if you build it, they will come
part 1: hierarchical relationships of cells, tissues, organs and organ systems

△ FRAMEWORKS

SCIENCE
LS 2.6.3 Investigate the functions of tissues.
LS 2.7.1 Illustrate the hierarchical relationship between cells, tissues, organs and organ systems.
LS 2.7.2 Analyze how two or more organs work together to perform a function.
LS 2.7.3 Identify organ systems in vertebrates and plants.
LS 2.7.4 Analyze the structure and function of tissues, organs and organ systems of a vertebrate.
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
W 5.6.10 Write across the curriculum.
W 5.7.10 Write across the curriculum.
W 5.8.10 Write across the curriculum.

△ OBJECTIVES

The students will learn:

OBJECTIVE #1 To list the level of organization of the human body.
OBJECTIVE #2 To define cells, tissue, organs and organ systems and explain their function.
OBJECTIVE #3 To explain the importance of fruits and vegetables for healthy organs and organ systems.
OBJECTIVE #4 To appropriately use verbal speaking skills in class discussion with the teacher and Garden Program Specialist.
Cells, tissues, organs and organ systems are fueled by nutrient-rich fruits and vegetables like those found in the garden.

**OVERVIEW**

The basic structural unit of all living organisms is the cell. Very simple organisms have only one cell; larger and more complex organisms are made of many trillions of cells. In the human body, cells are organized into tissues, which make up organs, which are parts of major organ systems, which interconnect and depend on each other to sustain the whole organism. To perform well, organs and organ systems rely on nutrients from fruits and vegetables.

**GARDEN ACTIVITIES**

▲ 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. Determine how the “Levels of Organization of the Body” and “Benefits of Fruits and Vegetables” visuals will be used and prepare appropriately.

2. Prepare your student discussions by checking with the Garden Program Specialist to determine which fruits and vegetables on the “Benefits of Fruits and Vegetables” table are growing in the garden.

**LESSON OUTLINE**

<table>
<thead>
<tr>
<th>activities</th>
<th>estimated duration</th>
<th>actual duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>in the classroom</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>▲ Offer the icebreaker</td>
<td>5 minutes</td>
<td></td>
</tr>
<tr>
<td>▲ Explain how organisms are organized into cells, tissues, organs and organ systems</td>
<td>15 minutes</td>
<td></td>
</tr>
<tr>
<td>▲ Display and discuss the “Benefits of Fruits and Vegetables” table and the relationship between healthy organs and fruits/vegetables.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>in the garden</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>▲ Plant, harvest and work in the garden following the Garden Guide</td>
<td>15 minutes</td>
<td></td>
</tr>
<tr>
<td>▲ Examine and discuss the fruits and vegetables in the garden that appear on the table</td>
<td>5 minutes</td>
<td></td>
</tr>
<tr>
<td>▲ Taste test fresh produce as available</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>back in the classroom</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>▲ Hand out Student Learning Workbooks, review and assign “Take it Home Activity” as homework</td>
<td>5 minutes</td>
<td></td>
</tr>
</tbody>
</table>

**TIPS FOR THE GARDEN**

*Pre-lesson preparation:*

1. Prepare garden activities for students that work with one or more of the fruits or vegetables on the “Benefits of Fruits and Vegetables” table.

2. Prepare to discuss students’ observations about which organ systems work harder during gardening activities and the benefits of fruits and vegetables for those organ systems.
# LESSON PLAN

## I. Start in the classroom

### A. Icebreaker

Offer the icebreaker. Ask the students: “How many cells do you think the human body has?”

**ANSWER:** over 75 TRILLION!

### B. Present Main Topic

- Display Levels of Organization of the human body visual and explain how living organisms consist of basic structural units, which are organized into cells, tissues, organs and organ systems.
- Describe the function of cells, tissues, organs and organ systems.
- Display “Benefits of Fruits and Vegetables” table and explain the importance of these foods for organs and organ systems.

## II. Take class to the garden

- Plant, harvest and work in the garden following the Garden Guide. During garden activities examine and discuss the health benefits of fruits and vegetables on organ systems.
- Ask students to observe which organ systems are working harder as students garden and how they need good fuel to feed organ systems during any activity.
- As available, harvest and taste fruits and vegetables on the “Benefits of Fruits and Vegetables” table (basil, tomatoes, peppers, etc.)

## 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, tissues, organs, and organ systems are fueled on nutrient rich foods like those found in the garden. Current research demonstrates that the vitamins and minerals found in garden fruits and vegetables improve the function of our organ systems and their ability to interact with each other. Although research is still exploring the ways that fruits and vegetables nourish our bodies, we know that they play an essential role in preventing heart disease, cancer, diabetes, obesity, visual impairment, and much more.

The “Benefits of Fruits and Vegetables” table (following page) describes which fruits and vegetables benefit certain organ systems. Note that this table only describes a very few of the health benefits of fruits and vegetables that are typically found in the garden.

