Category V Life Science Examples

Encouraging students to think about what they've learned

Food, Energy, and Growth
The material gives students several opportunities to revise their ideas (pp. 13s, 21s, 23s, 34s), and all but one of these (p. 23s) asks students to consider how their ideas have changed.

So why is it important to know what's in foods?

Now that you have completed your food tests, you know that some foods have only protein, some have only fats, some have only starch or sugar, but most have combinations of two or more of these components.

In order to grow and obtain energy, your body must have all of these substances. Your body uses mainly carbohydrates and fats for their stored energy. Your body uses proteins to build new body parts when it grows or when it repairs itself. The materials in food actually become part of our bodies when we grow and gain weight.

But your body doesn't need each of these components in equal amounts! Many of us tend to eat too many foods with lots of sugar and fat (which we need only in limited quantities) and not enough of the starches and protein (which we need more of).

19. a) Use what you have learned to write answers to the two key questions at the beginning of Lesson 2:

What's the difference between good foods and "junk" foods?

How could you find out which is which?

b) How are your answers different now than when you first thought about these questions at the beginning of the lesson?

It is important to understand that some of these food components are used mainly for energy and some mainly to help us grow. Cluster 2 will go into more detail about what happens to these components inside your body, and Cluster 3 will go into more detail about how the body uses food for energy and growth.

The last lesson in this cluster explains *where* food is used in our bodies. Where do you think?

We also use proteins for energy if we need energy beyond our carbohydrate and fat supplies. See note on p. TG 48 about **vitamins and minerals.**

19. a) Students should include the following key points: Foods that help you grow must have the proper nutrients for growth. "Junk foods" have too much of some nutrients that we only need in small amounts and not enough of the others. Many students associate fat and sugar with "junk food" and think that all sugar and fat is bad for you. Since each is a nutrient, your body needs it—but in smaller quantities than most people eat.

You could determine which componenets are present in any particular food by performing the food test on the food.

b) Answers vary

Where is food used in our bodies? Many students believe that food is used in our stomachs. They have very little notion of the cellular nature of organisms, and that nutrients from food are needed by cells. If students suggest that food is used in our stomachs, you might get them to think more deeply about this by asking: If energy is released from food, and if your muscles need energy when they work, how does the energy get to your muscles. Students answers to this question are interesting. Some might picture the human body like a giant electrical circuit, with the stomach being the battery, sending energy out to muscles over wires. The idea that this unit develops is that the "energy" goes around the body as digested food (glucose), to be released as needed for various cell activities.

Lesson 2

I. One explanation is that the grinding of the oatmeal by your teeth produced the sugar. Do you agree? How could you test this?

II. Another possible explanation is that something in your mouth chemically reacted with the oatmeal to change it into a new substance. If this is true, what could there be in your mouth that could do that?

III. A third possible explanation is that the saliva in your mouth contains sugar, and it mixed in with the oatmeal as you chewed. What do you think about this? **How could you test this?**

1. Think over the three possible explanations above. Write in your journal *your* explanation for why sugar is produced when oatmeal is chewed.
2. Try any tests you can think of to prove or disprove any of the three possible explanations.
3. Do you think digestion starts in the mouth? If you said yes, what evidence do you have? If you said no, why?
4. Discuss your explanation with your group partners. After your discussion, make any changes that will make your explanation better.

I. You could test this by grinding up oatmeal outside of the mouth, in a mortar and pestle, and then testing it.

III. You could test for sugar already in your mouth by testing saliva. (It tests negative for sugar.)

1. Answers will vary, but most students will probably choose one of the three possibilities stated at top of page.

2. If students test chewed oatmeal for sugar, they should also test saliva to determine if it has any sugar itself (it doesn't.). This would allow them to decide on whether they believe the 3rd possible explanation (III). (It is often helpful to chew on a clean rubber band or paraffin to produce saliva. Students should not test their saliva after eating.)

3. Digestion is the *chemical* breakdown of foods. It begins in the mouth when saliva chemically reacts with starches to form sugars (simple and smaller molecules.)

4. If students chose I or III, they may change to II after testing saliva and discussing the test results with their group partners.

Lesson 5

D. **Use one square of gelatin as the control (what does that mean?) Then sprinkle both sides of the other piece of gelatin with one-quarter teaspoon of meat tenderizer.**

E. After 2 minutes, poke the gelatin *gently* with a stirring rod to check its consistency. You may notice that water also comes out of the gelatin, but in this activity, you are mainly concerned with the consistency of the gelatin. Record your observations. Repeat this test at 5-minute intervals for at least four observations, more if time permits. Keep recording.

Think, write, and discuss

1. At the end of this experiment, how is the control gelatin different from the gelatin treated with meat tenderizer?

2. **Draw a conclusion from your observations:** In which case was the gelatin actually broken down or "digested"—the control or the one treated with meat tenderizer?

