

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:

- BEFORE YOUR VISIT**, students will read a content-rich article about the microbes that live on and in our bodies that make up our microbiome. This article will provide context for the visit, and also help them complete the post-visit writing task.
- AT THE MUSEUM**, students will read and engage with additional texts (including printed text, digital and physical/hands-on interactives, video, diagrams, models). This information will help them complete the post-visit writing task.
- BACK IN THE CLASSROOM**, students will draw on the first two components of the activity to complete a CCSS-aligned explanatory writing task about the different parts of the body where microbes live.

Materials in this packet include:

For Teachers

- Activity Overview (p. 1-2)
- Article (teacher version): "Body Buddies: The Microbes That Live In and On Us" (p. 3-5)
- Sample concept web (p. 6)
- Answers to student worksheet (p. 7)
- Essay scoring rubric (teacher version) (p. 8-9)

For Students

- Article (student version): "Body Buddies: The Microbes That Live In and On Us" (p. 10-12)
- Student worksheet for *The Secret World Inside You* exhibition visit (p. 13)
- Student writing task (p. 14)
- Essay scoring rubric (student version) (p. 15-16)

1. BEFORE YOUR VISIT

Students will read a content-rich article about the microbes living on and in our bodies that make up our microbiome. 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. 14, 15-16).
- Familiarize yourself with the teacher version of the article (p. 3-5), and plan how to facilitate the students' reading of the article.

Instructions

- Explain the goal: to complete a writing task about the different parts of the body where microbes live.
- Tell students that they will need to read an article before visiting the Museum, and read additional texts during the visit.

Common Core State Standards

RI.3.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.

RI.3.2 Determine the main idea of a text and explain how it is supported by key details; summarize the text.

W.3.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

New York State Science Core Curriculum

LE 3.1c

Next Generation Science Standards

DCI: LS2.A Interdependent Relationships in Ecosystems

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

Obtain and combine information from books and/or other reliable media to explain phenomena.

- 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/hands-on interactives, video, 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/secretworldinsidemyou/educators)
- Familiarize yourself with the student worksheet (p. 7) 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, video, diagrams, 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 about the different parts of the body where microbes live.

Preparation

- Plan how you will explain the student writing task and rubric (p. 14-16) 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/secretworldinsidemyou/educators. You can use this same activity with that article.

ARTICLE: TEACHER VERSION

About this Article

Lexile: 810

Wordcount: 591

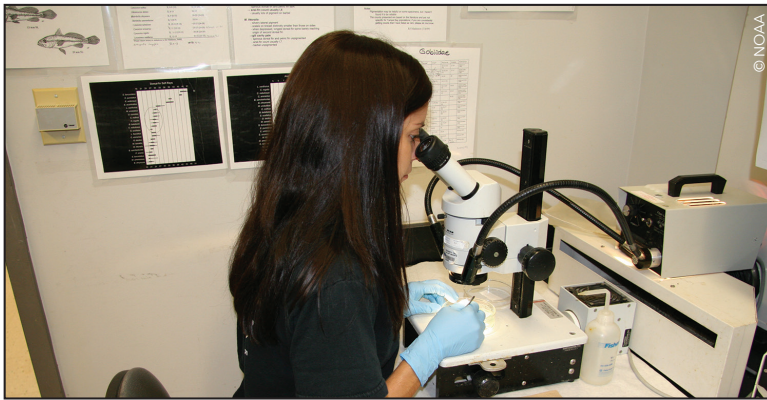
Text Complexity: The Lexile level for this text falls in the beginning of the 4-5 CCSS grade level band. This text is suitable as a read aloud for students in grades 3. Teachers should use their professional judgment and knowledge of students' independent reading levels regarding assigning this text for independent reading.

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

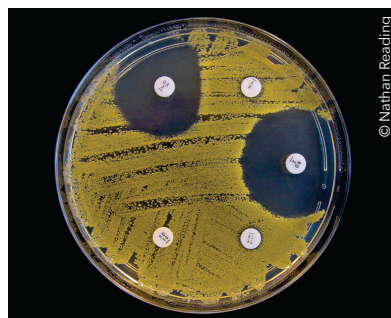
Body Buddies: The Microbes That Live In and On Us



Scientists use microscopes to examine things that are too small to be seen by the human eye.