This table is a handy tool when discussing organ systems and how these systems are fueled by the food students grow in the garden. Use this table while in the garden to discuss some different garden fruits and vegetables and the ways they benefit organs and organ systems.

EXTENSION

Instruct students to design an experiment and/or perform research regarding different fruits and vegetables in the garden that are not on the “Benefits of Fruits and Vegetables” table. Allow each student to choose or assign each student a fruit, vegetable or edible plant. Consider the following questions:

▲ What is the vitamin and mineral content in the fruit/vegetable?
▲ What is the health benefit? Which organs and organ systems does it benefit?
▲ What is the role of those organ systems and why is it important for them to function properly?

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.

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

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

The Health Value of Fruits and Vegetables
http://www.extension.iastate.edu/Publications/PM1855.pdf

Veggie Facts Sheets
http://goodlifegarden.ucdavis.edu/blog/2011/01/eggplants-the-mad-apple/
<table>
<thead>
<tr>
<th>Fruits/ Veggies</th>
<th>Organ Systems</th>
<th>Vitamin/Minerals</th>
<th>Benefits</th>
</tr>
</thead>
</table>
| Peppers (all colors) | Immune, Skeletal, Nervous, Cardiovascular, Endocrine | Vitamin C, Vitamin A, Vitamin E, Thiamine (B1), riboflavin (B2), & niacin (B3) | ▲ Helps you sleep  
▲ Improves your mood  
▲ Prevents several diseases  
▲ Prevents signs of aging  
▲ Prevents skin problems, like acne |
| Tomatoes (all colors) | Immune, Cardiovascular, Skeletal, Nervous | Vitamin A, Vitamin C, and Vitamin K | ▲ Builds strong bones  
▲ Helps blood clot to heal wounds  
▲ Helps vision |
| Strawberries | Immune, Cardiovascular, Endocrine, Digestive, Nervous | Vitamin C, Vitamin K, Manganese, Potassium, Omega-3 fatty acids, Magnesium | ▲ Helps regulate blood sugar  
▲ Rids body of toxins |
| Corn | Immune, Digestive | Vitamin C, Vitamin B1, Vitamin B5, & Folic Acid | ▲ Gives you energy  
▲ Helps with motion sickness  
▲ Improves your mood  
▲ Prevents signs of aging  
▲ Prevents several diseases |
| Summer Squash | Immune, Cardiovascular, Endocrine, Skeletal | Vitamins A, Vitamin C, & Niacin | ▲ Builds strong bones  
▲ Helps you sleep  
▲ Regulates blood sugar  
▲ Rids body of toxins |
| Winter Squash | Nervous, Circulatory | Vitamins A, Vitamin C, Iron, & Riboflavin | ▲ Helps vision  
▲ Prevents skin problems, like acne |
| Basil | Skeletal, Cardiovascular, Nervous, Immune, Digestive | Vitamin K, Vitamin A, Calcium, and Iron | ▲ Builds strong bones  
▲ Helps blood clot to heal wounds  
▲ Helps vision  
▲ Maintains strong bones  
▲ Settles the stomach |
| Cucumbers | Cardiovascular, Skeletal, Immune | Vitamin K, Vitamin C, Potassium, Magnesium, Manganese, Vitamin B | ▲ Anti-inflammatory  
▲ Builds strong bones  
▲ Gives you energy |
| Spinach | Nervous, Skeletal, Immune, Cardiovascular | Vitamin A, Vitamin C, & Vitamin K | ▲ Builds strong bones  
▲ Helps vision  
▲ Helps blood clot to heal wounds |
| Eggplant | Immune, Nervous | Vitamin B6, Vitamin C, Vitamin K, Copper, Manganese, Potassium Magnesium, Thiamine, & Phosphorus | ▲ Prevents diseases  
▲ Rids body of toxins |
| Onions | Immune, Endocrine, Cardiovascular, Muscular, Skeletal | Vitamin C, Vitamin D, Potassium, & Phosphorus | ▲ Lowers Blood pressure  
▲ Prevents diseases |
| Potatoes | Immune, Nervous, Cardiovascular, Endocrine | Vitamin C, Thiamine (B1), Riboflavin (B2), & Niacin (B3) | ▲ Helps with motion sickness  
▲ Helps vision  
▲ Helps you sleep  
▲ Improves ability to learn  
▲ Prevents skin problems, like acne |
Levels of Organization of the Human Body

LEVEL 1:
cells
(example: smooth muscle cell)

LEVEL 2:
tissues
(example: muscle tissue)

LEVEL 3:
organs
(example: lung)

LEVEL 4:
organ systems
(example: respiratory system)

LEVEL 5:
organism
(example: human being)
study guide for students

All living organisms consist of basic structural units too tiny to view with the naked eye. These tiniest building blocks are called cells. You’ve learned about cells and their basic structure in other classes. Some organisms consist of just single cells, such as bacteria. Not surprisingly, you can’t see bacteria—they are too small. It requires a powerful tool, a microscope, to magnify them under special lenses so they become visible. Larger organisms have more cells. Very complex organisms, like human bodies, consist of more than 75 trillion cells.

