# "Get used to it. You're surrounded. And covered. And filled . . . with microbes!"


## About the Author

Eleanor Spicer Rice, PhD, is an entomologist and the author of seven books, including *Dr. Eleanor's Book of Common Spiders*. She enjoys connecting with students around the world to share and spread her love of the natural world and its importance for our future. She resides in Raleigh, North Carolina, with her microbe-covered family and pets.

## About the Illustrator

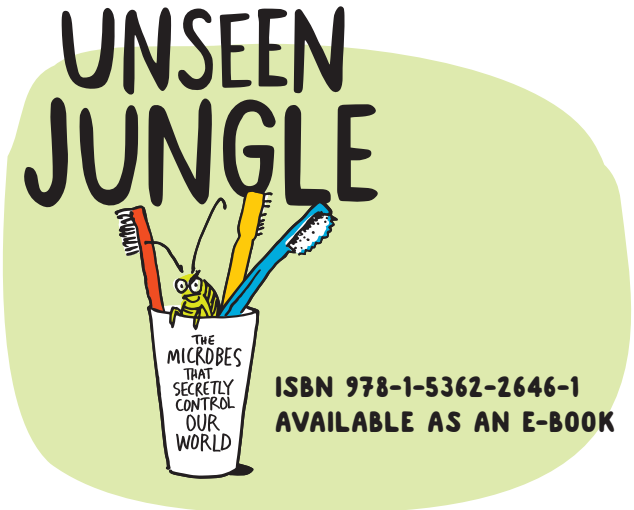
Rob Wilson is an award-winning illustrator and celebrated graphic designer whose work can be found on the covers of best-selling books, celebrated murals in his home state of Texas, and in galleries in London and New York City, where he lives now.

## About the Book

We can't see them, but microbes are everywhere—in our yards, our pets, our food, even our own bodies! In fact, the ratio of microbial cells to human cells living on and in bodies is nearly one-to-one.

*Unseen Jungle* opens a window to the hidden world of the microbes that affect our everyday lives. Aspiring young scientists will discover these creatures that secretly control our lives and learn the fascinating, sometimes hilarious, and sometimes gross stories of some of our wildest—but most common—creatures.

Use this guide to help your students explore the thrilling, strange, amazing unseen jungle that exists all around us.




ISBN 978-1-5362-2646-1
AVAILABLE AS AN E-BOOK

## Before Reading

Because we can't see them with the naked eye, microbes can seem mysterious. But understanding how important microbes—also known as microorganisms—are to our daily lives can help each of us realize how wonderfully complex this world can be and how we are never alone: we're covered and stuffed with microbes!

To help students understand the diversity and abundance of microbes, tell them first what microbes are: tiny creatures too small for us to see. Microbes include bacteria, fungi, and viruses. Yes, some microbes can make us sick, but most of them are either helping us or not bothering us at all! Only a tiny fraction of the microbes on this planet can hurt us. It's good to have them around!

Each person has their own microbial fingerprint. Think of the microbes that live on you as a bouquet of flowers. Some bouquets may have roses, daisies, or carnations, or all of those! The group of microbes that live on and in each of us is its own unique bouquet. Some of us may have more roses, while others might have only lilies! This bouquet is affected by all kinds of things, like whether or not we have pets in our homes, the microbes on and in the people we live with, how often we bathe, and more. Having more microbes doesn't necessarily mean someone is dirty. The microbes that live on us help to keep us well by attacking microbes that can make us sick. They also live inside us, helping us digest our food, improving our mental well-being, and more.

*Unseen Jungle: The Microbes That Secretly Control Our World* is about microbes that affect our daily lives, from the food we eat to the ladybugs crawling on our windowsills. These pages will help you share the joy of microbes with your students—and encourage them to notice microbes' impacts on the world around us all.

## Core Questions

Have students work in pairs to answer these questions using *Unseen Jungle* as a reference.

