if you build it, they will come
part 2: functions of tissues

△ FRAMEWORKS

SCIENCE

LS 2.6.1 Observe, describe and illustrate plant and animal tissues: muscle, blood, skin, xylem and phloem.
LS 2.6.2 Illustrate the hierarchical relationship of cells, tissues and organs.
LS 2.6.3 Investigate the functions of tissues.
LS 2.6.5 Model and explain the function of plant organs: Leaves, roots, stems and flowers.
LS 2.7.1 Illustrate the hierarchical relationships of cells, tissues, organs and organ systems.
LS 2.7.2 Analyze how two or more organs work together to perform a function.
LS 2.7.9 Describe interactions between major organ systems.
LS 2.8.1 Illustrate the hierarchical relationships of cells, tissues, organs, organ systems and organisms.

LANGUAGE ARTS

OV.1.6.1 Develop vocabulary from content area texts and personal reading.
OV.1.7.1 Develop vocabulary from content area texts and personal reading.
OV.1.8.1 Develop vocabulary from content area texts and personal reading.

△ OBJECTIVES

The students will learn:

OBJECTIVE #1 To describe the functions of tissues.
OBJECTIVE #2 To list and define the four types of animal tissue.
OBJECTIVE #3 To list and define the three types of plant tissue.
OBJECTIVE #4 Compare animal and plant tissues and the nutrients they need to function.
OBJECTIVE #5 To appropriately use verbal speaking skills in class discussion with the teacher and Garden Program Specialist.
Plants and animals have similar cells that perform similar functions, all of which depend on essential nutrients for fuel.

**OVERVIEW**

In multicellular organisms, similar cells performing the same function organize to form tissue. Animals have four types of tissue: connective, epithelial, muscle and nerve. Plants have three: ground, dermal, vascular.

**GARDEN ACTIVITIES**

▲ Building/maintaining vermicomposting bins
▲ Plant, harvest and work in the garden following the Garden Guide
▲ Recipes and Taste tests as time permits (refer to Delta Garden Study Recipe Book)
TIPS FOR THE CLASSROOM

Pre-lesson preparation:

1. Review the “Nutrients and Benefits for Plants” table in Supporting Information for Teachers.

LESSON OUTLINE

<table>
<thead>
<tr>
<th>activities</th>
<th>estimated duration</th>
<th>actual duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>in the classroom</td>
<td>Offer the icebreaker</td>
<td>5 minutes</td>
</tr>
<tr>
<td></td>
<td>Explain how cells organize to form tissue; describe the different types of animal and plant tissue</td>
<td>10 minutes</td>
</tr>
<tr>
<td>in the garden/chicken coop</td>
<td>Observe several plants and review the types of plant tissues</td>
<td>10 minutes</td>
</tr>
<tr>
<td></td>
<td>Compare plant and animal tissues and the nutrients they need to fuel those tissues</td>
<td>10 minutes</td>
</tr>
<tr>
<td></td>
<td>Harvest and taste produce as available</td>
<td>5 minutes</td>
</tr>
<tr>
<td>back in the classroom</td>
<td>Hand out Student Learning Workbooks, review and assign “Take it Home Activity” as homework</td>
<td>5 minutes</td>
</tr>
</tbody>
</table>

TIPS FOR THE GARDEN

Pre-lesson preparation:

1. Determine which trees or garden plants will be most appropriate to illustrate the 3 plant tissues. Prepare to discuss these tissues, their required nutrients, and nutrient sources, such as the compost pile and worm bin.

2. Review the “Nutrients and Benefits for Plants” table in Supporting Information for Teachers.
**LESSON PLAN**

## I. Start in the classroom

### A. Icebreaker

Ask students: What is one way that people use copper?

**ANSWER:** People use copper in many ways, such as making kitchen pots and electric wires. But one of the most important ways people use copper is as a nutrient. A very small amount of copper supports your bones, blood tissue, and immune system, but too much can be poisonous. Get the right amounts of copper by eating beans, leafy greens, and potatoes.

### B. Present Main Topic

- Explain how in complex organisms, cells performing the same function organize into tissue.
- Describe the four types of animal tissue and their functions.
- Describe the three types of plant tissue and their functions.

**MEETS OBJECTIVE #1**

**MEETS OBJECTIVE #2**

**MEETS OBJECTIVE #3**

## II. Take class to the garden

- Examine several plants, selecting different types. Review the three types of plant tissues. Take a close look at trees, if available, and the bark to study dermal tissue.
- Ask students to compare and contrast plant tissues to their own tissues and organ systems. Consider the similar sources of nutrients that plant and animal tissues require and the different places they find those nutrients (fertilizers and compost; fruits and veggies).
- Perform any gardening tasks as necessary.
- Taste available produce. Ask students for feedback.

**MEETS OBJECTIVES #3–5**

## III. Take class back to classroom

- Hand out the Student Workbook as reference material and class assignment. Review take it home activities and encourage students to do them.
Cells organize to form tissue in two different ways:

1. They are “interwoven” with extracellular fibers. In fact, the word “tissue” traces its origin to a Latin word meaning “to weave.”
2. They are held together by a sticky substance, almost like glue.

