Science & Literacy Activity

ACTIVITY OVERVIEW

This activity, which is aligned to the Common Core State Standards (CCSS) for English Language Arts, introduces students to scientific knowledge and language related to the human microbiome, the collection of microbes that live on and in us.

This activity has three components:

1. **BEFORE YOUR VISIT**, students will read a content-rich article about the human microbiome. This article will provide context for the visit, and also help them complete the post-visit writing task.
2. **AT THE MUSEUM**, students will read and engage with additional texts (including printed text, digital and physical interactives, videos, diagrams, and models). This information will help them complete the post-visit writing task.
3. **BACK IN THE CLASSROOM**, students will draw on the first two components of the activity to complete a CCSS-aligned explanatory writing task explaining how the human body is an ecosystem.

Materials in this packet include:

For Teachers

- Activity Overview (p. 1-2)
- Article (teacher version): "Human Microbiome: Your Body Is an Ecosystem" (p. 3-6)
- Sample concept map (p. 7)
- Answers to student worksheet (p. 8)
- Essay scoring rubric (teacher version) (p. 9-10)

For Students

- Article (student version): "Human Microbiome: Your Body Is an Ecosystem" (p. 11-13)
- Student worksheet for *The Secret World Inside You* exhibition visit (p. 14)
- Student writing task (p.15)
- Essay scoring rubric (student version) (p. 16-17)

Common Core State Standards

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts.

RST.6-8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

W.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

New York State Science Core Curriculum

LE 7.1c

Next Generation Science Standards

DCI: LS2.C: Ecosystem Dynamics, Functioning, and Resilience
Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life.

SEP 8: Obtaining, Evaluating and Communicating Information
- Integrate scientific information in written text with that contained in media and visual displays to clarify claims and findings.
- Read and synthesize information from multiple sources.
- Communicate scientific information in writing.

1. BEFORE YOUR VISIT

Students will read a content-rich article about the human microbiome, the collection of microbes that live on and in us. This article will provide context for the visit, and help them complete the post-visit writing task.

Preparation

- Familiarize yourself with the student writing task and rubric (p. 15, 16-17).
- Familiarize yourself with the teacher version of the article (p. 3-6), and plan how to facilitate the students' reading of the article.

Instructions

- Explain the goal: to complete a writing task explaining how the human body is an ecosystem.
- Tell students that they will need to read an article before visiting the Museum, and read additional texts during the visit.

- Distribute the article, student writing task, and rubric to students.
- Review the rubric with students and tell them that it will be used to grade their writing.
- Read and discuss the article, using the teacher notes to facilitate.

2. DURING YOUR VISIT

At the Museum, students will read and engage with additional texts (including printed text, digital and physical interactives, videos, diagrams, and models). The information they'll gather from these multiple sources will help them complete the post-visit writing task.

Preparation

- Review the educator's guide to see how themes in the exhibition connect to your curriculum and to get an advance look at what your students will encounter. (Guide is downloadable at **amnh.org/secretworldinsideyou/educators**)
- Familiarize yourself with the student worksheet (p. 8, 14) and the map of the exhibition (p.3 of educator's guide).

Instructions

- Explain the goal of the Museum visit: to read and engage with texts (including printed text, digital and physical/hands-on interactives, videos, diagrams, and models), and to gather information to help them complete the post-visit writing task.
- Distribute and review the worksheet and map. Clarify what information students should collect, and where.

Additional Suggestions for Facilitating the Museum Visit

- Have students explore the exhibition in pairs, with each student completing his or her own student worksheet.
- Encourage student pairs to ask you or their peers for help locating information. Tell students they may not share answers with other pairs, but may point each other to places where answers can be found.

3. BACK IN THE CLASSROOM

Students will use what they have learned from the pre-visit article and at the Museum to complete a CCSS-aligned explanatory writing task explaining how the human body is an ecosystem.

Preparation

- Plan how you will explain the student writing task and rubric (p. 15-17) to students.

Instructions

- Distribute the student writing task and rubric. Explain that they will use it while composing, and also to evaluate and revise what they have written.

Suggestions for Facilitating Writing Task

- Before they begin to write, have students use the writing task to frame a discussion around the information that they gathered at the Museum. They can work in pairs, small groups, or as a class, and can compare their findings.
- Referring to the writing prompt, have students engage in some form of pre-writing. They may make an outline and/or talk through their writing plan with a partner. Students should refer back to relevant parts of the text as well as their notes from the exhibit. They may revise their writing plan based on peer conversations.
- They should use the rubric as well as the bulleted points in the writing task instructions to help guide their writing.

