energy Transfer in Ecosystems; Ecosystem Dynamics, Functioning, and Resilience; Common Core Standards for integrating information; collaborative discussion; interpreting information; speaking and listening; language; and acquiring words and phrases.



The Mystery of Decomposition Abstract

Summary

In this 6th grade Science class, students begin to understand the process of **decomposition** and learn about the organisms responsible for it.

Objectives

After this lesson, students will be able to:

- Explain the process of **decomposition**
- Identify the organisms responsible for **decomposition**

Assessments

During this lesson, students will:

- Discuss the organisms responsible for **decomposition** (**fungus, bacteria and invertebrates**) and explain that the FBI are critical to the speed of **decomposition**
- Discuss that making **compost** piles speeds up **decomposition**, reduces waste and replenishes soil

Communication is strengthened by group discussion and collaboration with a partner to link inferences to observations.

Sustainability is highlighted by investigating the roles that **fungus, bacteria and invertebrates** play in replenishing soil.

Nourishment is understood by learning that soil fertility affects human health. **Life Skills** are honed as students explore the garden independently, guided by expectations for speaking, listening and following directions.

Academics fulfill Next Generation Science Standards for interdependent relationships in ecosystems; cycle of matter and energy transfer in ecosystems; ecosystem dynamics, functioning, and resilience; Common Core State Standards for integrating information; collaborative discussion; interpreting information; speaking and listening; language; and acquiring words and phrases. See **Connections to Academic Standards** below for details.

Edible Schoolyard curriculum emphasizes developing community and personal stewardship, along with skills that will help students navigate different situations throughout their lives; observing fungus, bacteria, and invertebrates in **decomposition**; and understanding that **soil is the lifeblood** and fertility of the garden.

This lesson follows the BEETLES Project's *Learning Cycle* (Invitation-> Exploration -> Concept Invention -> Application -> Reflection) and uses their *Discussion Routines* (Think-Pair-Share, Whip-Around). All are highlighted in *Green** with an asterisk for easy identification. See the documents BEETLES_Discussion_Routines.pdf and BEETLES_Learning_Cycle.pdf included in **Resources** below for more information. Games and activities from other sources are also identified in *Green*, without an asterisk.

Connections to *Academic Standards*

Next Generation Science Standards, Middle School

Disciplinary Core Ideas:

- LS2.A: Interdependent Relationships in Ecosystems
 - Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.
 - In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction.
 - Growth of organisms and population increases are limited by access to resources.
 - Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.
- LS2.B: Cycle of Matter and Energy Transfer in Ecosystems
 - Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS2-3)
- LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS-2-4)
- Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (MS-LS-2-5)

Crosscutting Concepts:

- Cause and Effect
 - Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS-2-2)
- Patterns
 - Patterns can be used to identify cause and effect relationships. (MS-LS-2-1)
- Energy and Matter
 - The transfer of energy can be tracked as energy flows through a natural system. (MS-LS-2-3)

Performance Expectations:

- MS-LS2 Ecosystems: Interactions, Energy, and Dynamics
 - MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. [Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.]
 - MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.] [*Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.*]

Common Core State Standards, English Language Arts and Literacy, Grade 6

- RI.6.7 Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.
- SL.6.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 6 topics, texts, and issues*, building on others' ideas and expressing their own clearly.
 - SL.6.1.b Follow rules for collegial discussions, set specific goals and deadlines, and define individual roles as needed.
 - SL.6.1.c Pose and respond to specific questions with elaboration and detail by making comments that contribute to the topic, text, or issue under discussion.

- SL.6.1.d Review the key ideas expressed and demonstrate understanding of multiple perspectives through reflection and paraphrasing.
- SL.6.2 Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.
- SL.6.4 Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.
- SL.6.6 Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate. (See grade 6 Language standards 1 and 3 for specific expectations.)
- L.6.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
 - L.6.1.a Ensure that pronouns are in the proper case (subjective, objective, possessive).
 - L.6.1.b Use all pronouns, including intensive pronouns (e.g., *myself*, *ourselves*) correctly.
 - L.6.1.c Recognize and correct inappropriate shifts in pronoun number and person.
 - L.6.1.d Recognize and correct vague pronouns (i.e., ones with unclear or ambiguous antecedents).
- L.6.3 Use knowledge of language and its conventions when writing, speaking, reading, or listening.
 - L.6.3.a Vary sentence patterns for meaning, reader/ listener interest, and style.
 - L.6.3.b Maintain consistency in style and tone.
- L.6.6 Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.