- What is a microbe?
- How can microbes help humans?
- Where are some places we can find microbes?
- Think about this: A mutualism is a relationship between two species where both species benefit. Do humans have a mutualistic relationship with microbes? If so, what are some examples?
- Think on it: What happens on our bodies when we use antibacterial soap? Write a list of pros and cons of using antibacterial soap. Explain your reasoning.

# Microbe Hunt

**Be a microbe detective! You can find microbes on nearly every surface on the planet. They come in all shapes and sizes. But the microbes below are missing! Read the description of each microbe on the next page. Use the clues in each microbe's job description to find them in the picture. When you find one, capture it by drawing a picture of it next to its description.**

# MISSING!

## LACTOBACILLUS

This mighty bacterium helps humans and other animals digest food. We have more of it in our digestive systems at night, which keeps us running clean in the morning.

# MISSING!

## PHOTORHABDUS LUMINESCENS AND ITS NEMATODE PARTNER IN CRIME

This bacterium travels in tiny worms called nematodes, which wiggle into insects, eat the bugs from the inside out, and, when they're done, make the bugs glow.

# MISSING!

## RABIES LYSSAVIRUS

This devious virus may attack the brains of many animals, but not the mighty opossum, which has a body temperature often too low for the rabies virus to survive.

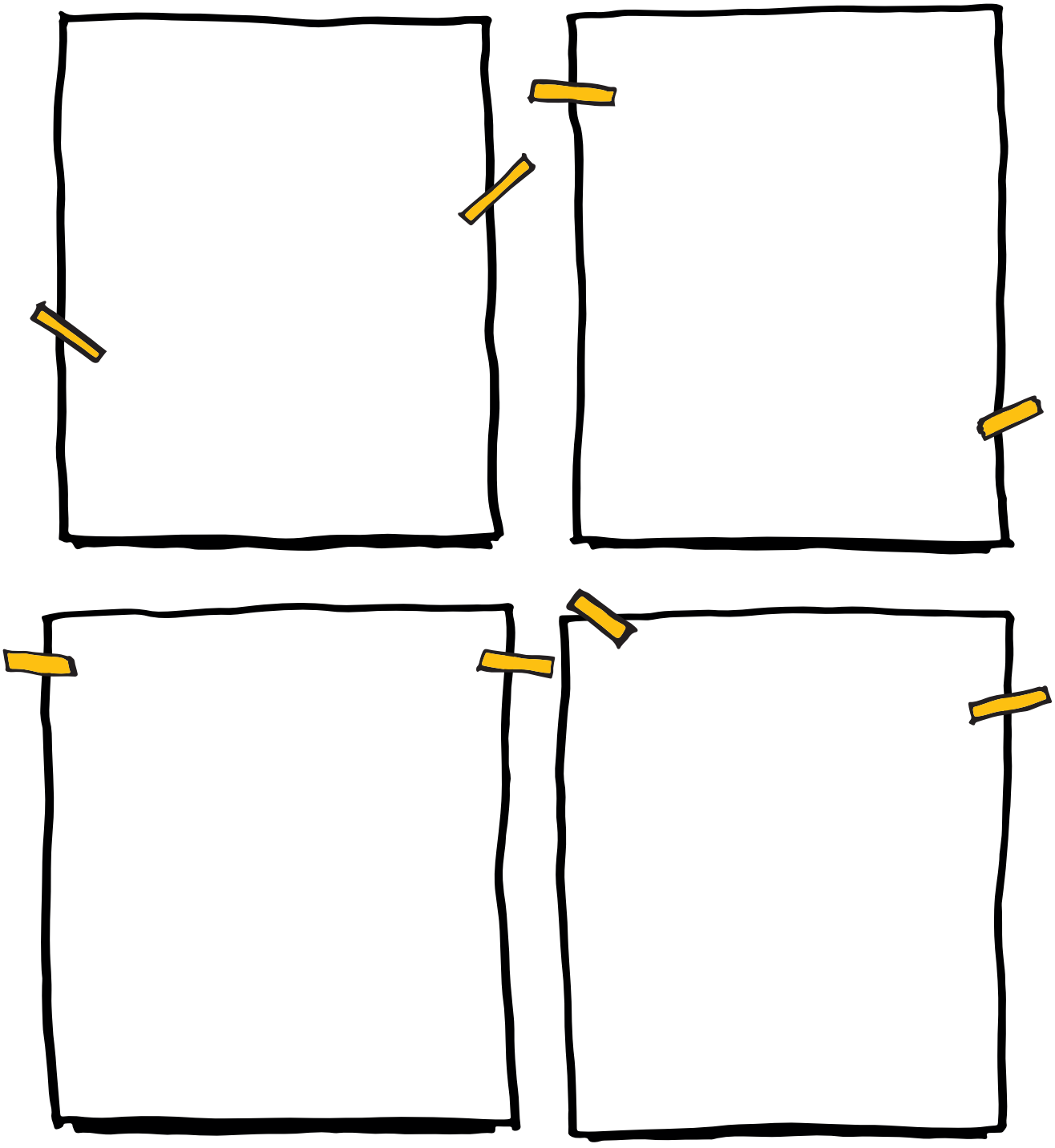
# MISSING!