Supports for Diverse Learners

This resource has been designed to engage all learners with the principles of Universal Design for Learning in mind. It represents information in multiple ways and offers multiple ways for your students to engage with content as they read about, discuss, view, and write about scientific concepts. Different parts of the experience (e.g. reading texts, or locating information in the Museum) may challenge individual students. However, the arc of learning is designed to offer varied opportunities to learn. We suggest that all learners experience each activity, even if challenging. If any students have an Individualized Education Program (IEP), consult it for additional accommodations or modifications.

Alternate Version of Article

Another version of the same article with a lower lexile level is available for download at amnh.org/secretworldinsideyou/educators. You can use this same activity with that article.

ARTICLE: TEACHER VERSION

About this Article

Lexile: 1030

Wordcount: 837

Text Complexity: The Lexile level for this article falls within the grade 6-8 CCSS text complexity band. In addition, a qualitative analysis of this text indicates that it is appropriately complex for middle school readers. However, teachers should use their knowledge of students' independent reading levels to determine the appropriate level of support students will need to read this text with a high level of comprehension.

Note: Assign partners prior to reading this text aloud with students and have them assign a "partner A" and "partner B."

Key for Teacher Notes

- Green text
  specific strategies
- Regular text
  instructions for teachers
- *Italicized text*
  teacher's instructions to students
- Underlined text
  important domain-specific words

Human Microbiome: Your Body Is an Ecosystem

What is an ecosystem?

An ecosystem is a community of living things that interact with each other and their environment. Forests, lakes, and caves are ecosystems, and each contains a unique mix of living things, like plants and animals. Every ecosystem also contains non-living things, like air, sunlight, rocks, and water.

You are an Ecosystem

The human body is also an ecosystem. We are home to thousands of kinds of bacteria, viruses, fungi, and other microscopic organisms—trillions of them. There are more microbes living on just your skin right now than there are people on Earth. And there are a thousand times more than that in your gut! Together all the microbes in and on the human body form communities that make up the human microbiome. Like fingerprints, no two human microbiomes are the same. You aren't just an ecosystem—you are an *unique* ecosystem.

The human body is an ecosystem. We are home to trillions of microbes.

Humans & Microbes

Microbes first appeared over 3.5 billion years ago. This makes them the oldest form of life on Earth. Over the past six million years, humans and microbes have coevolved to form complex relationships. Humans need a microbiome to stay healthy, and the microbiome needs environments provided by the human body in order to survive.

To avoid contamination by other bacteria, biologists study the human microbiome in a sterile environment.

Just like the plants and animals in an ocean or a desert, the species that make up a microbiome interact with each other. They rely on these interactions in order to eat, grow, and reproduce. Different species of microbes live in different places in and on our bodies. They are adapted to these environmental conditions, from the cool, dry skin of your knee to the warm, moist darkness inside your mouth.

Think-Pair-Share: *Let's take a moment to think about this title. Have you heard of the "human microbiome?" If you have, tell your partner what you think it means. OR, look for smaller words you do know within the larger word "microbiome."*

Listen in to students' conversations. You may hear students say that "micro" means tiny, and that "biome" is a word they have heard in science but not in relation to the human body. You may want to facilitate a brief whole-class discussion based on what you overheard students say to partners about the word "microbiome." The goal here is not to define the word before starting the read aloud, but to activate students' knowledge and/or speculation about what the word means.

Think Aloud: *This paragraph starts out by telling us what an ecosystem is in general. It's important that we understand this.*

Think-Pair-Share: *Take a moment to turn and talk with your partner about what an ecosystem is.* (Zoom in on these first three sentences of the first paragraph, and encourage students to paraphrase what the text is saying in their own words).

Alternatives: If students do not have background knowledge on ecosystems, you may opt to **think aloud** instead, demonstrating how you **paraphrase** the first three sentences, stopping to allow for brief discussion. You may also show images of the ecosystems mentioned in the text (forests, lakes, caves) on the Smartboard, pointing out the living things and non-living things that interact with each other. Conclude this section with notes on the whiteboard or a chart that list the components/characteristics of an ecosystem.

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Think Aloud: *The text has shifted from talking about ecosystems in the environment to another very different kind of ecosystem . . . the one in our bodies!*

Think Aloud: ***Microbes** are the living things in our ecosystem (the text names three kinds – bacteria, viruses and fungi)...*

Think-Pair-Share: *What do you think the non-living things are in the human ecosystem, the* **microbiome**? Listen in to students' conversations and select a student to share out. (Possible answers: water and nutrients from food).

Shared Writing: Create working definition of **microbiome** that you can revisit later (after finishing the reading and/or after visiting the exhibit). Begin concept map graphic organizer on chart paper/whiteboard (see sample map on p.7). Add **fungi**, **viruses** and **bacteria** to concept map.

