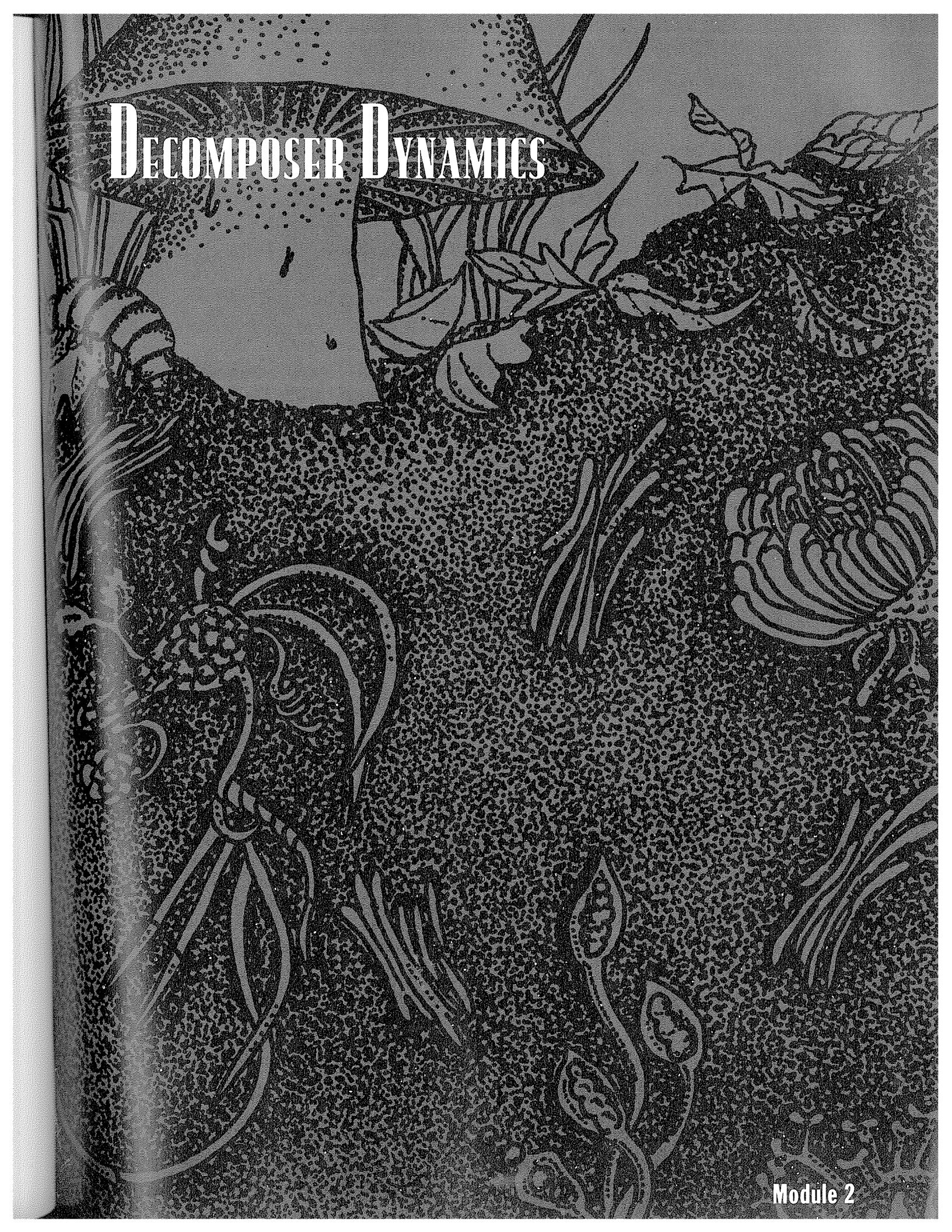
Decomposer Dynamics
Module 2

Decomposer Dynamics

Contemplating Decay

If you're like most of us, you probably haven't given much thought to rot. Mold-covered leftovers, odorous garbage, a faded and drooping bouquet of flowers—we see and smell them daily, but don't usually pause to consider them indicators of the ongoing and crucial ecological process of decomposition.

