

Category II Summaries for Life Science Examples

Assisting teacher in identifying own students' ideas

Food, Energy, and Growth

The module includes several questions to assist teachers in identifying their own students' ideas. The *Teacher's Guide* notes that "Key Questions...for each cluster or lesson...will give you some insight into their thinking" (p. **1t**). Key Questions relate to several of the key ideas. For example, the following question is used to find out what students think about the idea that food provides molecules that serve as fuel and building material for all organisms: "Why do people—and all living things—need food?"(p. **1s**). Questions like "Where do you think that food finally winds up in your body, so that it can release its energy or help you grow?" (p. **14s**) and "How do we get we get energy out of food?" (p. **35s**) are used to elicit students' thoughts about the idea that extracting energy from food is carried out within the cells. For the idea that food must first be digested into molecules in order to be used, students are asked to draw a diagram showing what they think happens to food in the body (p. **18s**). Each of these questions (and a few others) are (a) specific to benchmark ideas and commonly held ideas students have about them, (b) are identified as serving this purpose, (c) are likely to be comprehensible to students, and (d) ask students to make predictions or give explanations about phenomena. A few questions include suggestions for how teachers can further probe their students' ideas (e.g., "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? [p. **13t**] or "If you read some papers that use complex terms without explaining them, you may want to ask those students what they mean by those words" [p. **18t**]). However, this does not occur consistently. Furthermore, no annotated samples of student work are provided.

WHY DO LIVING THINGS NEED FOOD?

Cluster
1

Think about your favorite meal.
Think about all the foods you can buy at the grocery store or a farmers market.
Think about all the foods advertised on T.V.

Why do you eat the foods you eat? Why does anyone eat food? What happens to people when they don't get enough good food? What happens when they eat too much "bad" food?

Think of all the foods that are "good for you" that you don't like, and all of the "junk foods" that you do like. What's the difference between "good" foods and "junk" foods?



Many questions are posed in this unit simply to stimulate class discussion. Questions marked with numbers are ones that students should write answers to. We recommend that students use a journal, or "science log" for writing answers to questions so they can refer back to their earlier ideas when appropriate. They can also use the journal for recording observations and data from lab activities.

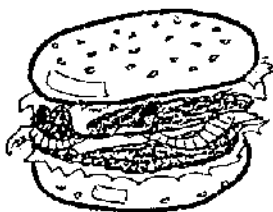
Key Questions

Why do people—and all living things—need food?

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

Where is food used in our bodies?

The Key Questions in this unit are the "objectives" for each cluster or lesson. When they are first presented in the cluster or lesson, they are for stimulating discussion, activating students' prior knowledge, and giving an idea of what's ahead. Don't ask for or give definitive answers at this time—they will be developed during the cluster. But do ask students to voice their present ideas. This will give you some insight into their thinking, and perhaps stimulate some initial debate and questions that will carry through the cluster.



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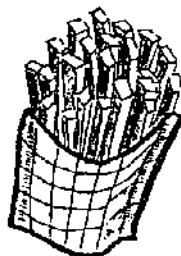
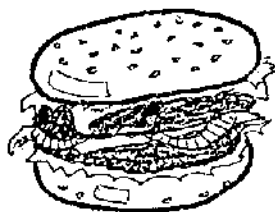
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WHERE THE ACTION IS — THE CELLS

Lesson 3



Let's review:

1. People need energy from food for all life activities; different components from food are needed for growing well. (How cells extract the stored energy in food (cellular respiration) and how cells and organisms grow (protein synthesis) are discussed in Cluster 3.)

1. You have learned that food does *two* things for people. To the best of your ability, explain what those two things are.



If you said that food gives people energy and helps people grow, you are on the right track. You also need to say

- *why* people need energy and
- *what* it is about food that helps people grow.

Many students have the naive notion that food goes into their stomach, is changed in some way, and goes out through their rectum. Most students don't know much about cells. They might know about blood cells, but only a few know that cells make up nearly every structure in our bodies, and that food needs to travel to all cells for their activities.

Let students write their initial thoughts on this question *before* any class discussion, then open up discussion for brainstorming. The idea of cells is developed through this entire lesson.



Key Question

Where do you think that food finally winds up in your body, so that it can release its energy or help you grow?

If your leg muscles need energy to help you run, does your body actually take food to your legs?

If your eyelid muscles need energy to wink, does your body have a way of getting food to your eyelids?

Or does food just go to your stomach, get changed somehow, and come out the other end?

Let's begin to discuss these questions by thinking about what makes up your body.

If you look through a very powerful microscope at skin, what will you see?



If you look through a magnifying glass at the skin on the back of your hand, you will see skin details—the hairs and what they come out of, the little cracks on the skin, places that might be dry and dead.



Lesson

3

Lesson Statement: After thinking about what cells are and where they can be found, students make a sand sculpture as an analogy to the cell structure of living things.

Purpose: To help students reconstruct any prior knowledge about cells, and further develop the idea that every single part of a living organism is made up of cells.

Approximate Time: 1 class period. See Advance Preparation in blue pages.

HOW AND WHERE IS FOOD USED IN HUMAN BODIES?