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Just like the plants and animals in an ocean or a desert, the species that make up a microbiome interact with each other. They rely on these interactions in order to eat, grow, and reproduce. Different species of microbes live in different places in and on our bodies. They are adapted to these environmental conditions, from the cool, dry skin of your knee to the warm, moist darkness inside your mouth.

Think aloud about this section, paraphrasing to help students understand it. You may want to add some key details to the working definition of microbe. The example given here is helpful because it shows how some bacteria are able to live on human skin.

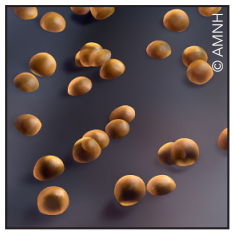
Think Aloud: Think back to earlier in the text when we discussed ecosystems. The organisms living in a forest interact with each other. (Give an example – "*For instance, owls eat mice*"– or invite a student to give an example). Species in our microbiome interact in the same way.

Think-Pair-Share: *What is this section of the article is saying about how the species in the microbiome interact with each other?* Listen in and select student to share out. It is important that students understand that different places on our bodies provide ideal conditions for different microbes.

How do scientists study the human microbiome?

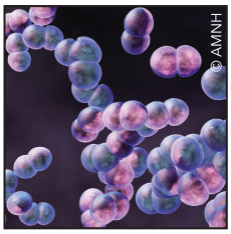
How do scientists find out which organisms make up a human microbiome? They can do experiments. James Meadows, a researcher at the University of Oregon, placed people in a "clean room": a room as free of microbes as possible. (Microbes are everywhere.) Scientists sealed off the room and sterilized it. They filtered the air to prevent microbes from coming in from the outside. Then they divided the space into two rooms. One stayed empty. People entered the other room, one at a time. After each person left, the researchers took a sample of the air in the room. Scientists repeated the experiment many times, and could always tell which room had been occupied. They could measure bacterial "clouds" in the room—bacteria that had come off the person's body. Because every person's microbiome is unique, they could also identify different people from their bacterial "clouds."

Scientists are just beginning to understand what roles these organisms play in human health. Some species benefit us, like gut bacteria that help digest food. Some cause harm, like pathogens that cause disease. Many simply coexist with us—it seems that most species are either benign or beneficial to humans. Scientists call these bacteria commensal (if they are harmless) or mutualistic (if they offer a benefit). Sometimes bacteria that are harmless or beneficial in one place can cause problems in another.



***Staphylococcus* bacteria can help protect our skin against fungi and yeast. But they can also cause infections and even life-threatening diseases.**

***Propionibacterium acnes* is commonly found on human skin where it is harmless. But if it becomes trapped in a hair follicle, it can cause acne.**



***S. epidermidis* is usually harmless, but it can cause infection if it enters the body.**

Competition in the Biome

Just like organisms in any ecosystem, microorganisms within the microbiome compete with each other for space and resources. They also prevent other organisms from entering the ecosystem. Some of this competition benefits us. For example, a bacteria on our skin called *Bacillus subtilis* competes with the fungus that causes athlete's foot, preventing the fungus from infecting us.

Scientists are studying how these microorganisms work in our bodies, and learning about the balance between different bacterial communities. Products like antibacterial hand sanitizers can wipe out all bacteria on a patch of skin, good and bad alike. Antibiotic drugs also destroy helpful bacteria along with

START Think-Pair-Share/Paraphrase: *Look away from the text and explain to your partner how scientists study the* ***microbiome****... refer back to the text when you need to, but don't just read from the text – in your explanation, use your own words.* Listen in and select a student to share out OR "re-voice" what you heard a student say to save time.

Open-Ended Question/Think-Pair-Share: *Why do you think it was important for the room to be sterile?* Listen in and select student(s) to share out. You may want to direct students' attention to the accompanying image of the clean room (on p. 4) as you pose this question.

Possible Follow-Up Question: What do you think the term "bacterial cloud" means?

Add bolded terms to concept map. This can be done independently (least support), in partners (some support), or as a shared writing guided by the teacher (most support).

See attached sample concept map (p. 7).

Think Aloud: So, just like competition among animals in ecosystems, different species of microbes compete in our microbiome. For example, in the forests of the American West, wolves and bears are in competition with each other because they both prey on elk. In the same way, a bacteria and fungus compete in our microbiome. An example is the Bacillus subtilis on our feet – it competes with the fungus that causes athlete's foot. When there is enough of that bacteria to crowd out the fungus, we avoid getting athlete's foot.