**Connective tissue**, one of the four types of tissue found in vertebrates, is an example of tissue with cells spread throughout an extracellular matrix. It takes its name from the “weave” and type of its associated fibers. Connective tissue contains several subgroups, including loose connective tissue, which is the most common. It anchors organs and fastens epithelial tissue (another main type of tissue, please read on for details) to other underlying tissues. Other types of connective tissues are fibrous and specialized. Fibrous connective tissues are typically found in ligaments and tendons. Specialized connective tissues include fat-storing tissues, cartilage, bone and blood. The latter might be surprising, given that blood has a different function compared to other connective tissue. However, because it does have an extracellular matrix, it is considered part of this group.

**Epithelial tissue** makes up another major type of animal tissue. It serves as a protective barrier against microorganisms, injury and fluid loss. Skin represents epithelial tissue as does the lining of organs and cavities. Epithelial tissue is classified based on the shape of the cells found on the top surface as well as the number of cell layers.

**Muscle tissue** contains cells capable of movement, especially contraction. It is the most abundant in most animals. Three major classifications of muscle tissue exist:

1. **Cardiac muscle tissue**, which is found in the heart. The contractions performed by cardiac muscle tissue are involuntary.
2. **Skeletal muscle tissue**, which attaches to bones via tendons. It supports and executes the body’s voluntary movements.
3. **Visceral (smooth) muscle tissue**, which is present in the arteries as well as many organs. It also is capable of contractions, but it moves more slowly than the skeletal muscle tissue.

**Nervous tissue** represents the fourth tissue type. It consists of neurons to detect stimuli and transmit signals to and from different parts of the body. Neurons comprise two major parts:

1. **Cell body**, including a nucleus, cytoplasm and other organelles
2. **Nerve processes**, which resemble “finger-like” protuberances to direct and conduct signals. Axons carry signals away from the cell body; dendrites carry the signals to the body. What, exactly, are nerves? Bundles of axons and dendrites. Strictly speaking, the expression “I am just a bundle of nerves” is redundant. Nerves are already bundled!

Plants, with their much less complicated structure, have fewer organs and only three types of tissues:

1. **Dermal tissue**, which functions similar to skin. It consists of the epidermis, a single layer of tightly arranged cells, and the periderm, also called bark. Dermal tissue protects the plant against pathogens and fluid loss and provides insulation. Dermal tissue can be specialized to a certain degree, e.g., the epidermis of leaves secretes a sticky coating that enables the plant to retain water.
2. **Vascular tissue**, which transports water and nutrients through the plant. It comprises the phloem (also called inner bark) and the xylem (the woody interior part of a plant, essentially dead cells).
3. **Ground tissue**, which supports the plant and stores food and nutrients. It consists primarily of parenchyma cells and two other types of cells.
Today, many farmers and home gardeners all over the world depend on inexpensive, conveniently available synthetic fertilizers. However, there are some disadvantages. If overused, synthetic fertilizers can leach out into our waterways, polluting our drinking water. They can also lead to the build-up of salt and ammonia in the soil, depleting the soil of moisture and nutrients, which in turn, impairs healthy plant growth.

Organic fertilizers are based on decomposed animal and plant waste, such as rotting leaves, manure, kitchen scraps, dead flowers, etc. As these materials break down, they release fertilizer molecules into the soil. Organic fertilizers release their nutrients slowly — sometimes too slowly for an impatient gardener — but in the long run, they provide an invaluable benefit by enhancing and improving the soil.

Many school gardens, including those built as part of the Delta Garden Study, favor an organic approach. This method aims to improve and maintain soil health and environmental balance through a continual application of compost, both garden compost as well as vermicast, also known as worm manure or earthworm castings. The bacteria and microbes (single-cell organisms) present in the worms’ intestines break down food particles, which are expelled as castings rich in organic matter, beneficial organisms, water-soluble nutrients and trace mineral.

<table>
<thead>
<tr>
<th>Nutrients and Benefits for Plants</th>
<th>Benefit to Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>helps grow new buds and keep certain tissues rigid</td>
</tr>
<tr>
<td>Copper</td>
<td>helps growth of young leaves and branches</td>
</tr>
<tr>
<td>Iron</td>
<td>required for photosynthesis</td>
</tr>
<tr>
<td>Magnesium</td>
<td>ingredient of chlorophyll and helps grow healthy leaves</td>
</tr>
<tr>
<td>Manganese</td>
<td>required for photosynthesis and helps new growth</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>supports leaves, roots, and photosynthesis</td>
</tr>
<tr>
<td>Potassium</td>
<td>supports stem growth and help plant make food</td>
</tr>
<tr>
<td>Zinc</td>
<td>helps form pollen for reproduction</td>
</tr>
</tbody>
</table>

The table above lists just a few essential nutrients that compost and vermicast provide for plants. You will notice that many of them are similar to the nutrients human organs and organ systems need to function. This table will be useful when discussing and comparing the nutrients both plants and animal tissues need for fuel.