Try to count all the living things you can see. You might spot people, trees, a squirrel, grass, birds, or insects. But did you know that most of the life around you can't be seen? That's because most living things are microbes: tiny, one-celled organisms that are invisible without a microscope.

Microbes live everywhere. They're in the water you drink, the food you eat, and the air you breathe. Right now, there are *trillions* of microbes in your belly and on your skin! These microbes live, feed, and reproduce in and on your body. But don't worry! Most of these microbes aren't "germs." They don't make you sick. Some of them actually help keep you healthy.



This is what *Staphylococcus aureus*, a type of bacteria, looks like under the microscope.

Many Homes for Many Microbes

Many kinds of microbes live in your body: there are fungi and viruses, but most are bacteria. And different types live on different parts of your body. Take your skin as an example. You can think of your skin as a landscape

Think-Pair-Share: Let's read this title together. What do you think this article might be about? Listen in and allow selected students to share their thinking about the title.

Think Aloud: Wow! This paragraph gave us some very important information... most living things are not actually people or animals!

Think Aloud: Turn and tell your partner what most living things actually are. Invite students to share out "microbes" and write the word on the board or chart paper.

Think Aloud: Let's read on to find out more about what microbes are.

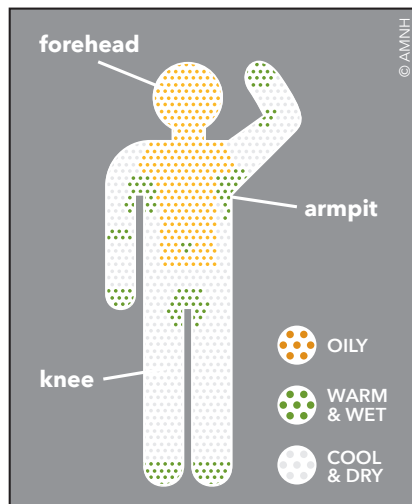
Think-Pair-Share: What are you learning about microbes? Listen in to get a quick sense of student understanding of the text so far.

Teacher-Led Shared Writing (Making a Web): Write the word "microbes" on a chart and draw a circle around it. Draw five or six spokes coming off the circle. Tell students: *You just spoke with a partner about what the text is teaching us about microbes... Let's put some of what we know about microbes so far on this web...*

Invite students to share out and scribe some descriptors as offshoots from the spokes of the web. (See attached sample web on p. 6). When possible, coach students to paraphrase the details they are recounting from the text into their own words.

with mountains, valleys, cracks, and forests. Some parts are cool and dry, and others are warm and moist. Other parts might be smooth or rough, oily, or covered with hair.

In every part, different types of microbes find the shelter, moisture, and other nutrients they need to grow. This is happening all over your body: a unique group of microbes live in each part of your gut, your mouth, and even in your brain.

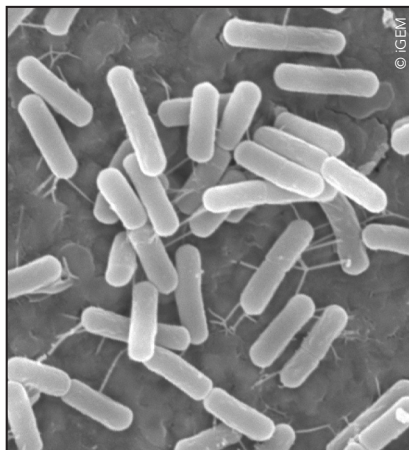


Your skin has lots of environments. Some are oily, others are warm and moist or cool and dry.

Body Buddies

When you shake someone’s hand or grab a doorknob, harmful microbes, called pathogens, might grab onto you. Fortunately, the helpful bacteria that live on our hands can usually fight them off. But using hand sanitizer can wipe out enough of the helpful bacteria to give harmful ones a chance to take over. So it’s better to wash your hands with soap and water, which will sweep away most pathogens. Some of your helpful bacteria will be swept away too, but will soon grow back where they belong in the palm of your hand.

Microbes are hard at work in other parts of your body too. They help protect you from pathogens, and also help you digest food, make vitamins, and even help your brain work! That’s why we need to be careful when



Bacillus subtilis is a type of bacteria typically found on skin. These bacteria don’t harm us, and they may protect us from harmful pathogens.