3. Look at the label on the meat tenderizer and decide which ingredient is responsible for this reaction. The chemical substance which actually breaks up the gelatin is—can you guess?—an enzyme.

4. Now think about real meat and how meat tenderizer works.
   a) Meat tenderizer reacts with which nutrient in meat?
   b) What does it do to that component?
   c) How do you think meat tenderizer works?

5. a) Explain, in your own words, using a couple of sentences, what happens to proteins in your body after you eat them. Talk about where the foods containing protein travel, what happens to them along the way, and what chemical substance is necessary for this to happen.

   b) Add to your drawing and explanation from Lesson 4, or start a new drawing, to show what you're learning that's new. Save your drawings for later use.

6. **Speculate:** Where in your body do you think the chemical substance—the enzyme—that breaks down protein could come from?

Step E requires students to check on the consistency of their gelatin every 5 minutes over a period of 20 minutes or so. During this time, you may want to have them write in their journals first a prediction about what they might see, and then their own speculation about what is happening. That is, their "observations" might include more than just a note about the appearance of the gelatin—they may also include some analysis of what might be happening. They should especially come to see the difference between any water that leaves the gelatin, and the product of the chemical reaction, which might look "watery." You may want to ask students to clarify their notes if they suggest that the gelatin is turning watery. Do they mean that it's turning into water, or simply changing to the *consistency* of water?

1. The control stayed very hard and firm while the one with the meat tenderizer got very soft and liquid-like.

2. The treated one.

3. Usually papain, a derivative of the papaya plant.

4. a) Protein.
   b) It helps digest the protein and make it soft and not so tough.
   c) It is an enzyme that chemically changes the protein so it can be used by cells.

5. The **key points** are:

- the protein enters your mouth (where it is crushed and ground as it is chewed).
- it goes through the esophagus to the stomach where the protein is mixed with enzymes that begin to chemically change it into simpler substances.
- it then leaves the stomach and goes into the small intestine where it is mixed with more enzymes that continue the process of chemically changing it into

6. Students' answers vary. It may be interesting to ask them why they think what they do. It comes from the walls of the stomach and small intestine and from the pancreas.

Lesson 6

Key concepts that should be included are:

- the digestive system includes the mouth, esophagus, stomach, and small intestine.
- digestion begins in the mouth.
- the enzymes in saliva change some starch into sugar.
- enzymes in the stomach begin to break down proteins into amino acids.
- enzymes in the small intestine continue to break down starch and protein while other enzymes in the small intestine break down fats into fatty acids.
- glucose, fatty acids and amino acids are small enough to get out of the small intestine, into and out of the circulatory system (which carries it to cells) and finally into each and every cell.
- all cells use digested food for energy and growth.
- undigested food passes from the small intestine to the large intestine and then out of they body as feces.

You might write a list of words on the board that students should use in their story, such as: digestive system, circulatory system, digest, mouth, small intestine, enzyme, stomach, amino acid, cells, blood vessels, glucose, fatty acids. You might have students participate in formulating the list.

THE DIGESTIVE AND CIRCULATORY SYSTEMS: Putting it all together

Lesson 9

In the first lesson of this cluster, you explored your beginning ideas about the path that food follows in your body and what happens to it along the way. In the lessons that followed, you experimented with chemically changing food, just as it's changed in the digestive system. You also built models of how food moves from the digestive system, through the circulatory system, to the cells, where it's used.

You might have discovered that your ideas about what hapens to food changed as you worked through this cluster. Now would be a good time to finish your second drawing of the human body (from Lesson 6). This will be a good way of organizing all you know about where food goes after you eat it, and what happens to it to prepare for its arrival in the cells.

A. Check your drawing to make sure that it includes the major parts of the digestive system. Label each part with its name.

B. Add to your drawing the path that digested food takes to get to a cell in a leg muscle and maybe a cell in your brain. Label this "path."

C. Think about how a heart would fit into your drawing, to show how blood is pumped around the body. Add the heart and attach it to the blood vessels.

D. Then write a short essay. Pretend that you're a piece of food—pick out one of your favorites—and write a story about what happens to you after you're eaten.

E. How did your ideas about what happens to food inside your body change as you worked through this cluster?

F. What questions do you have at this point about how our bodies use food?

Now get ready to shrink yourself down to the size of a cell and think about what goes on in every living part of your body! On to Cluster 3!

Lesson Statement: Students complete the picture they made at the beginning of the cluster and write a story about the food trip as a way of solidifying what they learned in this cluster.

Purpose: To pause and think and write about what has been learned about the food trip and to see what questions remain.

Approximate Time: 1 class period.

Lesson 9