Undoubtedly, you have realized that your body can do lots of different things—thanks to its many, many cells that perform different functions. Brain cells let you think, skin cells provide protection, blood cells transport materials through your body, and so forth.

Cells don’t work alone, they work in groups. They are organized according to the functions they perform. That allows them to do their work more efficiently. A group of cells that do the same job make up tissue.

Two or more tissues working together to get a job done are called organs. Organs perform more complicated jobs than tissues. Your stomach is a major organ that depends on various tissues to digest food. For example, three layers of muscle tissue contract in different directions to mash the food and push it in different directions and tissue from the lining produces acids to help break down food.

All organs are parts of organ systems. These systems interact together and depend on each other. The stomach is part of the digestive system. Other organs that make up the digestive system include the mouth, the esophagus, the small and large intestines, the salivary glands, and more. Put all the organ systems together and you have a whole organism.

The human body’s organ systems:

▲ Skeletal: To protect and support the body
▲ Muscular: To allow body movement
▲ Digestive: To break down food into nutrients and waste
▲ Excretory: To remove waste from the blood
▲ Circulatory: To move oxygen, nutrients and waste through the body

Continued next page
▲ **Nervous:** To control body movement, behavior and thought
▲ **Respiratory:** To supply oxygen to the body
▲ **Endocrine:** To control growth, development and reproduction
▲ **Reproductive:** To produce reproductive cells and offspring
▲ **Immune:** To protect the body against diseases and infections

If one organ system malfunctions or breaks down, the health or survival of the whole organism is affected.

Organs can malfunction for a number of different reasons. One way to prevent the failure of organ systems is to eat healthy foods, like fruits and vegetables. These foods provide each organ and organ system with important vitamins and minerals that your body must have to function, whether you are gardening, studying or watching television. For example, tomatoes are high in vitamin C which is essential for the immune system. The good news is that many of these fruits and vegetables, like tomatoes, can be grown in your garden and you are learning how!

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  (example: smooth muscle cell)

**LEVEL 2:**
- **tissues**
  (example: muscle tissue)

**LEVEL 3:**
- **organs**
  (example: lung)

**LEVEL 4:**
- **organ systems**
  (example: respiratory system)

**LEVEL 5:**
- **organism**
  (example: human being)
LIVING SYSTEMS

if you build it, part 1

LS 3.6.2 Illustrate the hierarchical relationship between cells, tissues, organs and organ systems.

1. What do you call the basic building block, or structural unit, of all living organisms?

2. List the levels of organization of the human body.

3. Why is it important to eat fruits and vegetables?

Take it Home

Play Pocket Tag: Put a strip of cloth or a sock into each player’s back pocket. Set the timer or stop watch for 10 minutes. The players try to grab each other’s strips of cloth without having their own strip taken. The player with the most cloth strips wins.
1. What do you call the basic building block, or structural unit, of all living organisms?
   Cells

2. List the levels of organization of the human body.
   - Cells
   - Tissues
   - Organs
   - Organ systems
   - Organism

3. Why is it important to eat fruits and vegetables?
   Answers may vary.
LIVING SYSTEMS

if you build it, part 1

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LIVING SYSTEMS

if you build it, part 1

answer key

1. **What do you call the basic building block, or structural unit, of all living organisms?**
   
   *Cells*

2. **List the levels of organization of the human body.**
   
   ▲ *Cells*
   ▲ *Tissues*
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   ▲ *Organ systems*
   ▲ *Organism*

3. **Why is it important to eat fruits and vegetables?**
   
   *Answers may vary.*
LS 3.6.2, LS 2.7.1  Illustrate the hierarchical relationship between cells, tissues, organs and organ systems.

1. What do you call the basic building block, or structural unit, of all living organisms?

2. Similar cells working together to do the same job are called a(n):
   a. Organ
   b. Tissue
   c. Cellulose

3. List the levels of organization of the human body.

4. Why is it important to eat fruits and vegetables?
1. **What do you call the basic building block, or structural unit, of all living organisms?**
   *Cells*

2. **Similar cells working together to do the same job are called a(n):**
   *b. Tissue*

3. **List the levels of organization of the human body.**
   - Cells
   - Tissues
   - Organs
   - Organ systems
   - Organism

4. **Why is it important to eat fruits and vegetables?**
   *Answers may vary.*
Levels of Organization of the Human Body

LEVEL 1:

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Example: ______________

LEVEL 2:

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Example: ______________

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LEVEL 4:

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Example: ______________

LEVEL 5:

____________________
Example: ______________