Teacher-Led Shared Writing (Adding to the Web):

Draw a line from the circle containing the word “microbes” and write “Kinds.” Draw a circle around the word “Kinds” and ask students to look back in the text and tell you the three different kinds of microbes listed. Invite students to share out, and scribe what they say, making three spokes coming from the word “Kinds,” writing “fungi,” “viruses,” and “bacteria” at the end of each spoke. (See attached sample web on p. 6).

Think-Pair-Share: What are we learning about how microbes live on our bodies?

Listen in and select a few students to share out with the large group. Facilitate a brief whole group discussion about what the class has learned from this text so far. As you invite students to share, remind them to refer to specific parts of the text and/or diagram as needed. (A central idea that should emerge from the discussion is the concept that microbes get what they need from the part of the human body that they are living on/in.)

In the margin or on a separate piece of paper, have students use sketching and labeling to show the sequence of events in the first three sentences. (They can draw three boxes and sketch/label in each box).

You may opt to do this as a teacher-led interactive writing, in which students come up to the white board or chart. Alternatively, students can act the scenes out in small groups or in front of the class, using labels to identify the “characters” (the hand, the doorknob, the pathogen, the beneficial bacteria). The three boxes/scenes may depict the following three actions:

- someone’s hand holding onto a doorknob
- pathogens transferring to the hand
- beneficial bacteria fighting off some of the pathogens

(Explain to students that microbes cannot be seen without a microscope but that the pictures/acting out can help us understand how they work).

we use antibiotics. Antibiotics are important medicines because they can kill dangerous pathogens. But they can also kill the helpful microbes in our bodies.

You are an Ecosystem!

You've probably heard of ecosystems like forests and prairies. An ecosystem is a community of living things, such as plants and animals, as well as non-living things like water, air, and rocks. Ecosystems don't have to be large. In fact, together, your body and your microbes make up an amazing ecosystem. Your body provides the environment for the trillions of microbes living inside you. And in return, they keep your body's systems working like they should.

Now you have a new way to think of yourself: You're more than an individual, you're a "superorganism!" You might feel funny about all those microbes living on you and inside of you. But remember, they're an important part of our bodies and our health.

Think-Pair-Share: *Why do you think antibiotic medications can be a problem for us? Listen in and select student(s) to share out. Facilitate brief whole group discussion. Clarify as needed.*

Think Aloud: *Wow! This paragraph compares our bodies to forests and prairies...*

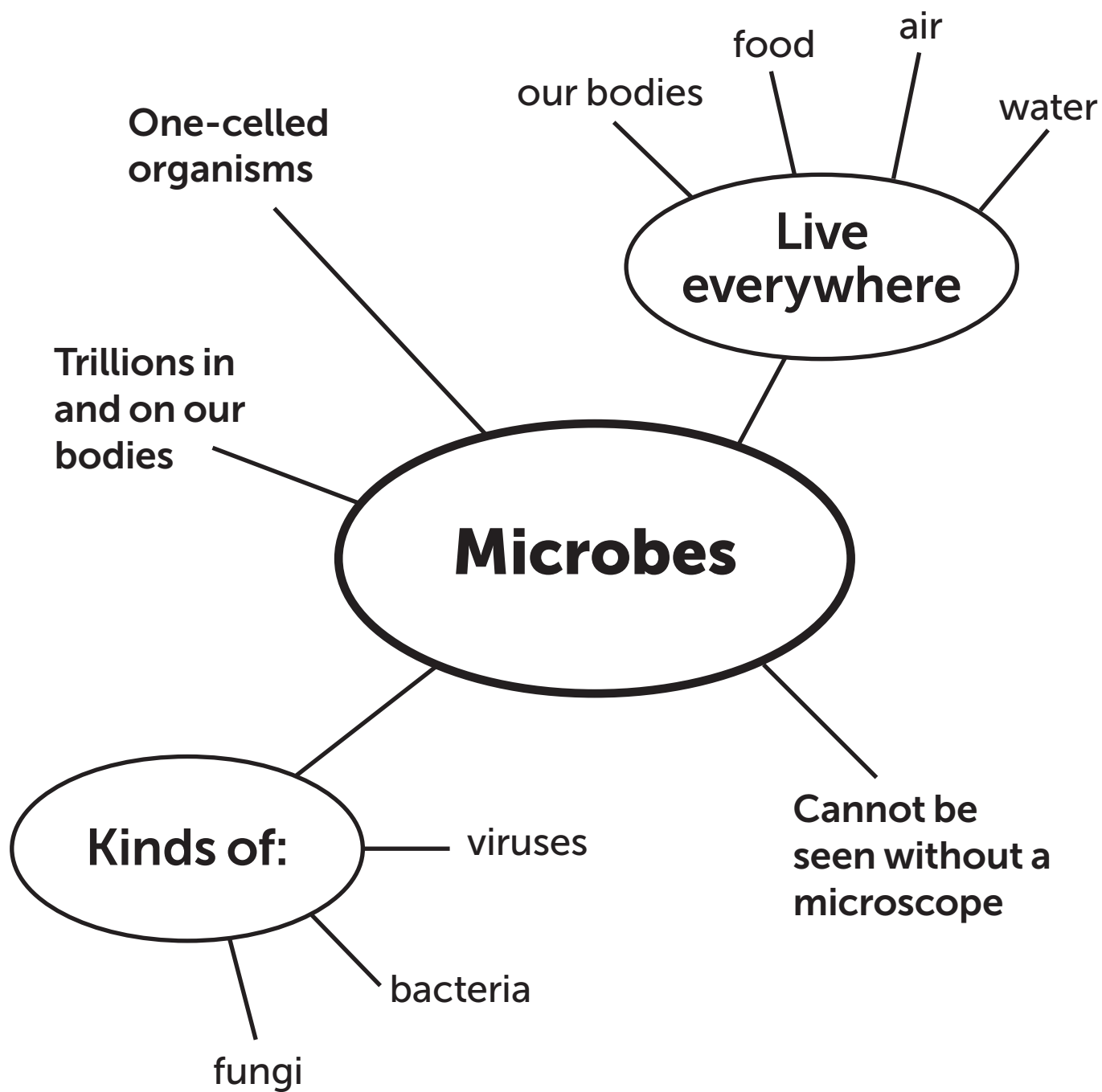
Think-Pair-Share: *In what way are our bodies like forests and prairies? Listen in and select student(s) to share out. Facilitate brief whole group discussion about how the human body—plus the the microbes that live in it and on it—is an ecosystem. Clarify as needed.*