Open-Ended Question: *What is problematic about hand sanitizers and antibiotic drugs based on what we just read?* Listen in and invite selected students to share out.

You may want to engage students in a brief discussion of how antibiotics were initially "discovered" and are life-saving drugs, but are wreaking havoc on our microbiomes.

Add **antibiotic drugs** and hand **sanitizers** to the concept map.

their targets. Fungi evolved the ability to produce anti-bacterial chemicals as they competed with bacteria over millions of years of evolution. By studying these fungi, scientists learned how to manufacture these anti-bacterial chemicals and turn them into antibiotic drugs, which have saved millions of lives. At the same time studies suggest that rapidly increasing antibiotic use in the United States has reduced the diversity of our microbiomes.

Being Healthy Means Having a Balanced Microbiome

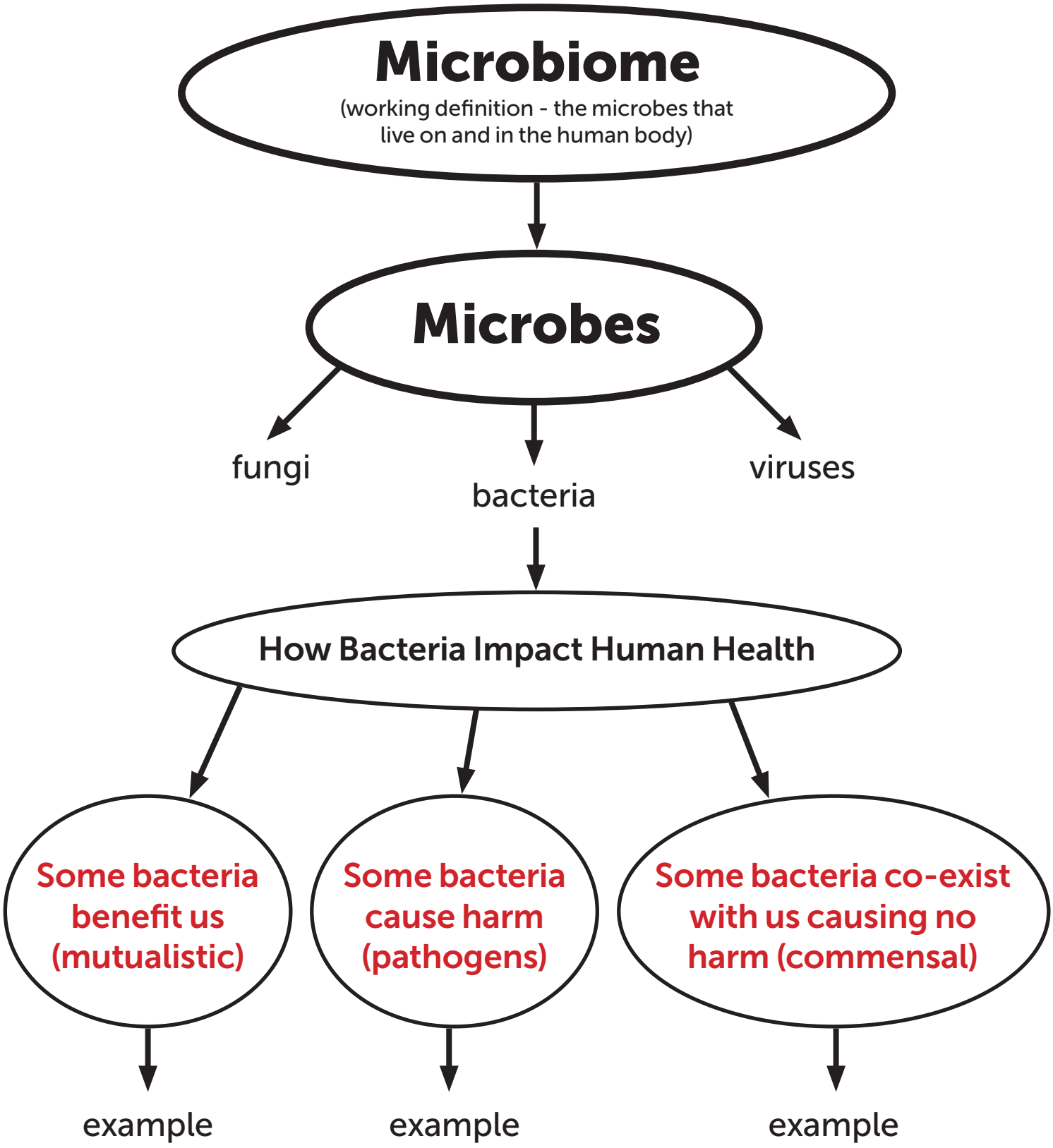
We now understand that a diverse and balanced microbiome is essential for a strong immune system. Some scientists think that infants who lack exposure to microorganisms develop a higher rate of allergies, asthma, eczema, and other health problems. Studies also suggest that the microbiome plays a role in obesity, and in conditions like depression.