## ENTOMOPHTHORA MUSCAE

This wild fungus infects flies, takes over their brains, and turns them into zombies, who climb above other, resting flies and allow the fungus to pour out of their bodies like a deadly rain. No, thank you!

# Draw four microbes you found that we haven't been looking for.

Notice how their shapes and textures are different from those of the ones you captured.



# Spread the (Microbial) Love

In this activity, your students will experience how microbes can spread through the air.

You will need:

- An extract, like vanilla or mint extract
- Cotton balls
- A ruler or tape measure

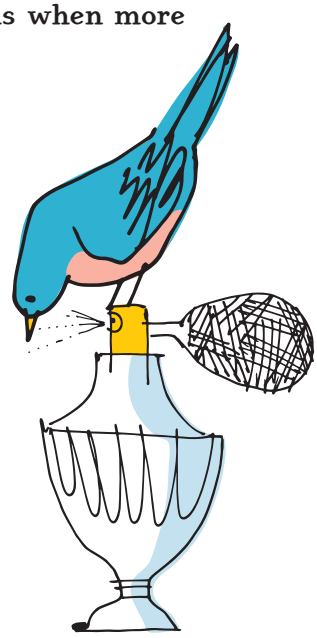
Tell students that microbes are so tiny that some travel easily in the air and others can move around through touch. Everything we breathe or touch contains microbes.

To explore how particles like microbes travel through the air, have students break into groups of two. Have each pair stand on opposite sides of the classroom from each other. Then dab cotton balls with extract and hand a cotton ball to students on one side of the room. These students are "infected" with "microbes" (the extract). Allow the other student without the cotton ball to walk toward their infected partner, a step at a time, and sniff. When the walking student smells the extract, have them stop. Use a ruler or tape measure to measure the distance between students when they notice the smell. Next, take them outside or to a large room, like a gymnasium. Have them repeat the experiment. See how close they must be in the larger space to smell the extract.

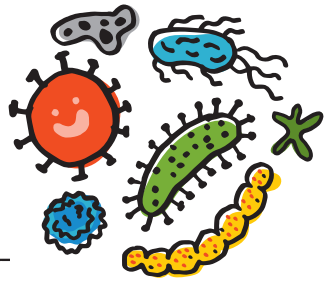
Talk to them about how airflow in larger spaces or the outdoors can reduce our contact with others' microbes, just as they must get closer to each other in larger spaces in order to smell the extract. Ask them to think about how they've seen this play out in their lives.

You can try variations of this experiment. For example, you can have some students wear surgical masks and others not to see if it changes the point of contact with the extract's smell. You could also try to vary the number of "infected" students with cotton balls to think about how much more easily microbial transmission happens when more people are sick.

A data sheet is provided on the following page.



# Spread the (Microbial) Love



Before you begin, list some ways microbes can spread:

_____

_____

_____

What do you think will happen when you take the experiment outside?