Formative Assessment

Exit Slip Questions:

- What did this article teach you about microbes?
- How do microbes help us?
- How can microbes be harmful to us?
- What was the most surprising thing that you learned in this article?

SAMPLE CONCEPT WEB



STUDENT WORKSHEET

Name _____

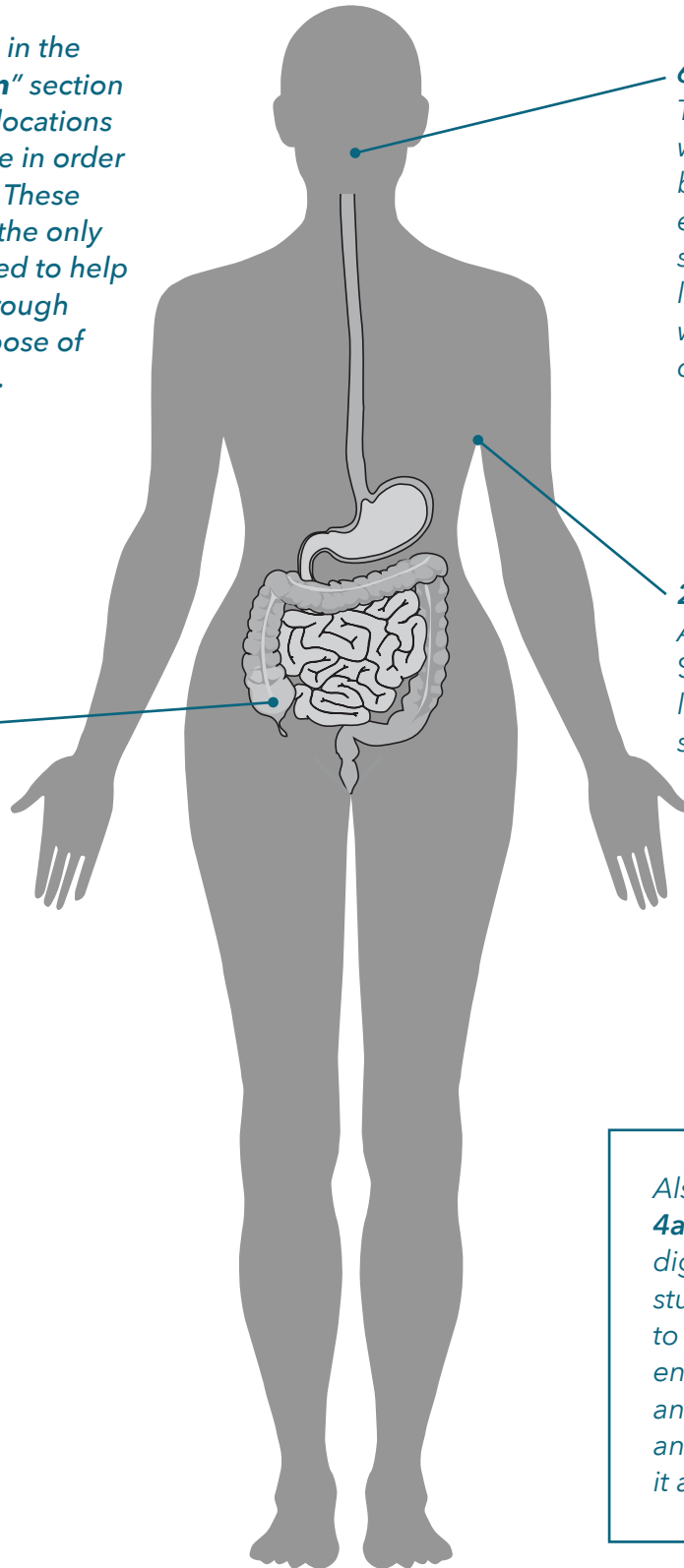
ANSWER KEY

As you walk around the exhibition, **take notes** on the different parts of the body where microbes live. **Circle** the place on the body below that these microbes are live, and **take notes** on what you learn about the environment and the microbes.

Refer to the following steps in the **"Teaching in the Exhibition"** section of the educator's guide for locations that students can investigate in order to complete the worksheet. These examples are by no means the only possibilities, but are provided to help you guide your students through the exhibition with the purpose of completing the writing task.

6b. Digestive System

In the large intestine, microbes are surrounded with food that's coming through to be digested. Some of these microbes can break down food that people can't digest themselves, turning them into useful nutrients.

**6a. Mouth**

The mouth is very wet, with lots of places for bacteria to live. For example, the chewing surfaces of teeth have lots of cracks and crevices where bacteria can feed on trapped food particles.

2a. Microbe Mix

Armpit is warm and moist. *Staphylococcus epidermis* lives there and feeds off of sweat from the body.

Also be sure to visit stop **4a. Interactive Table**. This digital interactive gives students the opportunity to explore many different environments both inside and outside a human body, and many students can use it at the same time.

ESSAY SCORING RUBRIC: TEACHER VERSION - page 1

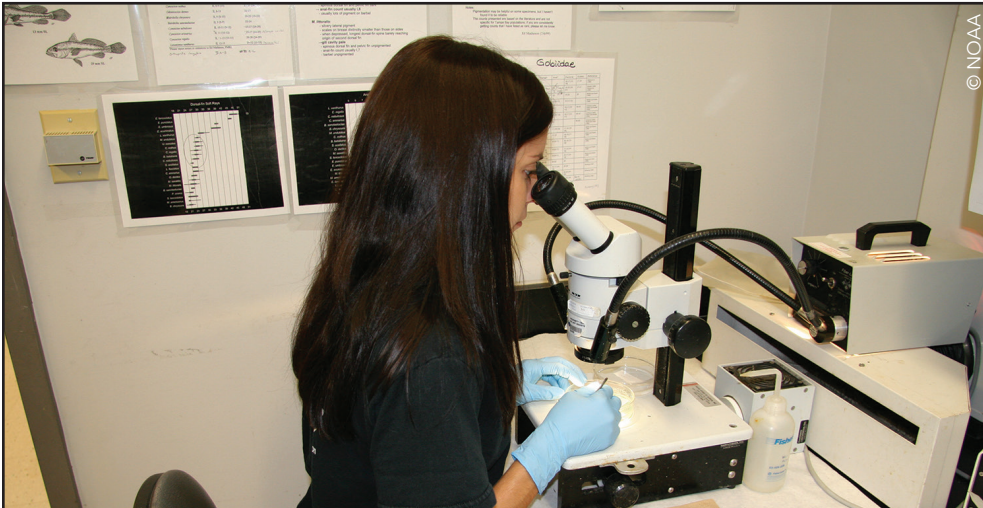
Scoring Criteria		Exceeds	Meets	Approaches	Needs Additional Support
		4	3	2	1
RESEARCH (worth 1/3)	Article: "Body Buddies: The Microbes That Live In Us and On Us"	Accurately presents information relevant to all parts of the prompt with effective paraphrased details from the article	Presents paraphrased 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: <i>The Secret World Inside You</i>	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 different kinds of microbes get what they need in the different environments on the human body	Accurately presents science content relevant to the prompt with sufficient explanations that demonstrate understanding of how different kinds of microbes get what they need in the different environments on the human body	Briefly notes science content relevant to the prompt; shows basic or uneven understanding of how different kinds of microbes get what they need in the different environments on the human body; minor errors in explanation	Attempts to include science content in explanations, but understanding of how different kinds of microbes get what they need in the different environments on the human body; content is irrelevant, inappropriate, 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 microbes and how they get what they need in the different environments on the human body	Introduces the topic of microbes and how they get what they need in the different environments on the human body; introduction may lack detail	Attempts to introduce microbes and how they get what they need in the different environments on the human body; introduction is inaccurate or incomplete	Does not introduce microbes and how they get what they need in the different environments on the human body
		Provides a relevant concluding paragraph	Provides a concluding section	x	Provides no sense of closure