The microbiome is so important that it is like an additional organ. It is a part of the body that serves vital functions, like the skin or kidneys. We need to preserve ecosystems in nature, so preserving our own ecosystem is important too.

Open-Ended Questions to use for Quick-Writes or to spark whole group discussion:

- What do you think the author means by "a diverse and balanced microbiome"?
- What are some of the ways that a diverse and balanced microbiome helps keep us healthy?

SAMPLE CONCEPT MAP



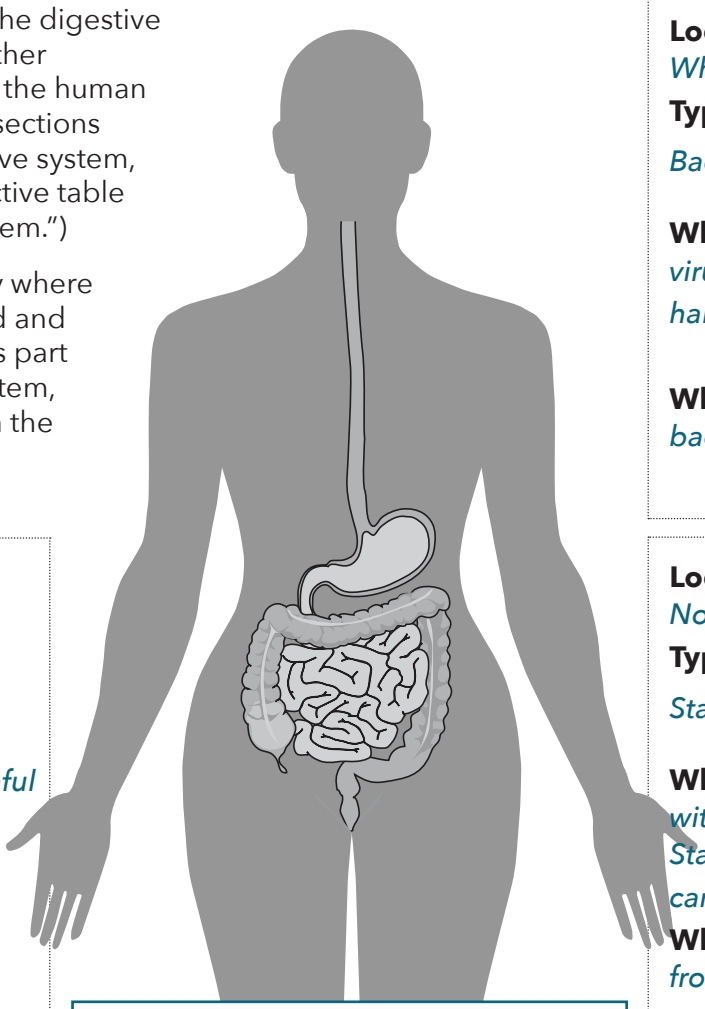
** The same bacteria that is helpful or harmless in one place can become pathogenic in a different place on the body.

STUDENT WORKSHEET

Name _____ **ANSWER KEY**

Use the boxes below to record information about different species in the human microbiome.

- **Select** one type of microbe that lives on the skin, one found in the digestive system, and at least two other microbes from any part of the human body. (See the exhibition sections about the skin and digestive system, as well as the large interactive table called "You are an Ecosystem.")
- **Label** the part of the body where these organisms are found and explain (1) what they do as part of the microbiome ecosystem, and (2) what they get from the ecosystem.



Location: *(Sample Answer) Whole Body*
Type of microbe:
Bacteriophage viruses

What they do: *These viruses kill helpful and harmful bacteria.*

What they get: *They use bacterial cells to reproduce.*

Location: Skin
Type of microbe:
Bacillus subtilis

What they do: *These bacteria can fight off harmful bacteria and fungi.*

What they get: *They consume dead skin cells and oils on skin.*

Location: *(Sample Answer) Nose*
Type of microbe:
Staphylococcus epidermidis

What they do: *Compete with other bacteria like Staphylococcus aureus that can cause disease.*

What they get: *Nutrients from the skin.*

Location: Digestive System
Type of microbe:
Lactobacilius acidophilus

What they do: *Help the body digest milk and can protect the digestive system.*

What they get: *Milk and other foods from the human diet.*

TEACHER NOTE: The answers above describe a few of the many organisms found in this exhibit. Students should visit a variety of sections in the exhibit including sections 2c (skin), 4a (interactive table), and 6b (digestive system) to gather information about microbes. Sometimes the species name is not given and students may describe the type of organism in general terms such as virus or bacterium. Students will need to find at least one skin-dwelling microbe, one from the digestive system, as well as at least one other from a third part of the body.