Connections to *Edible Schoolyard* Standards

Edible Schoolyard 3.0

In the Edible Schoolyard Program

- 1.0: Students work with each other and teachers to develop community and personal stewardship, along with skills that will help them navigate different situations throughout their lives.
- 1.1.1 - 1.3.12 This lesson fulfills all Edible Schoolyard Program standards, numbers 1.1 through 3.12. See *The Edible Schoolyard Berkeley Standards* for details.

In the Garden Classroom, Grade 6

- Techniques 2.2.3 Identify layers and components of a compost pile; observe fungus, bacteria, and invertebrates in **decomposition**; tend compost with guidance.
- Concepts 2.3.8 Understand that **soil is the lifeblood** and fertility of the garden: it is alive, diverse, and deserving of our care in cultivation and preservation.

The Mystery of Decomposition Lesson

Materials

- Compost Row (several piles of **compost** at different stages of **decomposition**)
- Extremely ripe tomatoes
- Hand lenses
- Hand shovels
- Job Board
- G6-2 **Decomposition** Definition
- G6-2 FBI images (**fungus, bacteria** and **invertebrates**)
- G6-2 Compost Row *Think-Pair-Share** sentence structures
- G6-2 Another Location *Think-Pair-Share** questions
- G6-2 Closing Circle *Think-Pair-Share** question

Before You Begin

- Build Compost Row
- Allow tomatoes to ripen and begin to **decompose**
- Collect the hand lenses and shovels and bring them to Opening Circle
- Create the Job Board
- Create the FBI images
- Copy **Decomposition** Definition for each adult leading a group
- Copy Compost Row *Think-Pair-Share** sentence structures for each adult leading a group
- Copy Another Location *Think-Pair-Share** questions for each adult leading a group
- Copy Closing Circle *Think-Pair-Share** question once to show at Closing Circle

Timeline Overview

Total Duration: 90 minutes

1. *Invitation** (10 minutes)
2. *Application** (40 minutes)

3. *Exploration** (10 minutes)
4. *Concept Invention** (10 minutes)
5. *Application** (10 minutes)
6. *Reflection** (10 minutes)

Procedures

At the Opening Circle

(Use the word elaborate in a sentence: “Can someone elaborate more on your peers’ definition?”)

1. *Invitation**: (10 minutes)

Welcome students and ask them to help solve the mystery of **decomposition**, by figuring out why these tomatoes aren’t looking so good.

- a. Ask two or three people to share their answers, building on the ideas of others. The goal here is to spark interest and not to answer the mystery yet.
- b. Explain that the garden can be thought of as an outdoor laboratory: a place to experiment and figure things out together. Tell students they will take a break from their working groups today to visit the lab we have set up.
- c. Go over today’s garden jobs and divide students into 4 working groups, one group for each job.
- d. In each small group, ask students to share one question they have about **decomposition** before participating in the lab.

In the Field (60 minutes total)

Garden Work Rotation

2. *Application**: (40 minutes)

Each group rotates through Compost Row as the other groups work in the garden.

- a. The first group jumps to **At Compost Row** step 3. *Exploration** while the other three groups begin their garden work.
- b. When the first group moves to step 4. *Concept Invention** the next group starts **At Compost Row**, step 3.
- c. Eventually, the first group will finish step 3 and loop back to begin 2. **Garden Work** after completing steps 3 and 4.
- d. It takes a total of 60 minutes of class time to get through steps 2, 3 and 4 because 3 groups do steps 3 and/or 4 simultaneously, which takes 50 minutes for all groups to cycle through, and that happens during the combined time of steps 3, 4 and 5, which is 60 minutes.

At Compost Row

Compost Lab (20 minutes total)

3. *Exploration**: (10 minutes)

Ask students to explore the **compost** pile, looking for examples of **decomposition**.

- a. Explain that they have a few minutes to search for things that might be connected to the mystery of the tomatoes, which they can share with the group afterward.
- b. Bring students back together as a group and have them break into pairs.
- c. Ask them to use the *Think-Pair-Share** process to complete the Compost Row sentence structures:
 - i. One thing I observed on my exploration is _____.
 - ii. I think this is connected to the mystery of the tomatoes because_____.
 - iii. To use *Think-Pair-Share**:
 - 1) Think - Give students an interesting broad question to think or write about briefly.
 - 2) Pair - Pair students, and ask them to discuss the question(s) with their partner.
 - 3) Share - Students share their discussion ideas with another pair of students or the instructor leads a whole group discussion about the topic.
- d. Have students circle up and discuss their findings as a group.