ESSAY SCORING RUBRIC: TEACHER VERSION - page 2

Scoring Criteria		Exceeds	Meets	Approaches	Needs Additional Support
		4	3	2	1
WRITING (worth 1/3)	Development	Clearly introduces three environments where microbes live in and on the human body	Introduces three environments where microbes live in and on the human body	Introduces only one or two environments where microbes live in and on the human body	Does not introduce any environments where microbes live in and on the human body
		Clearly and accurately describes how three microbes get what they need in three different environments on the human body	Describes how three microbes get what they need in three different environments on the human body	Describes how one or two microbes get what they need in three different environments on the human body OR attempts to describe how three microbes get what they need in three different environments on the human body in a manner that is inaccurate or incomplete	Does not describe how three microbes get what they need in three different environments on the human body
		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

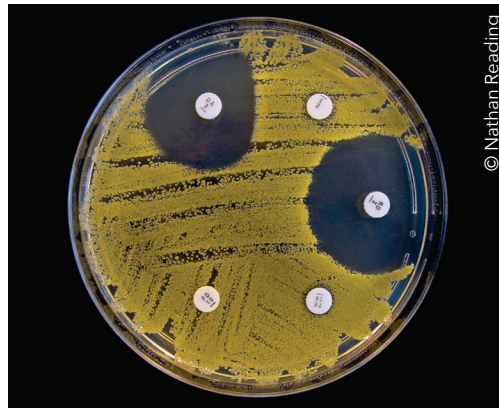
Body Buddies: The Microbes That Live In and On Us



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Try to count all the living things you can see. You might spot people, trees, a squirrel, grass, birds, or insects. But did you know that most of the life around you can't be seen? That's because most living things are microbes: tiny, one-celled organisms that are invisible without a microscope.

Microbes live everywhere. They're in the water you drink, the food you eat, and the air you breathe. Right now, there are *trillions* of microbes in your belly and on your skin! These microbes live, feed, and reproduce in and on your body. But don't worry! Most of these microbes aren't "germs." They don't make you sick. Some of them actually help keep you healthy.



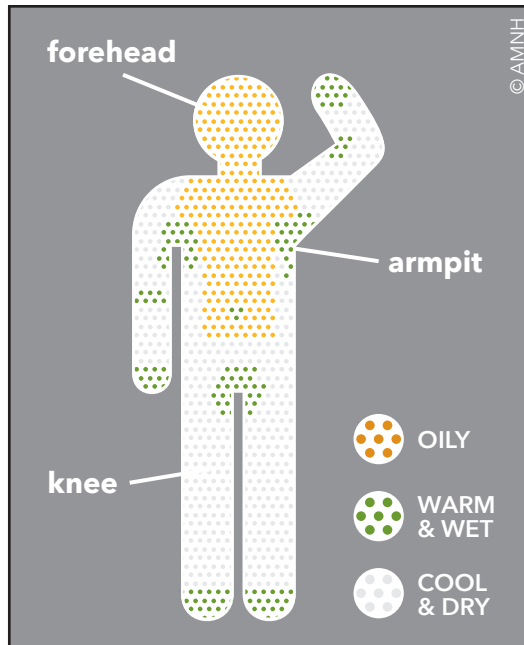
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Many Homes for Many Microbes

Many kinds of microbes live in your body: there are fungi and viruses, but most are bacteria. And different types live on different parts of your body. Take your skin as an example. You can think of your skin as a landscape

with mountains, valleys, cracks, and forests. Some parts are cool and dry, and others are warm and moist. Other parts might be smooth or rough, oily, or covered with hair.

