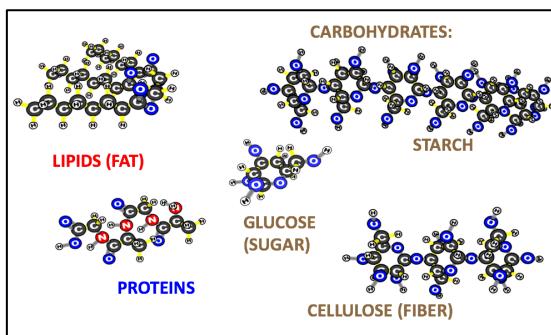


5.1: Tracing the Processes of Cows Growing: Digestion and Biosynthesis Directions

Materials:

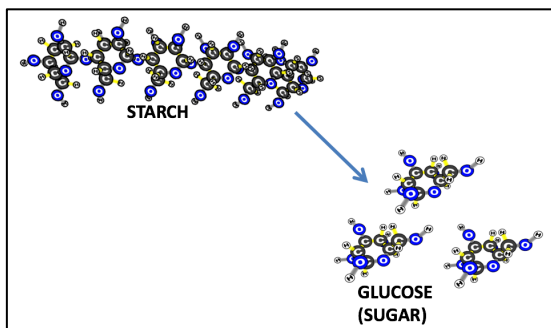
- 1 cow poster (11 x 17)
- 2 nickels
- 5 pennies

Procedure:



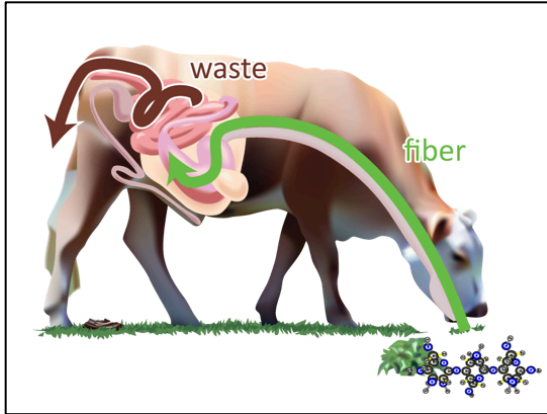
1. **Place your two nickels on the tuft of grass by the cow's mouth.** You do not need your pennies yet. Your nickels represent large organic molecules in grass or other food for the cow which contains fats, proteins, and carbohydrates. These large molecules cannot enter cells. However, cells need the matter and energy in these large molecules to grow and function. You can trace how large organic molecules in the cow's food provide matter and energy for all its cells.

2. Digestion starts when animals chew their food. As the cow swallows, the large organic molecules (nickels) in the food move from the mouth to the stomach. **Move your two nickels to the stomach and intestines.**



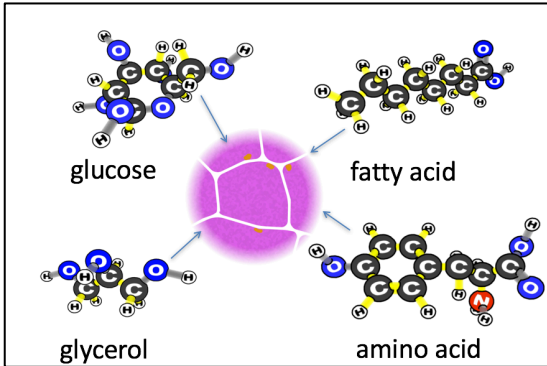
3. In the intestines, some of the large organic molecules (nickels) are broken into small organic molecules via digestion. For example, starch is broken down into glucose molecules. Represent digestion by **exchanging one of your nickels for five pennies.** **Place the pennies in the intestine.** You should now have five pennies and one nickel in the intestine.

Stop and think: Remember that large organic molecules have chemical energy, because they have C-C and C-H bonds. When large organic molecules are digested into small organic molecules the C-C and C-H bonds remain. *Based on this, what form of energy is present after digestion? Has the energy changed? Watch the animation of digestion in the PowerPoint.*

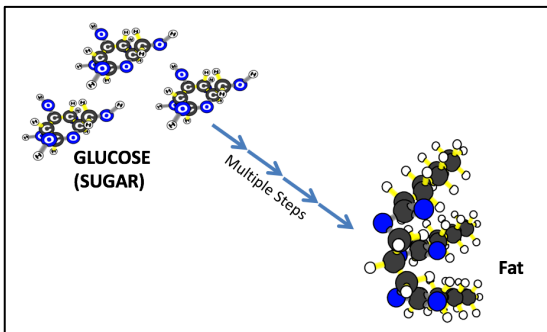


4. Animals can't digest all the food that they eat. Some organic molecules such as fiber leave animals' bodies as feces. **Move your remaining nickel, which represents the large organic molecule, fiber, out of the cow's body as feces.**

5. The small organic molecules (pennies) leave the intestines and enter the blood. Because these molecules are small, they can pass through the intestinal cells that line the intestine. The heart pumps the blood and the blood carries the small molecules to all parts of the cow's body.



6. The small organic molecules (the pennies) are carried by the blood to every cell in the cow's body. On the poster, circles represent different areas of cells (lung, heart muscle, leg muscle, intestine cell). **Choose one cell somewhere in the cow's body and move your pennies there.** These small molecules enter the cells, but don't come out. The cells combine some of the small organic molecules with oxygen to release energy. *What is this process called? What happens to the carbon atoms in those molecules?*



7. But cells use food in two ways. In addition to providing energy, the small organic molecules provide materials that cells use to grow and divide. In the cells, the small organic molecules are built again into large organic molecules. For example, in a series of steps, many glucose molecules can be combined into one fat molecule. This process is called biosynthesis and results in growth. **Exchange your five pennies for a nickel to represent biosynthesis.**

Stop and think: The small organic molecules with C-C and C-H bonds are combined into large organic molecules. *Based on this, what type of energy is present in the large organic molecules after biosynthesis? Has the energy changed? Watch the animation of biosynthesis in the PowerPoint.*