Location:
Type of microbe:

What they do:

What they get:

ESSAY SCORING RUBRIC: TEACHER VERSION - page 1

Scoring Criteria		Exceeds	Meets	Approaches	Needs Additonal Support
		4	3	2	1
RESEARCH (worth 1/3)	**Article: "Human Microbome: Your Body Is an Ecosystem"**	Accurately presents information relevant to all parts of the prompt with effective paraphrased details from the article	Presents paraphrased information from the article relevant to the prompt with accuracy and sufficient detail	Presents information from the article relevant to the purpose of the prompt with minor lapses in accuracy or completeness AND/ OR information is copied from the text	Attempts to present information in response to the prompt, but lacks connections to the article or relevance to the purpose of the prompt
	Museum Exhibition: *The Secret World Inside You*	Accurately presents information relevant to all parts of the prompt with effective paraphrased details from the exhibition	Presents paraphrased information from the article relevant to the prompt with accuracy and sufficient detail	Presents information from the exhibition relevant to the purpose of the prompt with minor lapses in accuracy or completeness AND/ OR information is copied from the text	Attempts to present information in response to the prompt, but lacks connections to the exhibition content or relevance to the purpose of the prompt
SCIENCE (worth 1/3)	**Science Explanations**	Integrates relevant and accurate science content with thorough explanations that demonstrate in-depth understanding of how the human body is an ecosystem	Accurately presents science content relevant to the prompt with sufficient explanations that demonstrate understanding of how the human body is an ecosystem	Briefly notes science content relevant to the prompt; shows basic or uneven understanding of how the human body is an ecosystem	Attempts to include science content in explanations, but lacks understanding of how the human body is an ecosystem; content is irrelevant, inappropri-ate, or inaccurate
WRITING (worth 1/3)	**Focus**	Maintains a strongly developed focus on the writing prompt for the entire essay	Maintains focus on the writing prompt for the majority of the essay	Addresses the prompt but is off-task some of the time	Does not address the prompt for most or all of the essay
		Clearly introduces the topic of the microbiome, and how the human body is an ecosystem	Introduces the topic of the human body as an ecosystem	Attempts to introduce the topic of the human body as an ecosystem; introduction is inaccurate or incomplete	Does not introduce the topic of the human body as an ecosystem
		Provides a relevant concluding paragraph	Provides a relevant concluding section	Provides a concluding statement	Provides no sense of closure

ESSAY SCORING RUBRIC: TEACHER VERSION - page 2

Scoring Criteria		Exceeds	Meets	Approaches	Needs Additonal Support
		4	3	2	1
WRITING (worth 1/3)	**Development**	Clearly introduces two types of microbes	Introduces two types of microbes	Introduces only one type of microbe	Does not introduce any types of microbes
		Clearly and accurately explains what two types of microbes do as part of the ecosystem	Explains what two types of microbes do as part of the ecosystem	Explains what one type of microbe does as part of the ecosystem OR explains what two types of microbes do as part of the ecosystem but lacks sufficient development	Does not explain what any microbes do as part of the ecosystem
		Clearly and accurately explains what two types of microbes get from the ecosystem	Explains what two types of microbes get from the ecosystem	Explains what one type of microbe gets from the ecosystem OR explains what two types of microbes get from the ecosystem but lacks sufficient development	Does not explain what any microbes get from the ecosystem
		Consistent use of precise and domain-specific language where appropriate	Some use of precise and domain-specific language	Little use of precise and domain-specific language	No use of precise and domain-specific language
	Clarity	Demonstrates and maintains a well-developed command of standard English conventions and cohesion, with few errors; response includes language and tone consistently appropriate to the purpose and specific requirements of the prompt	Demonstrates a command of standard English conventions and cohesion, with few errors; response includes language and tone appropriate to the purpose and specific requirements of the prompt	Demonstrates an uneven command of standard English conventions and cohesion; uses language and tone with some inaccurate, inappropriate, or uneven features	Attempts to demonstrate standard English conventions, but lacks cohesion and control of grammar, usage, and mechanics

ARTICLE

Human Microbiome: Your Body Is an Ecosystem

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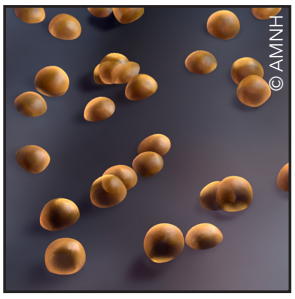
Scientists are just beginning to understand what roles these organisms play in human health. Some species benefit us, like gut bacteria that help digest food. Some cause harm, like pathogens that cause disease. Many simply coexist with us—it seems that most species are either benign or beneficial to humans. Scientists call these bacteria commensal (if they are harmless) or mutualistic (if they offer a benefit). Sometimes bacteria that are harmless or beneficial in one place can cause problems in another.