In every part, different types of microbes find the shelter, moisture, and other nutrients they need to grow. This is happening all over your body: a unique group of microbes live in each part of your gut, your mouth, and even in your brain.



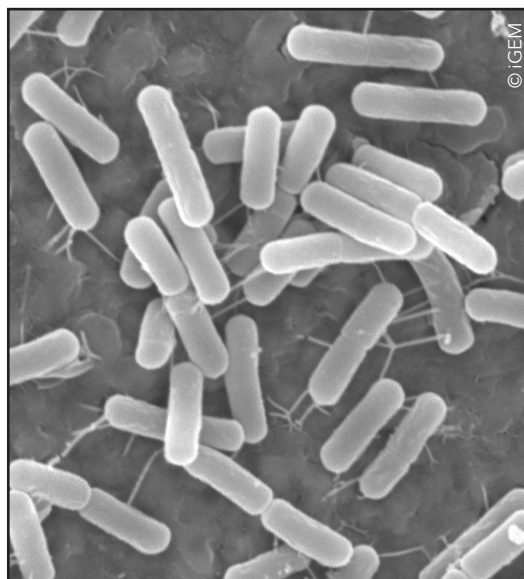
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Body Buddies

When you shake someone's hand or grab a doorknob, harmful microbes, called pathogens, might grab onto you. Fortunately, the helpful bacteria that live on our hands can usually fight them off. But using hand sanitizer can wipe out enough of the helpful bacteria to give harmful ones a chance to take over.

So it's better to wash your hands with soap and water, which will sweep away most pathogens. Some of your helpful bacteria will be swept away too, but will soon grow back where they belong in the palm of your hand.

Microbes are hard at work in other parts of your body too. They help protect you from pathogens, and also help you digest food, make vitamins, and even help your brain work! That's why we need to be careful when



***Bacillus subtilis* is a type of bacteria typically found on skin. These bacteria don't harm us, and they may protect us from harmful pathogens.**

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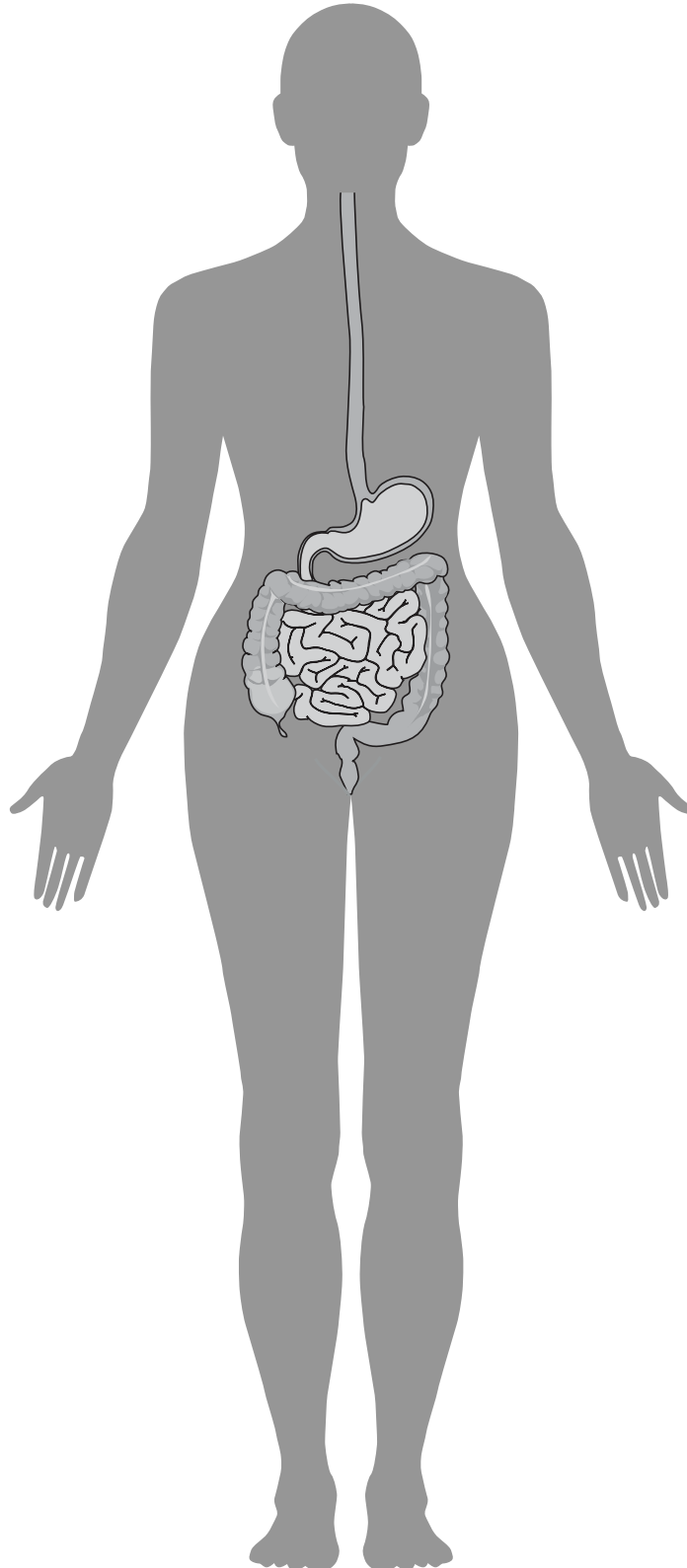
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Now you have a new way to think of yourself: You're more than an individual, you're a "superorganism!" You might feel funny about all those microbes living on you and inside of you. But remember, they're an important part of our bodies and our health.

