4.2: How do Decomposers Get the Energy They Need to Move and Function? Reading

***Purpose for Reading**: As you read this text, work to make sense of how decomposer body systems move matter and energy into, around, and out of a decomposer so that decomposers are able to move and function.*

Zooming into Movement

Scientists work to explain things we can observe—like decomposers moving—by “zooming in” to the smaller systems that decomposers are made of—cells and the molecules that make up cells. Let’s zoom into a decomposer to figure out how it moves.

Macroscopic scale: We observe decomposers moving and changing at the macroscopic scale. Bread mold can be observed changing colors, growing in size, and spreading across the bread. What is happening inside the body at the microscopic and atomic-molecular scales to allow that movement to happen?

Cellular scale: Decomposers are made of cells that digest food on the outside. The fungal cells secret enzymes that break down complex molecules into smaller, simpler molecules that can be absorbed across the cell membrane. For example, a mold fungus that is growing on bread can break down the starch and fiber molecules into simple glucose molecules, which can be absorbed and used to produce forms chemical energy that the fungal cells can use during cellular respiration.

Atomic-molecular scale: Decomposers’ cells all need energy to do their work. The cells all rely on the same process to get their energy: cellular respiration, a process that releases energy by combining glucose and oxygen.

Using Four Steps to Explain Cellular Respiration

We can explain cellular respiration—and how decomposers get energy to move—by answering the four numbered questions on the Three Questions handout:

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

Cells need two kinds of molecules—glucose and oxygen—for cellular respiration. Here’s how they get each.

Glucose In: All fungi need a way to move glucose containing important matter and energy from where it is absorbed from a substance to every cell in the fungus. The hyphae of the fungus serve as a simple circulatory system that distributes glucose to cells all over the fungus.

Oxygen In: You had another kind of molecule on the reactant side of your chemical change placemat—oxygen. How did those six oxygen molecules get to the cell? Oxygen is absorbed individually by fungal cells or is carried to interior fungal cells by the hyphae.

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

Once the glucose and oxygen arrive in the cell they can go through a chemical reaction. Glucose reacts with oxygen to produce carbon dioxide and water. Here’s the chemical equation for this reaction:

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6\ CO_2 + 6\ H_2O$$

3. What is happening to energy?

Cells transform the chemical energy in the glucose molecules into energy for cell functions, motion energy, and heat. Because of cellular respiration, decomposers’ cells have access to the energy necessary to move. Every cell has a function; cellular respiration makes it possible for each cell to do its specific work.

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

Carbon Dioxide and Water Out: During cellular respiration, energy is released in the cell to enable the work of the cell to occur but what happens to the other products? The atoms found in glucose are rearranged into carbon dioxide and water, and are no longer needed by the cell so they are considered waste products. Cells have to get rid of unwanted waste products. Carbon dioxide and water move out of cells and into the surrounding environment.

The decomposer movement we observe at the macroscopic scale is possible because cellular respiration is happening at the atomic-molecular scale.

Football Fields of Fungi

Unlike the blood vessels of animals or the phloem of plants, the branching hyphae of fungi extend outside of the fungus' body and into the substance it is breaking down. The exterior fungal hyphae form a mat called a mycelium. Most of the time, we cannot see the mycelium mat because it is embedded in another substance such as bread, a tree trunk, or the soil. However, the mycelium can be *huge*! In 2000, a group of scientists discovered an underground mycelium mat in the Malheur National Forest in Oregon that covered the equivalent of 1600 football fields! This fungus is between 1900-8600 years old and weighs up to 35,000 tons, making it the largest known living organism in terms of total biomass. As such, it has been nicknamed the *Humongous Fungus.*