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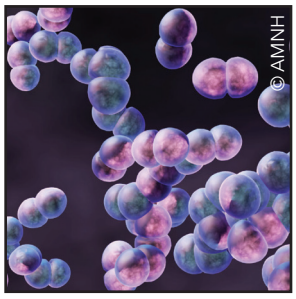

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their targets. Fungi evolved the ability to produce anti-bacterial chemicals as they competed with bacteria over millions of years of evolution. By studying these fungi, scientists learned how to manufacture these anti-bacterial chemicals and turn them into antibiotic drugs, which have saved millions of lives. At the same time studies suggest that rapidly increasing antibiotic use in the United States has reduced the diversity of our microbiomes.

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The microbiome is so important that it is like an additional organ. It is a part of the body that serves vital functions, like the skin or kidneys. We need to preserve ecosystems in nature, so preserving our own ecosystem is important too.

STUDENT WORKSHEET

Name _____

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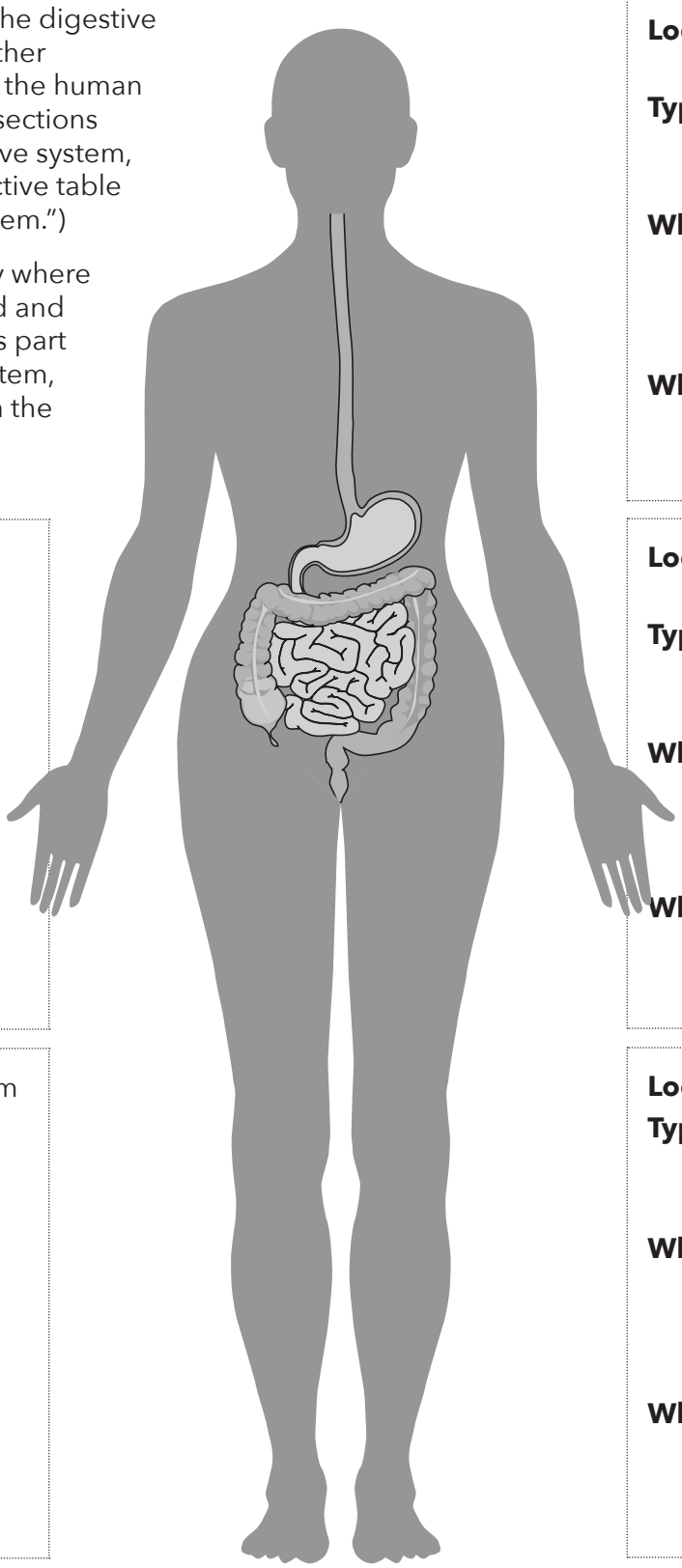
- **Select** one type of microbe that lives on the skin, one found in the digestive system, and at least two other microbes from any part of the human body. (See the exhibition sections about the skin and digestive system, as well as the large interactive table called "You are an Ecosystem.")
- **Label** the part of the body where these organisms are found and explain (1) what they do as part of the microbiome ecosystem, and (2) what they get from the ecosystem.