**ACTIVITIES:**

▲ Any general garden task that will complement a discussion and lecture about tissue, especially plant tissue. Instruct the students to examine several plants closely. Examine the outside of a tree, if available, for a close look at the bark, which represents dermal tissue. Explain the three types of plant tissue and their functions.

▲ Build or maintain worm composting bins using the Garden Guide for directions.

**SOURCES**

The Complete Book of Science, Grades 5-6
2005 School Specialty Publishing

Science, See learning in a whole new light
by Scott Foresman, 2007 Pearson Education Inc.

Animal Cells And Tissues

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http://www.wormpost.com/benefits/composting.html

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http://www.doityourself.com/stry/7-benefits-of-vermicomposting

Biology.about.com
http://biology.about.com/od/anatomy/a/aa122807a.htm

Red Worm Composting
www.redwormcomposting.com

Vermicomposting – NMSU’s College of Agriculture
http://aces.nmsu.edu/pubs/_h/h-164.pdf
if you build it, they will come
part 2: functions of tissues

study guide for students

Very simple organisms, for example, bacteria, consist of only a single cell that can handle all functions to survive and reproduce. More complex organisms such as the human body are made up of trillions of different cells, doing many specialized jobs. Similar cells performing the same function work in groups, called tissue. Each tissue performs a specific activity and can be identified by its appearance.

Animals, including humans, have four types of tissues: connective, epithelial, muscle, and nerve. Plants have three: dermal, vascular and ground.

These are the four types of tissue found in the body:

1. **Connective:** This is a Jack-of-all-trades type of tissue. It has many jobs to do and it’s mastered them all: It binds, supports and protects other tissues in the body. It also forms blood, stores fat and fills space. Blood is the connective tissue of cells separated by a liquid (plasma).

2. **Epithelial:** It covers body surfaces and lines body cavities. Your skin is epithelial tissue. Other examples are mucous membranes, the lining of your heart and glands.

3. **Muscle:** It contracts to allow movement, including that of your head, torso and limbs, as well as that of your heart.

4. **Nervous:** It transmits messages to and from your brain and controls all body activity.

Plants are simpler organisms compared to animals with fewer organs and fewer tissues. Plant tissues include:

1. **Ground:** It anchors and supports the plant and stores food.

2. **Dermal:** It covers and protects the plant, almost like a skin.

3. **Vascular:** It transports water and nutrients through the plant.

Each one of these tissues, plant or animal, requires nutrients to work properly. We know that humans and other animals look for nutrients in foods like fruits and vegetables, but plants don’t have to look for their food. They can pull nutrients and make their own food from the soil, water, and sun. Although plants and animals find nutrients differently, much of the nutrients that we need to feed our tissues, organs and organs systems are the same. For example, gardeners

Continued next page
can feed plants a boost of nutrients in the form of fertilizer. Fertilizer can be purchased at the store, but you can make your own fertilizer in a worm bin or compost pile.

Take a look at these nutrients commonly found in plant fertilizers. Think back to the previous lesson. Do they look familiar?

- **Calcium**
- **Iron**
- **Manganese**
- **Zinc**
- **Copper**
- **Magnesium**
- **Potassium**

**connective tissue** binds, supports and protects other tissues in the body. It also forms blood, stores fat and fills space.

**epithelial tissue** covers body surfaces and lines body cavities.

**muscle tissue** contracts to allow movement, including that of your head, torso and limbs, as well as that of your heart.

**nervous tissue** transmits messages to and from your brain and controls all body activity.

**ground tissue** anchors and supports the plant and stores food.

**dermal tissue** covers and protects the plant, almost like a skin.

**vascular tissue** transports water and nutrients through the plant.
LIVING SYSTEMS

if you build it, part 2

**LS 3.8.16.** Identify genetic traits that make organisms more likely to survive and reproduce in a particular environment. (This lesson will focus on genetic traits applicable to chickens.)

1. **What type of tissue would you find lining the mouth?**
   a. Nervous
   b. Epithelial
   c. Dermal
   d. Muscle

2. **Which of these is not an animal tissue?**
   a. Nervous
   b. Connective
   c. Dermal
   d. Muscle

3. **Name the four types of tissue found in the human body:**
   1. 
   2. 
   3. 
   4. 

4. **Name the three types of tissue found in a plant:**
   1. 
   2. 
   3. 

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**Take it Home**

Muscle tissue needs to be worked in order to stay strong. Make a point to work your muscles tonight!
1. **What type of tissue would you find lining the mouth?**  
   b. Epithelial

2. **Which of these is not an animal tissue?**  
   c. Dermal

3. **Name the four types of tissue found in the human body:**  
   1. Connective  
   2. Epithelial  
   3. Muscle  
   4. Nervous

4. **Name the three types of tissue found in a plant:**  
   1. Ground  
   2. Dermal  
   3. Vascular