

Decomposers break down dead animals and plants.

A Feast for Decomposers

Chapter 1: Introduction

Imagine you're invited to a feast. When you get there, your host serves you droppings, dry brown leaves, bare bones, feathers, and a fallen tree. But you can't eat that! This is a feast for decomposers, not for humans. Decomposers are fungi, bacteria, worms, and other small organisms that specialize in breaking down dead matter.

Decomposers can break down things that nothing else can. Bones, droppings, and other dead matter may not seem like food, but they contain materials that decomposers can use for energy and growth. For example, dead matter contains energy storage molecules that many decomposers use for cellular



Droppings may not seem like food, but to decomposers, they make a good meal.



Decomposers can break down something as large as a fallen tree.

Cellular Respiration



In cell parts called the mitochondria, glucose (an energy storage molecule) plus oxygen combine to make carbon dioxide plus water, releasing energy. This process is called cellular respiration.

respiration. Cellular respiration is a process that many organisms, including humans, use to release energy in order to survive. During cellular respiration, oxygen and energy storage molecules combine, releasing energy and giving off carbon dioxide. Energy storage molecules contain carbon, an important component of living things. Through cellular respiration, decomposers are able to release carbon found in dead matter, making it available to the ecosystem. Without decomposers, this carbon would stay trapped in the dead matter. Decomposers don't just release carbon from dead matter, they also make other materials available to an ecosystem, such as nitrogen. Nitrogen is a critical nutrient for plant growth. Decomposers may be small, but they play an important role in any ecosystem. To learn more about decomposers, read one or more of the chapters that follow.

Chapter 2: Wonderful Worms

Earthworms are an essential part of soil ecosystems, and one of the major decomposers on Earth. If you looked out at a field of cows, the worms living in the soil under the field might weigh more than all the cows combined! Without worms (and their poop, called "casts"), we would not have the rich, fertile soil needed to grow the food we eat.

Worms take large pieces of things like dead leaves, manure, and even cardboard, pull them below the surface of the soil, shred them, and digest them until they are small enough for bacteria to consume. Worms use the energy storage molecules in dead matter and oxygen they take in through their skin to perform cellular respiration, releasing energy and giving off carbon dioxide. The worms' shredded and partially digested food mixes with the soil, and all the nutrients contained in the dead matter become available for new plants to use. Worms also digest soil and turn it into nutrient-rich casts, which help plants grow. One earthworm can produce about 10 pounds of casts in one year. That's a lot of poop!



Worms are decomposers that live in the soil.



This cutaway view shows worms beneath the surface of the soil. One worm is dragging a dead leaf underground. The worm will partially digest the leaf, leaving pieces small enough for bacteria to consume.



Termites are one kind of insect that can break down dead matter. Termites break wood down into small pieces. Then smaller decomposers, like bacteria, can break it down even more.

Chapter 3: Insects Break the Big Stuff Down

When an organism dies, many different types of decomposers feed on it. However, not all of the decomposers show up at the same time. Different decomposers have different jobs and eat different types of dead matter. The first decomposers on the scene are usually insects.

Insects are responsible for the first round of decomposition because they make matter more accessible to other decomposers. Decomposing insects eat all kinds of dead matter: dead plants, animal carcasses, and animal droppings. They use the energy storage molecules in the dead matter to release energy during cellular respiration. As they eat, they shred dead matter into smaller pieces, allowing tiny decomposers like bacteria to break the dead matter down even more. In some cases, bugs also give other decomposers access to places they couldn't have gotten to otherwise. For example, insects that eat dead plants leave tunnels behind them, giving other decomposers a way of getting to parts of the plant matter like the insides of fallen tree trunks—that would have been closed off otherwise.

Different insects have different roles to play in breaking down dead matter, and different insects arrive on dead organisms at different times. In fact, the timing of each insect appearing after the death of an organism is so predictable that scientists use the presence of certain insects to tell them how long an organism has been dead.

Chapter 4: Soil Bacteria by the Billions

In addition to the decomposers we can see, there are even more that are too small to see. Many billions of tiny bacteria live in the soil. These microscopic decomposers work all the time to break down dead matter.

After worms and other bigger decomposers have broken dead matter down into smaller pieces, soil bacteria break down the dead matter even further. These bacteria are able to get at the energy storage molecules remaining in the dead matter, using those molecules to release energy. Many kinds of bacteria perform cellular respiration, taking the carbon trapped in dead matter and putting it back into the ecosystem as carbon dioxide.