_____

_____

Record your data. How far from the source were you when you detected its smell?

Inside _____ ft. _____in.

Outside _____ft. _____in.

What happened? How was the detection inside different from the detection outside?

_____

_____

Why do you think that is?

_____

_____

If the smell were a microbe, like one that causes a cold, how do you think you could protect yourself from it?

_____

_____

# Mutualism . . . or Madness?

In *Unseen Jungle: The Microbes That Secretly Control Our World,* many of the microbes mentioned have mutualistic interactions with their hosts. Others are parasitic, meaning the microbe benefits from its interaction but the host does not. Others still are commensal, where the microbes and their hosts just kind of hang out, neither benefiting nor hurting the other. Instruct your students to research a microbial mutualism, parasitism, or commensalism. Students can draw the microbe and its host, then write three paragraphs explaining the interaction. Make sure they understand whether the interaction is mutualistic, parasitic, or commensal. Invite students to share their microbial story with the class, and let the class guess whether each interaction is parasitic, mutualistic, or commensal.

## Word Hunt Bonus!

After students find the key words from *Unseen Jungle: The Microbes That Secretly Control Our World* in the word search on the next page, invite them to choose three or more words and use them in a descriptive paragraph. The paragraph can be a fun story, a scientific explanation, or a creative narrative of their choice! See what they can create! How many words can they use?

## Double the Hunt

After students complete the word hunt, invite them to use the book to find definitions or stories related to each word. Have them write the page number next to each word that they find and then write, in their own words, definitions for the words or provide the context in which the word was found. For example, a cat (found beginning on page 9) has microbes in its anal glands, which produce a signature smell that makes other cats aware of its territory.

# Word Hunt

Just as our bodies are packed with microbes, the letters below are packed with 25 key words. How many can you find, young scientists?

M C A T E R P I L L A R E P L
R I T E R M I T E N R E B P B
G M C I C A D A E S O Y O S A
U F V R G L R O I C A M R P C
M U I D O M S A L P C E C C T
D R A R G B G I A O H O I B E
I E R T M S I L A U T U M E R
M L A O Z O T O R P F A O D I
Z L N R Y C A T L L U I S B A
L E D O G E N E Y O N L Q U I
A V I R U S E S A S G M U G O
R A B I E S O B R H I Y I C O
G U B Y D A L O O T C T T E R
M I R N B R E S E A E R O I E
P O A O R F M G E A G L A C H
C A M I C R O B I O M E O I R

## Word Bank

MICROBIOLOGY, MUTUALISM, CICADA, MOSQUITO, ARCHAEA, FUNGI, MITE, ALGAE, PROTOZOA, VIRUSES, MICROBE, PLASMODIUM, BACTERIA, FRASS, GENE, LADYBUG, ROACH, CAT, FLY, MICROBIOME, RABIES, DOG, TERMITE, CATERPILLAR, BEDBUG

*Unseen Jungle: The Microbes That Secretly Control Our World*
GRADES 2-5
The activities in this guide connect with the
Next Generation Science Standards as listed below.

| Activity | NEXT GENERATION SCIENCE STANDARDS: Science and Engineering Practices | NEXT GENERATION SCIENCE STANDARDS: Disciplinary Core Ideas | NEXT GENERATION SCIENCE STANDARDS: Crosscutting Concepts |
|---|---|---|---|
| Core Questions | • Asking Questions and Defining Problems | • LS2.A: Interdependent Relations in Ecosystems<br>• PS2.B: Types of Interactions | • Cause and Effect |
| Spread the (Microbial) Love | • Planning and Carrying Out Investigations<br>• Analyzing and Interpreting Date<br>• Using Mathematics and Computational Thinking | | • Cause and Effect |
| Mutualism . . . or Madness? | • Obtaining, Evaluating, and Communicating Information<br>• Analyzing and Interpreting Data | • PS2.B: Types of Interactions | • Cause and Effect |
| Word Hunt | • Obtaining, Evaluating, and Communicating Information | | |