5.4: How do Decomposers Grow? Reading

Purpose for Reading: *As you read this text, work to make sense of how decomposers build up matter so that they are able to grow.*

Zooming into Growing

Scientists work to explain things we can observe—like decomposers growing—by "zooming in" to the smaller systems that decomposers are made of—cells—as well as the molecules that make up cells. Let's zoom into a decomposer to figure out how it grows.

Macroscopic scale: We observe decomposers growing at the macroscopic scale. Bread mold grows a little bigger every day until it has no more bread to decompose. What is happening inside the decomposer at the microscopic and atomic-molecular scales to allow the bread mold to grow?

Cellular scale: Every cell in bread mold needs food. During digestion, large molecules are broken into smaller molecules that can be absorbed by the mold through the mycelium (the network of branching hyphae). These small organic molecules are then able to move to all of the mold's cells through the individual hyphae. Some of the small organic molecules are combined into large organic molecules (biosynthesis) in the bread mold's cells. After cells grow larger they can divide. Cells connect to build tissue and body systems. How do cells produce the matter—mostly large organic molecules—that they are made of?

This is a puzzling question since only small organic molecules can be absorbed through the mycelium.

Atomic-molecular scale: Large organic molecules in the bread mold's food are broken down into smaller nutrient molecules during digestion so that they can be absorbed through the mycelium. These small organic molecules are carried to cells all over the bread mold by the hyphae. Small organic molecules enter cells all over the bread mold and rearrange into large molecules specific to the mold's needs. This building of large organic molecules in all kinds of cells is how the bread mold grows.

Using Four Steps to Explain Biosynthesis

We can explain biosynthesis—the building up of materials in a living organism—by answering the four numbered questions on the Three Questions handout:

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

Small organic molecules In: Small organic molecules (including amino acids, glucose, fatty acids, and glycerol) move into cells all over the bread mold through the mycelium.

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

Small organic molecules are combined to make large organic molecules such as fats, proteins, and starches. The chemical change also produces water molecules.

3. What is happening to energy?

The chemical energy stored in the high energy bonds (C-C and C-H) in the small organic molecules remains in the bonds when they are combined into large organic molecules since the bonds are not changed.

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

Cells Grow and Water Out: Cells grow bigger and may eventually divide as more large

organic molecules are made. Water leaves the cells.

Fungal Fanatics

Like plants and animals, fungal cells must use small organic molecules to produce the large organic molecules necessary to grow, function, and develop. Also, like plants and animals, fungal cells can produce a wide variety of large molecules from the simple sugars, fatty acids, amino acids, and glycerol that each cell absorbs.

Sometimes a fungus can produce very unusual molecules during biosynthesis. One kind of fungus, called *ergot*, grows grains such as rye. Ergot produces a chemical compound during biosynthesis that is very similar to the molecular structure of the drug LSD. If a person consumes rye grains that are infested with ergot fungus, they will develop a disease called *Ergotism* in which the affected individuals demonstrate very bizarre symptoms such as hallucinations, delusions, intense vomiting, burning or crawling sensations on the skin, and writhing.

Coincidentally, many of these same symptoms were reported in the individuals accused of witchcraft in Salem, Massachusetts in the 1690s. The weather recorded in the swampy areas around Salem during this time period was also ideal for the growth of the ergot fungus, and rye crops were common to these early American colonists. This has led many to speculate that the behaviors that led to the accusations of witchcraft during the Salem Witch Trials were actually the result of ergot poisoning.