Children think about decomposition perhaps even less than we do. Yet when asked to explain what happens to dead things in nature, they propose an array of possibilities. They realize that dead things disappear over time, but attribute this to causes they can see, such as rain, trampling, or large scavenger animals.

The main cause of decomposition eludes us because the primary perpetrators are invisible. From a brown apple core to a rotting fence post to a road-killed animal, it is microbes—organisms too tiny to see with the naked eye—that are doing the bulk of the deed of decomposition.

Whereas larger decomposer organisms with which children are often familiar (e.g., termites, earthworms, and millipedes) accomplish a lot of the physical breakdown of dead plants and animals, it is microbes like fungi and bacteria that are largely responsible for returning the once living materials to their basic elements. This module reveals the fascinating world of decomposer microbes to your students, and sets the stage for further exploration of nutrient cycling in Module 3.

Overview of Students' Learning Experiences

In this module students learn about microbes as decomposers, develop experimental design skills, and apply their knowledge to a variety of everyday situations.

Students set up a controlled experiment, or "fair test," culturing bacteria and fungi on non-living items to discover the invisible causes of decomposition. Then they use their investigation skills to design experiments to figure out what environmental factors favor the growth of microbes. This sequence of investigations moves from basic to applied research, as students use the results of their second investigation to set up compost in the classroom. They also apply their experiment design skills to critiquing hypothetical science fair projects.

Assessment activities provide other opportunities for students to apply their work in real-world contexts. They design exhibits to teach others about what causes dead leaves to "disappear," become engineers to tackle an environmental problem by designing decomposition-friendly landfills, and help resolve a legal dispute involving a composting business. These experiences enrich students' understanding of decomposition while challenging them to put their knowledge, skills, and inquiry habits into action.

Module 2 Overview Chart

DECOMPOSER DYNAMICS		
Mode	**Lesson Title**	**Activities**
Activating Ideas	**2.1** Introducing Microbes as Decomposers	**Day 1:** Students propose how dead plants disappear over time, then examine mold, and talk about microbes as decomposers.
Investigating and Processing for Understanding	**2.2** Stalking the Unseen	**Days 2–3:** Students hear a story of a scientist who studies microbe decomposers, then go outside to collect non-living items and observe evidence of decomposition.
	2.3 Culturing Bacteria and Fungi Decomposers	**Days 4–9:** Students design and carry out controlled experiments to culture microbes.
	2.4 Dead Leaf Storyboards— Performance Assessment	**Days 10–11:** Students work in groups to create displays that show what happens to a dead leaf over time.
	2.5 Testing Conditions That Promote Decomposition	**Days 12–17:** Students test factors that promote the growth of microbes, then use their findings to make compost
Applying and Assessing	**2.6** The Bag That Wouldn't Go Away— Performance Assessment	**Days 18–19:** Students design and set up model wasted disposal systems that will help biodegradable plastic bags decompose.
	2.7 A Jury's Dilemma— Written Assessment	**Day 20:** Students analyze a trial involving a dispute about a composting business, then outline how a Special Investigator could gather evidence to help settle the case.

Planning Ahead

GROW MOLD SPECIMENS About five days before you begin this module, seal small, moist chunks of squash or pumpkin in sandwich-size ziplock baggies. You'll need one baggie for every two students in your class. Keep the baggies in a warm place to encourage mold to grow.

CHOOSE AN OUTDOOR STUDY SITE If your students explored an outdoor site during Module 1, try to use the same study site for this module to deepen their understanding of that piece of land. Otherwise, look around the schoolyard for a place where students can collect non-living (organic and inorganic) items, and samples of leaves at different stages of decomposition. If you live in a semi-arid environment, try to find a relatively moist location,

such as at the bottom of a slope or near a streambed. If no place in the schoolyard is suitable, make arrangements to take the class to a nearby park or other piece of land where students can collect things.

REVIEW VOCABULARY Many of the vocabulary words that were introduced and defined in Module 1 are used in Module 2 (e.g., *ecosystem, producer, consumer, decomposer, nutrient*). If your students haven't experienced Module 1, you might want to review these vocabulary words before beginning this module, and/or spend more time on the terms during lessons (see Appendix pages 390–392 for a list of vocabulary definitions).