4. *Concept Invention**: (10 minutes)

Introduce the FBI (**fungus, bacteria, insects**) and their roles in **decomposition**.

- a. Present the FBI images.
- b. Explain that Decomposers, like all living organisms, have three main needs for survival:
 - i. Food (Any organic matter is their food.)
 - ii. Air
 - iii. Water
- c. Have students explain, in their own words, the definition of **decomposition**.
- d. After they attempt the definition on their own have a student read the definition out loud.
 - i. The process of breaking down organic material, such as dead plant or animal tissue, into smaller molecules that are available for use by the organisms of an ecosystem.
- e. Ask the students to solve the mystery and share what was going on with the tomatoes they saw in opening circle. (*They were decomposing.*)
- f. Return the group to their Garden Work Rotation or directly to Another Location for step 5, if this is the last group to finish the Compost Lab.

- i. Ask students to apply this somewhere else in the garden and see if **decomposition** is happening only here in our **compost** area or if it's happening everywhere all the time.

At Another Location

5. *Application**: (10 minutes)

Have students investigate **decomposition** beyond Compost Row.

- a. Move the group to a new location, like under a tree.
 - i. All groups can do this step simultaneously, after they have rotated through Compost Row and done their Garden Work Rotation.
- b. Ask students to find something they think is connected to **decomposition** here, in this new location.
- c. Have students use the *Think-Pair-Share** process to answer Another Location Think-Pair-Share questions:
 - i. How is what you found connected?
 - ii. What is its role in **decomposition**?
- d. Invite students to share their answers with the group.

6. At the Closing Circle

7. *Reflection**: (10 minutes)

Have students think back and reflect on their time learning about **decomposition** and doing garden work today.

- a. Ask students to think about a question they have about **decomposition** now.
- b. Facilitate a *Think-Pair-Share** allowing students to share with each other, using the Closing Circle Think-Pair-Share question.
 - i. I am still wondering this about **decomposition**: _____.
- c. Ask for volunteers to share their questions with the whole group as time allows.

Vocabulary

Fungus

Bacteria

Invertebrate

Decomposition

Compost

Contributors

All lessons at the Edible Schoolyard Berkeley are developed in collaboration with the teachers and staff of the Edible Schoolyard and Martin Luther King Jr. Middle School.

Learning Cycle and Think-Pair-Share discussion routine © The Regents of the University of California. All materials created by BEETLESTM at The Lawrence Hall of Science.