Cluster
3

Have you ever had the experience of waking up late and rushing off to school hungry? Or have you been involved in some activity and had to postpone dinner for several hours? Can you remember how you felt? You probably had that hungry feeling in your stomach, but was your body tired too—did you feel like you didn't have very much energy?

In this cluster, we will take an imaginary trip down into the cells to see how they actually use food to supply the energy you need, and how cells actually use the building blocks of food to help you grow and repair damaged body parts.

In Cluster 3, you will try to come up with answers to two very important questions:

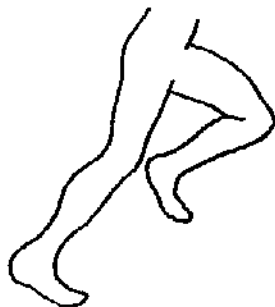
Key
Questions

How do we get energy out of food?

Why do you have to eat well in order to grow?

The key questions are the objectives for this cluster. Students should be able to answer them by the end of the cluster.

Take a few minutes to write down your ideas about each of these questions. Also, write any additional questions that might come to your mind as you think about them.



SOME OF THE MILLIONS OF ACTIVITIES THAT YOU PERFORM EVERYDAY:

- moving your legs when you run
- moving the muscles of your face and vocal cords when you talk or laugh
- causing electrical signals to move through your nerves when you touch something hot
- making new skin to cover over a cut

As you do more of this cluster, your answers to these questions will probably become more detailed and more in-depth. They might even change as you think about how our bodies really use food.



THE FOOD TRIP, Part 1: The digestive tract

Lesson 4



This lesson is a preassessment for Cluster 2. If students work on this activity individually, you will have a record of what they believe before instruction, which will help you understand better and respond to their questions throughout the cluster.

1. Student pictures will vary greatly in the parts they include. Some will show only the mouth, throat, and stomach. Others might show more. Don't give them clues here about what other parts to include. They should discover these and add to the picture as you continue the cluster. Have students keep these drawings, since they will add to them, and you may want an opportunity later in the cluster to talk with them about some part they included in the early drawing.

2. Students at this age often think of the food's path as going straight to the stomach, then out through the excretory organs. Their ideas about what happens along the way are often vague and naive, such as "food changes to energy when it's digested."

It is important that students explain the processes in their own words and not try to use vocabulary that may have no meaning to them. If you read some papers that use complex terms without explaining them, you may want to ask those students what they mean by those words.

3. Answers vary.

Once you swallow, the food you eat starts on a fantastic trip down into your body. Think for a minute about eating a tuna fish sandwich. What happens to that sandwich after you swallow it? Where does the food go?

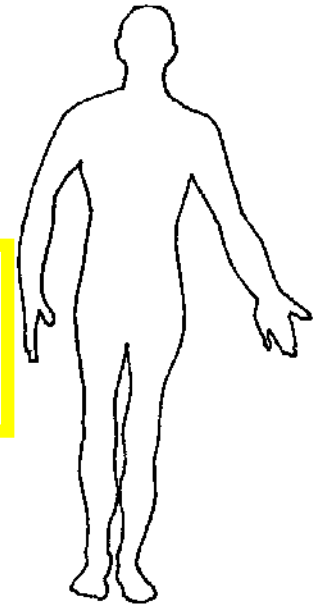
How far can you trace food on its trip into your body?

1. On an outline picture of the human body (labeled "My first drawing of the food trip"), draw in any parts or organs you think your food goes through, and label them. Use lines and arrows to show where the food goes.

2. Write a short paragraph under the drawing to explain what you believe about the path food takes in your body, from where it's eaten to where it's used. Explain what you believe happens to food as it travels through your body.

3. Think of two questions you have about how, where, and why food is digested. Write them on the same page with your drawing and paragraph.

4. Save your drawing to refer to later.



Most of you probably included a stomach in your drawing. Most people know that food travels to the stomach. The really important question here is

Does food get used for energy and for materials for new cells *right in the stomach*, with the waste products moving farther down and passing out of the body? Or does food go somewhere else?

Be very thoughtful about this question. We talked a bit about cells in Cluster 1. What do cells have to do with digestion and the food trip?

Lesson 4

Lesson Statement: Students show what they know about the path of food in the human body by drawing the organs involved in this process on a picture of a human torso and then writing about the process.

Purpose: To explore students' prior knowledge about what happens to food after they eat it.

Approximate Time: 1 class period.

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 components 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

THE FOOD TRIP, Part 1: The digestive tract

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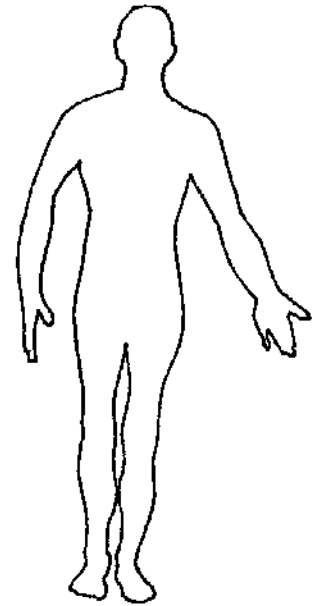
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