There are many thousands of species of soil bacteria. Some are very sensitive to changes in temperature and chemical composition of soil, while others are very hardy and can handle severe heat and cold. Some can even lie dormant for many years, waiting for just the right conditions. No matter what, you can be sure that healthy soil will contain many bacteria—as many as a billion per teaspoon!



Soil bacteria can't be seen by the naked eye, but they can be seen under a microscope. This image of soil bacteria has been magnified 17,000 times larger than their actual size.



This image has been magnified 9,700 times. It shows a tiny root hair from a plant, covered with even smaller bacteria.

Chapter 5: Surprising Soil Fungus

You may think you've never seen soil fungus, but you have. Fungus is hidden everywhere in the soil, and sometimes it grows upward to form mushrooms in all colors and shapes.

Mushrooms and other soil fungi are not plants—they are decomposers. Soil fungus is good at decomposing tough dead matter, like dead leaves and pieces of wood, and getting the energy storage molecules that were trapped inside. Through the process of cellular respiration, the fungus uses these energy storage molecules for energy, releasing carbon dioxide into the air.

Soil fungi are not plants, but they are often helpful to plants. Some fungi in the soil help protect the roots of plants. They grow around roots, helping the plant get nutrients from a larger area of the soil and hiding the roots from pests.



We can see soil fungus when it forms mushrooms that pop up from the ground.



Underground, soil fungus spreads out in all directions. It's everywhere!



Different types of soil fungus form mushrooms in many different sizes, shapes, and colors.



Some fungi break down wood. You may find them growing on dead trees and fallen logs.

Chapter 6: Fungi That Feast on Wood

Take a walk in the forest, and you will notice all sorts of wonderful shapes growing on dead tree trunks, fallen logs, and piles of decomposing leaves. Some look a lot like the mushrooms you eat, and some look like orange fans or black bubbles. These are wood-decay fungi, which help decompose things like fallen branches and even whole trees. Like other kinds of fungi, they take the energy storage molecules trapped in dead matter and use them to get energy through cellular respiration. In the process, they give off carbon dioxide.

Wood-decay fungi are the only organisms that have evolved to decompose lignin, a substance found in wood. Also, fungi can get deep into the wood to help break it down (unlike bacteria, which just decompose on the surface). For these two reasons, fungi are the the main decomposers in forest ecosystems, where there are lots of large pieces of wood to break down. Next time you are walking past some trees, check to see if there's any fungus nearby!

Chapter 7: Mold Makes Fuzzy Fruit

You know what happens when you leave a peach in the fruit bowl too long—it grows blue and white fuzz and eventually you throw it out. But what about when a peach falls off a tree and there's no one around to eat it (or forget to eat it)? It still grows that blue and white fuzz, called "mold." Mold is a kind of fungus that helps decompose things like fruit and bread, using the energy storage molecules trapped inside to get energy through the process of cellular respiration.

When a peach falls to the ground, mold grows quickly, breaking the fruit down. This allows the fruit to provide nutrients for other organisms in the soil, which break it down further into nutrients for new plants to use. The peach pit might even sprout into a little tree, which will grow in the nutrient-rich soil provided by the decomposers—and use the carbon dioxide they give off during cellular respiration.



Fruit decomposes when it falls on the ground.



This strawberry has fuzzy white mold growing on it. Mold is a kind of decomposer.



Seen through a microscope, mold looks very different.



These are the bones of a dead whale on the ocean floor. Aquatic bacteria and other decomposers break down the bones over many years.

Chapter 8: Aquatic Bacteria Bonanza

Imagine the magnificent blue whale, largest animal on Earth. Blue whales live a long time, but eventually they die. What happens to those 181,000 kilograms (400,000 pounds) of whale flesh? The ocean doesn't just get filled with rotting whales and fish. That's because decomposers step in and help break down their bodies.

Aquatic bacteria are one of the many kinds of decomposers that help break down the body of a whale that dies in the ocean. After sharks and other fish eat the large chunks of flesh, and smaller animals like marine worms eat the bits of meat that are left over, bacteria begin to feed off the fat left in the whale's bones. These bacteria use the energy storage molecules in the whale's body to release energy. The bacteria also provide nourishment for clams, sea snails, and other animals. This can go on for decades, with the carcass of one whale providing decomposers with food for 80 years!