


Digestion

The Science of Food:
Activity 6

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Digestion

This activity's objectives are aligned with the National Science Education Standards, specifically those related to Science as Inquiry and Physical Science. In this activity, students will learn about digestion and proteins by observing the action of meat tenderizer on luncheon meat. Students will make predictions, make and record qualitative observations, and draw conclusions.

Science concepts addressed in this activity include:

- Food must be broken down into smaller units before it can be used by the body.
- Digestion is the process of breaking food down.
- Special chemicals in the body break food molecules into smaller units.
- Proteins—found in all meats, dairy products and vegetables (especially peas and beans)—are important for muscles and cell growth and repair.

Student Worksheets

Student pages in the teacher's guide are provided in English and in Spanish.

Reference

Moreno N., and B. Tharp. (2011). *The Science of Food: Teacher's Guide*. Fourth edition. Baylor College of Medicine. ISBN: 978-1-888997-76-7. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698

from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

Image Reference

Photo courtesy of Hardyplants. Released into the public domain.
http://commons.wikimedia.org/wiki/File:Fruit_of_papaya.jpg

Key Words

food, foods, nutrition, digest, digestion, digestive system, mouth, teeth, chew, saliva, stomach, small intestine, large intestine, bacteria, liver, pancreas, chemical, enzyme, molecule, nutrient, absorb, amino acid, meat tenderizer,

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Materials



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Materials

Have students work in groups of 4 to conduct this activity.

Per Group of Students

- 2 clear, re-sealable plastic bags, sandwich size
- 1/2 slice of turkey luncheon meat
- 1/2 tsp of meat tenderizer or papaya enzymes (available at health food stores)
- Plastic, serrated knife

Setup

Before beginning the activity, you will need to obtain meat tenderizer (located in the spice section at the grocery store). You also will need a piece of sliced turkey luncheon meat for each group.

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Image Reference

Photo by JP Denk © Baylor College of Medicine.

Key Words

materials list, materials needed,

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Science Safety Considerations

- Follow all instructions.
- Begin the investigation only when instructed.
- Report accidents or spills.
- Do not eat the luncheon meat.
- Be careful when using the plastic knife.
- Wash hands thoroughly after the investigation.



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Science Safety Considerations

Students always must think about safety when conducting science investigations. This slide may be used to review safety with your class prior to beginning the activity.

Safety first!

- Always school district and school science laboratory safety guidelines.
- Have a clear understanding of the investigation in advance.
- Practice any investigation with which you are not familiar before conducting it with the class.
- Make sure appropriate safety equipment, such as safety goggles, is available.
- Continually monitor the area where the investigation is being conducted.

Safety Note. Caution students to not eat the luncheon meat.

References

1. Dean R., M. Dean, and L. Motz. (2003). *Safety in the Elementary Science Classroom*. National Science Teachers Association.
2. Moreno N., and B. Tharp, (2011). *The Science of Food Teacher's Guide*. Fourth edition. Baylor College of Medicine. ISBN: 978-1-888997-76-7. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes

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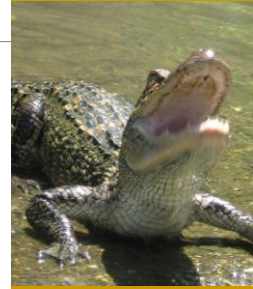
Key Words

science, classroom, safety, lab, laboratory, rules, safety signs,

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What's Really In That Mouth?

- Why do we have teeth?
- Why do we have saliva?
- Where does our food go after we swallow it?
- What parts of the digestive tract can you name?
- How long does it take to digest food?



Alligators have a complete digestive system and are known for their large mouth and teeth.



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What's Really In That Mouth?

To focus students' attention, ask, *Why do you think we have teeth?* Lead a class discussion about what happens to food as we eat it. Students should know that teeth are important to tear the foods we eat into smaller pieces that are easy to chew and swallow.

Then ask, *Why do you think we have saliva? What does saliva do during digestion? Where does our food go after we swallow it?*

Challenge students to think about the parts of the human digestive tract, and to name as many parts as they know. You also may want to challenge them to estimate how long it takes for a human to digest food. Tell students that food usually stays in the stomach for two to three hours, after which it passes into the small intestine, where it is combined with secretions from the liver and pancreas.

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Image Reference

Photo courtesy of Sidious1701. Released into the public domain.
http://commons.wikimedia.org/wiki/File:Gators_mouth.jpg

Key Words

digestion, digestive system, mouth, teeth, saliva, swallow, digestive tract, food,

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Let's Get Started

- Label your bags “1” and “2.”
- Cut the piece of luncheon meat in half and place one of the halves into bag 1 and the other into bag 2.
- Add ½ teaspoon of meat tenderizer to bag 2.
- Seal the bags and shake bag 2 so that the meat is coated with the tenderizer.
- Place the bags aside for one hour.
- Predict what will happen to the meat.
- After about an hour, observe and record the texture and color of the meat in both bags.



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Let's Get Started

In this activity, students will observe the action of meat tenderizer on luncheon meat. They will discover that chemicals in the body break down the proteins in meat.

