Category IV Life Science Examples

Representing ideas effectively

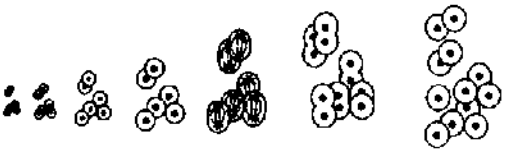
Food, Energy, and Growth - Example 3
The representation of cell growth and division is neither labeled nor explained well enough for students to appreciate that cells grow by adding new material (p. **48s**). Another representation (of the prerequisite idea that living things are made up of cells) could reinforce the misconception that cells are *inside* the body rather than that they *make up* the body. While students make a sand model of a living organism and are asked how the sand organism is like and different from the real thing (p. **16s**), the diagram shown in the text has a solid line around the body, implying that there is *something* that encases the sand particles, or, analogously, *something* that encases the cells in the human body. Given that many students think of the body as something that *encases* cells, the use of this solid line is problematic (requiring, at the least, a note to the teacher pointing out the need to make clear to students this important distinction between the model and the real thing).

20!/2 =

G. How many different proteins could be made from various combinations of the 20 amino acids? Could you use a calculator to make some kind of approximation? Try it!

Actually, scientists have analyzed many different proteins to find out which amino acid building blocks they are made of. They have found that protein molecules consists of anywhere from 50 to more than 10,000 amino acid molecules, where each amino acid can be used more than once—in fact, they can be used numerous times. Think that gives nature enough combinations to play with?

All of the proteins that make up our body parts are made by our cells—tiny little factories using amino acids from digested food as raw materials. When you grow, your cells make new proteins, and add them to their own internal structures. As the cell gets larger, it divides and forms new cells. More and more cells are added to your muscles (skin, blood, etc.) as you grow. Your new cells come from the food you eat!



As each cell makes new proteins, they are added to the cell. As the cell gets larger, it divides, forming 2 cells and starting the process all over. This is how you grow!

To review:

3. Explain, as completely as you can, what happens to a muscle when you grow.

4. How does food help a teenager get taller?

5. How does food help a lizard regenerate a tail that gets torn off?

6. How does food help a plant increase its size?

3. New proteins are made from the amino acids of our digested food. When the cell is big enough, it divides and forms new muscle cells.

4. Vegetable and animal proteins in food are digested into amino acids, which are delivered to the cells by the blood. They are assembled into new proteins inside the cells. Glucose from our food provides the energy needed for all of these growth processes.

5. This process is exactly the same in animals as in humans. In this case, the new proteins are formed in cells in the tail stump.

6. Plants can make their own amino acids from the glucose they make in photosynthesis and the minerals they take in from the soil. Their growth process is essentially the same, then, as in animals.

What happens to *extra* material from the food you eat that is *not* needed for energy, or that is *not* used for growing or repairing your body? Your body makes fat cells out of it! Extra food you eat that isn't used for energy and isn't used for new materials is *stored* by your body as fat cells for later use. Some animals do this to prepare for winter, when food is very scarce. Plants store extra food as starch (not fat) so they can live when there's not enough sunlight to make their own food. (People also store extra carbohydrates as starch for short term use.)

Lesson 12

At first, students may feel insulted by the level of this activity, but usually they will get into the sculpture part of it quickly. Be sure, however, that they realize why they are doing this--that they understand the similarity between grains of sand of their sculpture and cells of all living things. Also, help them realize that just as grains of sand come in different sizes, shapes and colors, so do cells in all living things. Heart cells are different from skin cells, and different again from blood cells, etc.

Their sculpture is different from living organisms in several ways. The most important way is that the "cells" in their sculpture are not organized into tissues and organs, like the heart, the liver, bones, muscles, the brain, etc.

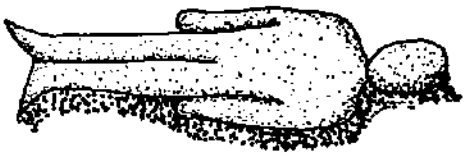
3. By now students are beginning to construct the idea that food has to travel to every place in our bodies--to all cells--to be used for energy and growth. They might ask some questions like "Does food go to the end of your fingers?" or "Does food go into your brain?"

But they also might still be thinking that food needs to travel only to those places where you are growing, or only to those places that obviously need energy, like muscles. They should develop an understanding that every cell in our bodies has a place in making our bodies work correctly, and each cell needs energy.

Try This

A. Take a cup full of wet sand. Mold and shape it to look like a living organism of some kind: a person, a plant, an animal. Describe in your journal how the sculpture resembles a real person, plant or animal. Think about what each grain of sand represents. Also describe how this sand model is different from a living organism.

All of your body's cells are living. They need food and oxygen just like all living things do. They get rid of waste products, just like all living things do. They're busy all the time, doing all different kinds of things. You'd be surprised at the different activities that go on in cells.



So now the question is, does the food you eat go to your stomach, get used somehow in your stomach, and then go straight out through the other end?

Or does the food you eat perhaps just get *changed* somehow in your stomach, and then move to your cells, to be used in your cells? Choose one of these two possibilities that you think makes the most sense to you at this time. To make this choice, think about this: Where does your body need fuel for energy? Where does your body need "raw materials" for building new muscles, skin, blood, etc. as you grow?

We'll continue to talk about where food is used as the unit goes on.

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Does this discussion make you think of other questions about food, energy, and cells?

3. Write any other questions you would like to find answers to in your journal.

Cluster 2 covers where your food goes after you chew it. You may be surprised!

Lesson 3