Location: Skin
Type of microbe:

What they do:

What they get:

Location:

Type of microbe:

What they do:

What they get:

Location: Digestive System
Type of microbe:

What they do:

What they get:

Location:
Type of microbe:

What they do:

What they get:

Location:

Type of microbe:

What they do:

What they get:

STUDENT WRITING TASK

After reading "*Human Microbiome: Your Body Is an Ecosystem*" and taking notes in The Secret World Inside You exhibition, write an essay in which you explain how the human body is an ecosystem.

Be sure to:

- Define the word "ecosystem."
- Give one example of a type of microbe from the reading and explain what they do as part of the microbiome ecosystem, and what they get from the ecosystem.
- Give one example of a type of microbe from the exhibition and explain what they do as part of the microbiome ecosystem, and what they get from the ecosystem.

ESSAY SCORING RUBRIC: STUDENT VERSION

Scoring Criteria		Exceeds	Meets	Approaches	Needs Additonal Support
		4	3	2	1
RESEARCH (worth 1/3)	**Article: "Human Microbiome: Your Body Is an Ecoystem"**	I have used information correctly from the article to write my essay; I have given a lot of detail to explain the information in my own words	I have used information correctly from the article to write my essay in my own words	I have used information from the article to write my essay, but not all of my information is correct AND/OR I didn't use my own words	I did not use information from the article to write my essay
	Museum Exhibition: *The Secret World Inside You*	I have used information correctly from the exhibition to write my essay; I have given a lot of detail to explain the information in my own words	I have used information correctly from the exhibition to write my essay in my own words	I have used information from the exhibition to write my essay, but not all of my information is correct AND/OR I didn't use my own words	I did not use information from the exhibition to write my essay
SCIENCE (worth 1/3)	**Science Explanations**	All of the information I included about how the human body is an ecosystem is correct	Most of the information I included about how the human body is an ecosystem is correct	Some of the information I included about how the human body is an ecosystem is correct	None of the information I included about how the human body is an ecosystem is correct
WRITING (worth 1/3)	**Focus**	My entire essay is about the human microbiome	Most of my essay is about the human microbiome	Some of my essay is about the human microbiome	None of my essay is about the human microbiome
		I included a clear introductory paragraph on the microbiome, and how the human body is an ecosystem	I included an introductory paragraph to the essay	I included an introductory sentence to the essay	I did not include an introduction
		I wrote a concluding paragraph that relates to the information in my essay	I wrote a concluding section that relates to the information in my essay	I wrote a concluding sentence at the end of the essay	I did not write a concluding sentence at the end of the essay

ESSAY SCORING RUBRIC: STUDENT VERSION

Scoring Criteria		Exceeds	Meets	Approaches	Needs Additonal Support
		4	3	2	1
WRITING (worth 1/3)	**Development**	I clearly introduced two types of microbes	I introduced two types of microbes	I introduced only one type of microbes	I did not introduce any types of microbes
		I clearly and accurately explained what two types of microbes do as part of the ecosystem	I explained what two types of microbes do as part of the ecosyste	I explained what one type of microbe does as part of the ecosystem	I did not explain what any type of microbe does as part of the ecosystem
		I clearly and accurately explained what two types of microbes get from the ecosystem	I explained what two types of microbes get from the ecosystem	I explained what one type of microbe gets from the ecosystem	I did not explain what any type of microbes get from the ecosystem
		I used all appropriate science vocabulary words correctly	I used most science vocabulary words correctly	I used some science vocabulary words correctly	I did not use any science vocabulary words
	Clarity	I edited my essay for spelling, punctuation, and grammar; there are no errors	I edited my essay for spelling, punctuation, and grammar; there are some minor errors but the reader can still understand my writing	I did not carefully edit my essay for spelling, punctuation, and grammar; there are errors that may make the essay hard for readers to understand	I did not edit my essay for spelling, punctuation, and grammar; there are many errors that make the essay hard for readers to understand