STUDENT WORKSHEET

Name _____

As you walk around the exhibition, **take notes** on the different parts of the body where microbes live. **Circle** the place on the body below that these microbes are live, and **take notes** on what you learn about the environment and the microbes.



STUDENT WRITING TASK

Living things get what they need to live from their environment. Your body is home to trillions of microbes, tiny organisms that live in you and on you. These microbes get what they need from the places they live on or in the body. This is why we call these places “environments” for microbes.

Write an essay in which you describe how different kinds of microbes get what they need in the different environments on the human body.

Include one example from the article “Body Buddies: The Microbes That Live In and On Us.” Include two examples from the The Secret World Inside You exhibition. For each example, describe what the environment is like on/in that particular part of the body, and write about what kinds of microbes live there.

ESSAY SCORING RUBRIC: STUDENT VERSION

Scoring Criteria		Exceeds	Meets	Approaches	Needs Additional Support
		4	3	2	1
RESEARCH (worth 1/3)	Article: "Body Buddies: The Microbes That Live In Us and On Us"	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: <i>The Secret World Inside You</i>	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 different kinds of microbes get what they need in the different environments on the human body is correct	Most of the information I included about how different kinds of microbes get what they need in the different environments on the human body is correct	Some of the information I included about how different kinds of microbes get what they need in the different environments on the human body is correct	None of the information I included about how different kinds of microbes get what they need in the different environments on the human body is correct
WRITING (worth 1/3)	Focus	My entire essay is about how different kinds of microbes get what they need in the different environments on the human body	Most of my essay is about how different kinds of microbes get what they need in the different environments on the human body	Some of my essay is about how different kinds of microbes get what they need in the different environments on the human body	None of my essay is about how different kinds of microbes get what they need in the different environments on the human body
		I included a clear introductory paragraph on microbes, and how they get what they need in the different environments on the human body	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 to my essay	x	I did not write a concluding sentence or section at the end of the essay

ESSAY SCORING RUBRIC: STUDENT VERSION

Scoring Criteria		Exceeds	Meets	Approaches	Needs Additional Support
		4	3	2	1
WRITING (worth 1/3)	Development	I clearly introduced three environments where microbes live in and on the human body	I introduced three environments where microbes live in and on the human body	I introduced only one or two environments where microbes live in and on the human body	I did not introduce any environments where microbes live in and on the human body
		I correctly described how three microbes get what they need in three different environments on the human body	I described how three microbes get what they need in three different environments on the human body	I described how one or two microbes get what they need in three different environments on the human body	I did not described how any microbes get what they need in three different environments on the human body
		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