

5.3: How do Animals Digest Food? Reading

Purpose for Reading: As you read this text, work to make sense of how animal body systems break down matter so that animals are able to grow, move, function.

Zooming into Eating and Digestion

Scientists work to explain things we can observe—like animals growing, moving, and functioning—by “zooming in” to the smaller systems that animals are made of—cells—as well as the molecules that make up cells. Let’s zoom into an animal to figure out how animals break down the food they eat.

Macroscopic scale: We observe animals eating at the macroscopic scale. A cow eats grass. What is happening inside the body at the microscopic and atomic-molecular scales to the food the cow eats?

Cellular scale: Every cell in a cow's body needs food. All animals need a way to breakdown food (digestion) into small organic molecules, move the small organic molecules to cells all over the body (such as bone cells, nerve cells, muscle cells) so that the cells function (cellular respiration and biosynthesis). How is the food the cow eats changed into matter and energy it can use to grow, move, and function?

Atomic-molecular scale: Large organic molecules in the grass are broken down into smaller organic molecules during digestion. These small organic molecules are carried to cells all over the cow's body by the blood. Small molecules enter cells all over the cow's body. The small organic molecules are changed through cellular respiration and biosynthesis into the forms of matter and energy needed for growth and movement.

Using Four Steps to Explain Digestion

We can explain digestion—the breaking down of food into small organic molecules—by answering the four numbered questions on the Three Questions handout:

1. How do molecules move to the location of the chemical change?

Food starts breaking down into smaller pieces as animals chew their food. Food continues to break down as it moves through the animal's digestive system. In both carnivores and herbivores, most digestion takes place in the small intestine.

2. How are atoms in molecules rearranged into different molecules?

Digestive cells in the stomach and small intestine produce molecules (enzymes) that can break large organic molecules (proteins, carbohydrates, and fats) up into small organic molecules (amino acids, glucose, fatty acids, and glycerol).

3. What is happening to energy?

The chemical energy stored in the high energy bonds (C-C and C-H) in the large organic molecules remains in the small organic molecules because those bonds are not changed.

4. How do molecules move away from the location of the chemical change?

The small organic molecules move out of intestine cells and into the blood. As the heart pumps, these important nutrient molecules are carried in the blood to cells all over the animal's body.

Digesting Fiber?

Ruminants (animals like cows, sheep, and goats) have enzyme-producing bacteria and special stomach chambers that allow them to digest high-fiber diets like hay and alfalfa. However, humans and most other omnivores lack these special adaptations. You might wonder why fiber is still recommended as a daily aspect of a healthy human diet.

There are two kinds of fiber in the human diet. Some kinds of fiber, called soluble fiber can be digested by humans. Soluble fiber is found in foods like oats, apples, and carrots. Soluble fiber slows the absorption of food from the intestines into the blood. This allows more nutrient absorption and reduces the risk of some medical disorders like high cholesterol and diabetes. Insoluble fiber is found in whole grain foods, nuts and vegetables; it cannot be digested by humans. However, this kind of fiber increases the bulk of food as it is digested. It helps a person to feel fuller after eating and makes it easier for the body to move food through the intestines. Both kinds of fiber are essential to a healthy human diet.

Most non-ruminant animals also need fiber in their diet for many of the same reasons as humans. For example, dogs and cats are primarily carnivores but need fiber to prevent digestive problems. If a dog or a cat does not consume enough fiber, it can lead to problems such as impacted anal glands. This is where fluid builds up and obstructs the end of the large intestine, requiring treatment from a veterinarian.

Reading Strategy

Reread this section of the text and complete the appropriate section of your *Matter & Energy in Animals Graphic Organizer*.