Resources

G6-2_FBI_Images.pdf

G6-2_Decomposition_Definition.pdf

G6-2_Compost_Row_TPS.pdf

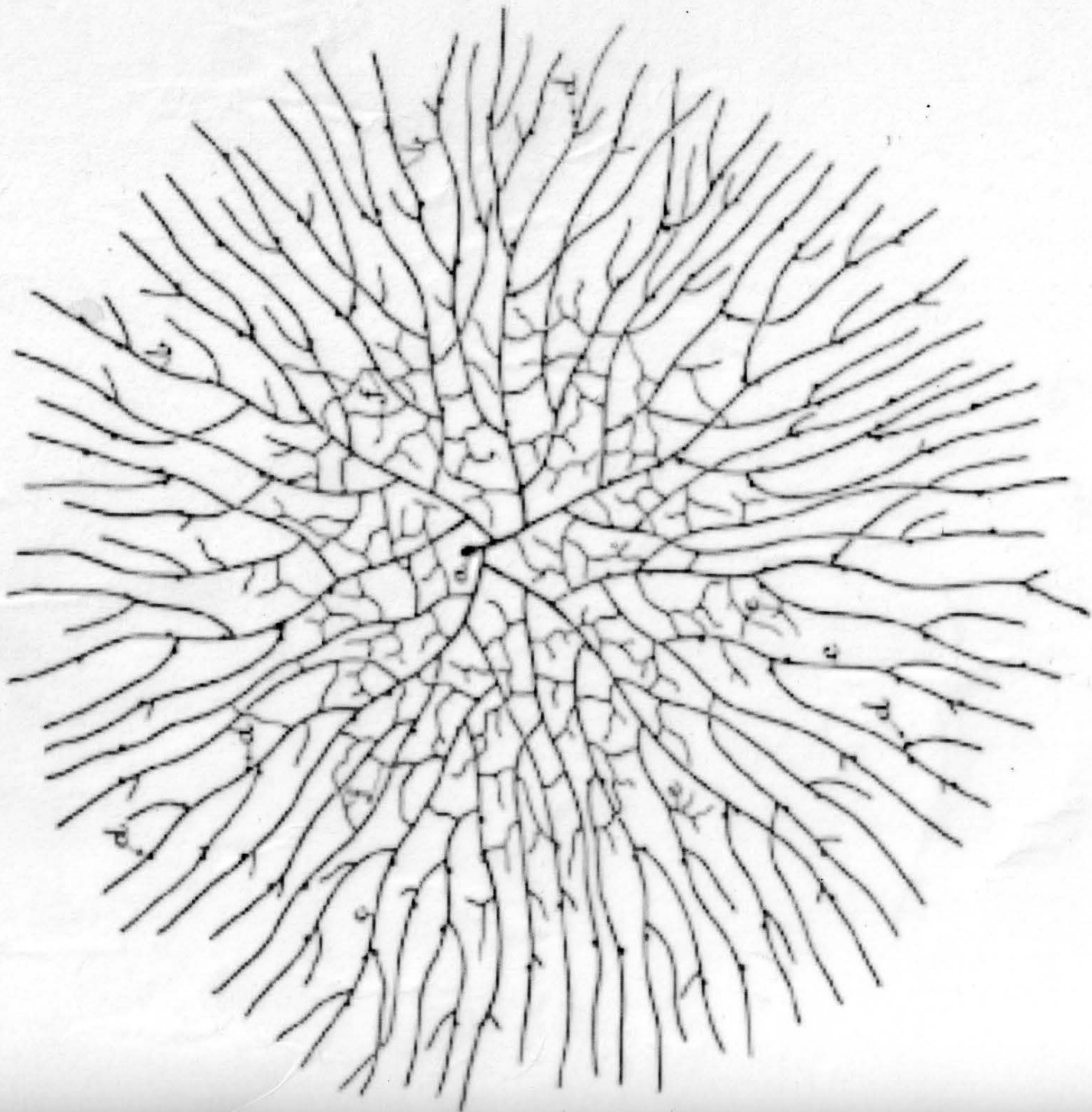
G6-2_Another_Location_TPS.pdf

G6-2_Closing_Circle_TPS.pdf

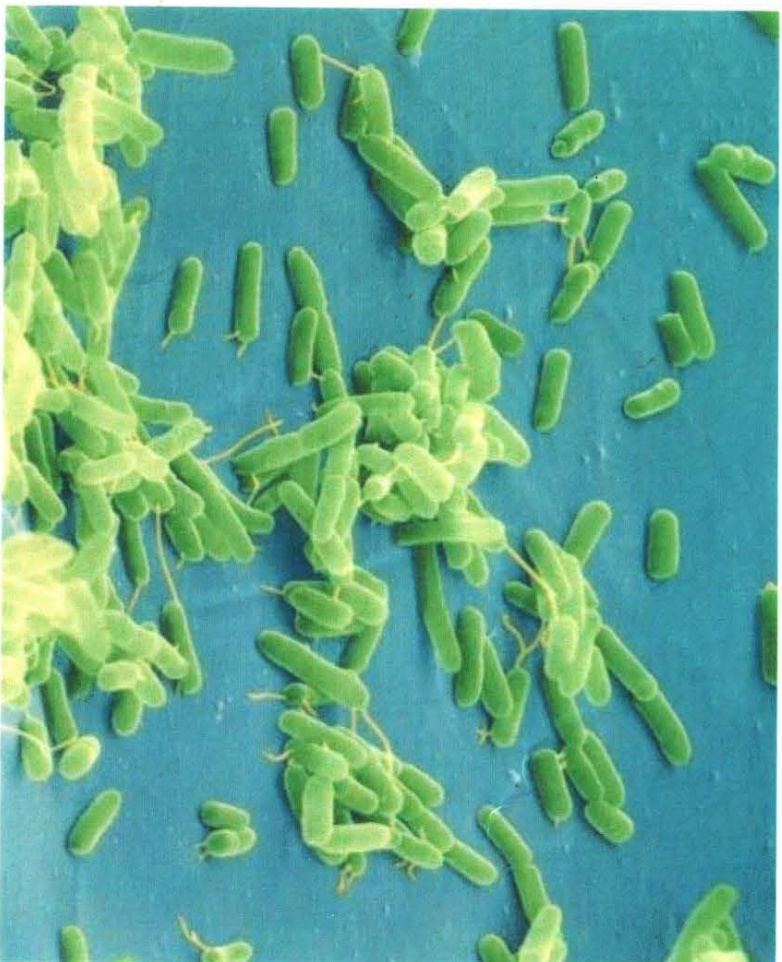
BEETLES_Learning_Cycle.pdf (see lesson G6-0)