GATHER MATERIALS A list of materials used in this module is provided in the Appendix (pages 386–387). Although locally available or homemade options are always provided, it is sometimes more convenient to order equipment made especially for science experiments, such as petri dishes for Lesson 2.2. Have each student bring in a 1-liter plastic soda bottle for Lesson 2.6.

COLLECT RESOURCE BOOKS Students find microbes fascinating, so a classroom collection of trade books on microbes will get well used. See the following resource list for suggested titles for both you and your students.

RESOURCE LIST

For Teachers

REFERENCES AND BACKGROUND READING

Life in a Bucket of Soil
by R. Rhine (Lothrop, Lee & Shepard, 1972)
Each chapter is devoted to a common soil organism, and includes information on breeding, interactions, feeding, defense, and the organism's effect on soil. Helpful information on methods of collecting, keeping, and studying soil critters.

Microbes and Man
by J. Postgate (Cambridge University Press, 1992)
A good introduction to microbes for the general reader. Focuses on the omnipresent microbes and their varied activities, such as making the soil fertile, cleaning up the environment, changing our food, protecting humans from other microbes, and causing diseases. Also describes how to handle microbes, and includes a chapter on decomposition.

The Rodale Guide to Composting
by M. Hunt and J. Minnich (Rodale Press, 1979)
A readable book for those wanting to know everything about composting. Offers a comprehensive treatment of the history, benefits, techniques, materials, and technology of composting.

Worms Eat My Garbage
by M. Appelhof (Flower Press, 1982)
A practical guide to setting up a worm composting system. Although written for household use, its information is easily adapted to the classroom. Contains detailed information on the care of worms and other compost organisms, as well as how to recycle worm castings.

For Students

Science Books

Discovering Fungi
by J. Coldry (Bookwright Press, 1987)

Over forty large color photographs with text focus on the life history, ecological role, and economic importance of fungi. Includes a variety of beautiful and bizarre examples. From the twenty-three-volume "Discovering Nature" series.

Earthworms, Dirt and Rotten Leaves: An Exploration in Ecology
by M. McLaughlin (Atheneum, 1986)

The opening chapters draw in even the most squeamish students with information on earthworms' ecological importance and how to get started studying them. Subsequent chapters include inquiries about earthworms' adaptations, interrelationships, behavior, and body structure.

Lots of Rot
by B. Schatell (Lippincott, 1981)

This humorous and informative book tells where to find rot, what causes it, and how to grow your own. It includes easy experiments that help students discover facts about mold, bacteria, and mildew. The author emphasizes the importance of rot in natural cycles.

Microbes and Bacteria
by F. Sabin (Troll, 1985)

A simple, brief, illustrated overview of microbes and their reproduction, including protozoans, algae, fungi, slime molds, bacteria, and viruses.

Scavengers and Decomposers: The Cleanup Crew
by P. Hughey (Atheneum, 1984)

Looks at scavengers and decomposers in a few different environments, including oceans, freshwater, and the African plains.

The Smallest Life Around Us: Exploring the Invisible World of Microbes
by L. Anderson (Crown, 1978)

A basic introduction to microbes. It emphasizes the importance of microbes in the cycle of life, as well as in making foods such as cheese and bread. Also includes simple experiments.

Throwing Things Away: From Middens to Resource Recovery
by L. Pringle (Crowell, 1986)

This historical, precise, and straight-talking overview informs students about the development of human waste disposal practices in the United States. Includes staggering statistics on the amount of waste we generate.

Stories

The Fall of Freddie the Leaf
by L. Buscaglia (C.B. Slack, 1982)

Brightly illustrated story about the life cycle of leaves. It emphasizes growth and change as necessary processes for living things.

The Paperbag Prince
by C. Thompson (Knopf, 1992)

The story of an old man who makes an abandoned dump his home. Colorful and detailed illustrations enhance a warm and wonderful story that encourages a new way of looking at our world, and highlights the rejuvenating power of nature.