Have the Materials Manager for each group collect 1/2 slice of turkey luncheon meat, a plastic knife and two re-sealable plastic bags. Instruct groups to label their bags “1” and “2.” Then, have students cut the piece of turkey in half. Students should place one section of turkey in bag 1, and the other section in bag 2, into which they also should add 1/2 teaspoon of meat tenderizer. Instruct groups to seal their bags and shake the turkey slice within bag 2 so that it is well coated with tenderizer. Have the students place their bags to one side of the classroom for about an hour. (If students will be making observations the following day, refrigerate the bags to prevent spoilage.)

Have students write, in their journals or on a sheet of paper, what they predict will happen to the slices of turkey. After an hour, have students observe the texture and color of the meat samples *without* removing them from the plastic bags. You may want to provide some interesting facts as students make their observations. For instance, meat tenderizer contains an enzyme called papain, which is extracted from the papaya plant. Enzymes break proteins apart into amino acids, smaller molecules that serve as the building blocks of new proteins for the body. And amazingly, enzymes themselves also are a kind of protein molecule!

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Key Words

lesson, experiment, luncheon meat, meat, meat tenderizer,

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Let's Talk About It

- What did the meat look like after it was combined with meat tenderizer for one hour?
- Did the color change?
- Did the texture change?
- Did your prediction match your observation?
- What do you think the meat tenderizer was doing to the meat?



Meat tenderizer contains an enzyme called papain, which is extracted from the papaya plant.



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Let's Talk About It

This activity introduces the concept that food must be broken down, both physically and chemically, before it can be used by the cells within an organism. Students learn about digestion and proteins by observing the action of meat tenderizer on luncheon meat, and they discover that the stomach serves as a powerful mixing machine in which food is combined with special chemicals (enzymes) that begin to break large food molecules into smaller ones.

Stimulate a class discussion about students' observations by asking, *What did the meat look like after it was combined with meat tenderizer for an hour? Had it changed color or texture?*

Have each group share its observations with the class. Then ask each group, *Did your observation match your prediction of what would happen when the meat was left in the bag with meat tenderizer? Ask students, What do you think the meat tenderizer was doing to the meat?* Explain that meat tenderizer is a chemical that helps to soften the muscle fibers in meat by beginning to break them down into smaller pieces.

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Image Reference

Photo courtesy of abcdz2000. Getty Images: Free Images\1124778.
<http://www.freeimages.com/photo/1124778>

Key Words

lesson, experiment, meat, meat tenderizer, color, texture,

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The Science of Digestion

- Food must be broken down physically and chemically before it can be used by the body.
- These special chemicals break down food molecules in the body.
 - Saliva
 - Stomach enzymes
 - Bile
 - Pancreatic fluid
- During digestion, proteins are broken down into amino acids, from which our bodies build new proteins.



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The Science of Digestion

In this activity, students learned about the following properties of food.

- **Food must be broken down, both physically and chemically, into smaller units before it can be used by the cells within an organism.** In humans, digestion begins in the mouth, where pieces of food are mechanically broken, by chewing, into smaller pieces. In addition, saliva mixes with the food and begins to break it down. After food is swallowed, other components of the digestive system—stomach, small intestine, large intestine, liver and pancreas—continue the process of making food available for use by cells in the body.
- **Digestion is the process of breaking food down.**
- **Special chemicals in the body break food molecules into smaller units.** Molecules such as saliva in our mouth, enzymes in our stomach, bile released from the liver, and pancreatic fluid from the pancreas, help break down the fats, proteins and carbohydrates from food into smaller molecules.
- **Proteins—found in all meats, dairy products and vegetables (especially peas and beans)—are important for muscle and cell growth and repair.** Proteins and their building blocks (amino acids) are vital to every cell in the body. Because humans are not able to make their own amino acids, they must consume at least a small amount of protein (equivalent to about 4 ounces of chicken white meat) each day. During digestion, proteins are broken down into the different amino acids of which they are made. The body then builds new proteins from these amino acids.

You might say that amino acids are recycled!

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Key Words

food, digestion, digest, saliva, enzymes, bile, pancreatic fluid,

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Extensions

- Investigate the importance of chewing by repeating the experiment using finely chopped luncheon meat, rather than a whole piece of meat.
- Use plant parts instead of meat. Does the meat tenderizer break down plant material too?
- Test whether meat or plant parts break down more if they are left in the meat tenderizer for a longer time.



Cattle are ruminants. This means they re-chew partially digested food.



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Extensions

- Students can investigate the importance of chewing by repeating the experiment using a finely chopped piece of luncheon meat and comparing the outcomes of the two experiments.
- Students can repeat the experiment using plant parts (such as spinach leaves or lettuce). Does the meat tenderizer break down plant material?
- Students can test whether leaving the meat or plant parts in meat tenderizer for a longer time affects how much they break down.

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Image Reference

Microsoft Office Clip Art.

Key Words

lesson, experiment, extensions, food, digestion, chew, chewing, plants, meat tenderizer,

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