6.2 Other Decomposers Reading: Bread Mold



Mold on bread, Photo Credit: Public Domain (wikicommons)

Where and How Do Bread Molds Live?

Bread mold is a specific type of fungus that grows on bread. Like other fungi, bread molds are made up of multiple fungal cells that cannot make their own food (photosynthesize) but absorb nutrients from their environment, such as from bread. The mold you see on the surface of bread is only part of the fungus. Tiny tubular structures called hyphae spread throughout the bread and absorb nutrients. The network of hyphae (called the mycelium) spreads throughout an entire slice or even loaf of bread.

Mold prefers warm and humid conditions. Although mold can grow on many types of food, the sugars, starches, and proteins in bread are great sources of nutrients for mold to use to grow and thrive. Under a microscope, you can see that the mold on the surface is actually fruiting bodies, like mini-mushrooms, with a stalk rising above the bread and tiny spores that form at the ends of those stalks. These spores spread the mold from one food source to another, similar to dandelion seeds blowing in the wind. Although you cannot see them, there are millions of mold spores in the air all around you at any time. The spores also give mold their black, blue-green, or red color, which generally can indicate the fungal species.

One common type of bread mold is *Penicillium*, a blue-green mold with white borders. *Penicillium* was the first mold used to produce antibiotics (Penicillin) that kill specific types of bacteria in human bodies. Another type of bread mold, the "red bread mold" (*Neurospora crassa*) has been used by scientists for decades as a "model organism" for studying genes and their mutations. Mold also is an important part of the environment because it helps break down organic matter, such as leaves, wood, and food (including bread). Molds usually don't infect people like bacteria. However, molds can cause allergic reactions and respiratory problems in humans and, under the right conditions, produce mycotoxins (poisonous substances) that can make people sick.

How Do Molds Live and Grow?

Mold, unlike plants which get their energy directly from the sun using photosynthesis, get their energy by digesting organic matter similar to animals. Fungi have no mouths or stomachs but instead absorb sugars directly through their mycelium as they grow through or over their food. All the cells in the fungi use that sugar to live and grow. We can explain how bread mold does this in four steps.

Step 1: Cells in the bread mold absorb sugars in their environment through their thread-



like hyphae via the chemical process of digestion.

Unlike most animals which ingest food and then digest it internally, fungi first digest food and then ingest it. Organic matter with small organic molecules, such as sugars, can be absorbed fairly readily by mold, but larger, more complex molecules require the mold to make enzymes (proteins that break large organic molecules into small organic molecules). The cells in the hyphae send the enzymes into the bread, then absorb the small organic molecules that are produced when the enzymes break down the starches and proteins in the bread.

Step 2: Small organic molecules move to all the cells in the fungus.

Tiny holes between cells in the hyphae allow for the rapid flow of small organic molecules from cell to cell throughout the whole fungus within the mycelium.



Step 3: All the cells get energy by combining small organic molecules with oxygen in the process of cellular respiration.

All the cells need energy to carry out their life functions, and they get that energy by combining glucose sugars with oxygen. You are familiar with the chemical equation for cellular respiration:





Step 4: Cells grow by making large organic molecules from small organic molecules in the process of biosynthesis.

Molds grow when their hyphal cells grow and divide. They grow by using the small organic molecules they absorb from their environment. They combine the small organic molecules to make large organic molecules—proteins, fats, and carbohydrates.



Digging Deeper: Where You Can Learn More About Bread Mold?

- To find out if it is safe to eat moldy bread:
 - http://www.npr.org/sections/thesalt/2017/04/21/523647669/is-it-safe-to-eat-moldy-bread
- To find out about Alexander Fleming and the discovery of penicillin:
 - <u>https://www.khanacademy.org/partner-content/mit-k12/chem-and-bio/v/bread-mold-kills-bacteria</u>
 - <u>http://time.com/4049403/alexander-fleming-history/</u>
- To find out how bread mold could help build better rechargeable batteries:
 - https://www.sciencedaily.com/releases/2016/03/160317145852.htm
 - https://www.smithsonianmag.com/innovation/could-mold-power-batteries-future-180958527/