BEETLES_Discovery_Routines.pdf (see lesson G6-1)

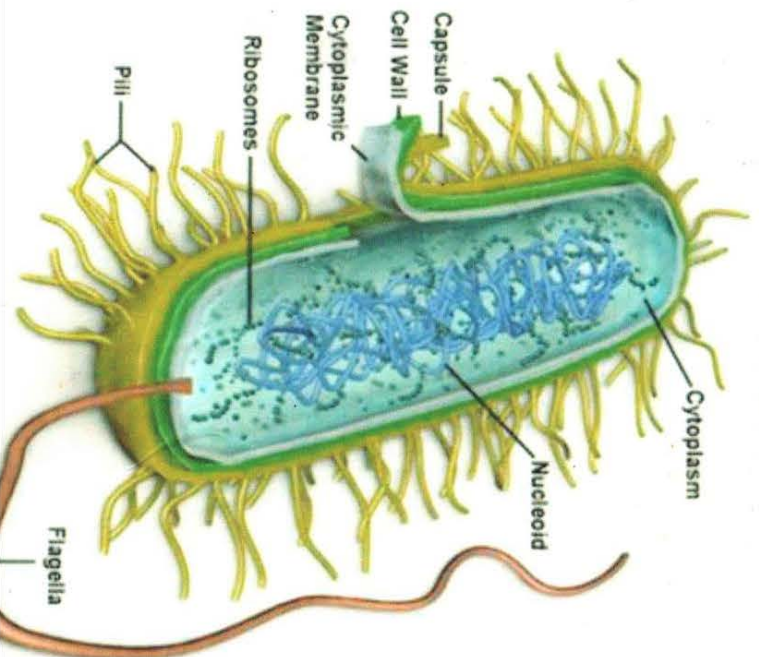
F U N G U S



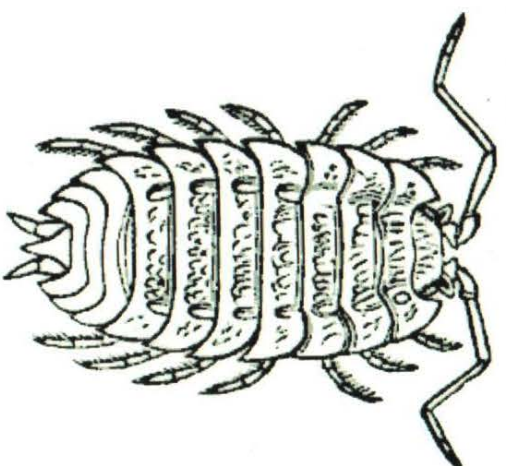
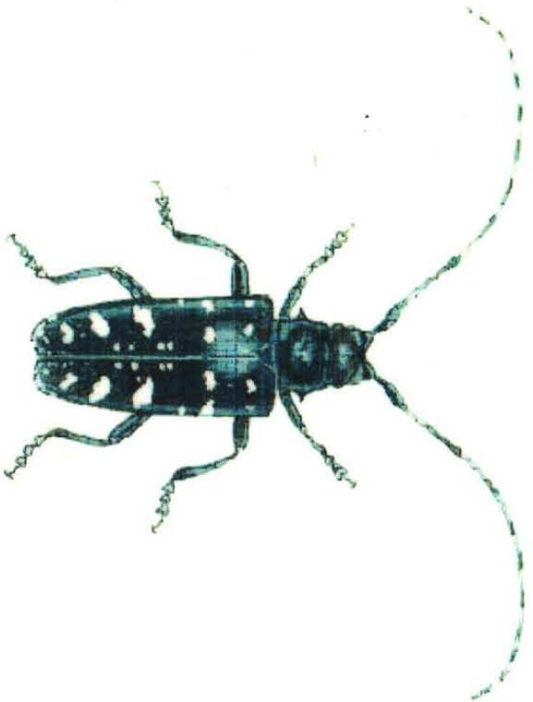
BACTERIA



Cell Structure



INVERTEBRATES



Decomposition

The process of breaking down organic material, such as dead plant or animal tissue, into smaller molecules that are available for use by the organisms of an ecosystem.

1. One thing I observed on my exploration is _____

2. I think this is connected to the mystery of the tomatoes because _____

1. How is what you found connected?

2. What is its role in decomposition?

***1. I am still wondering this
about decomposition:***

