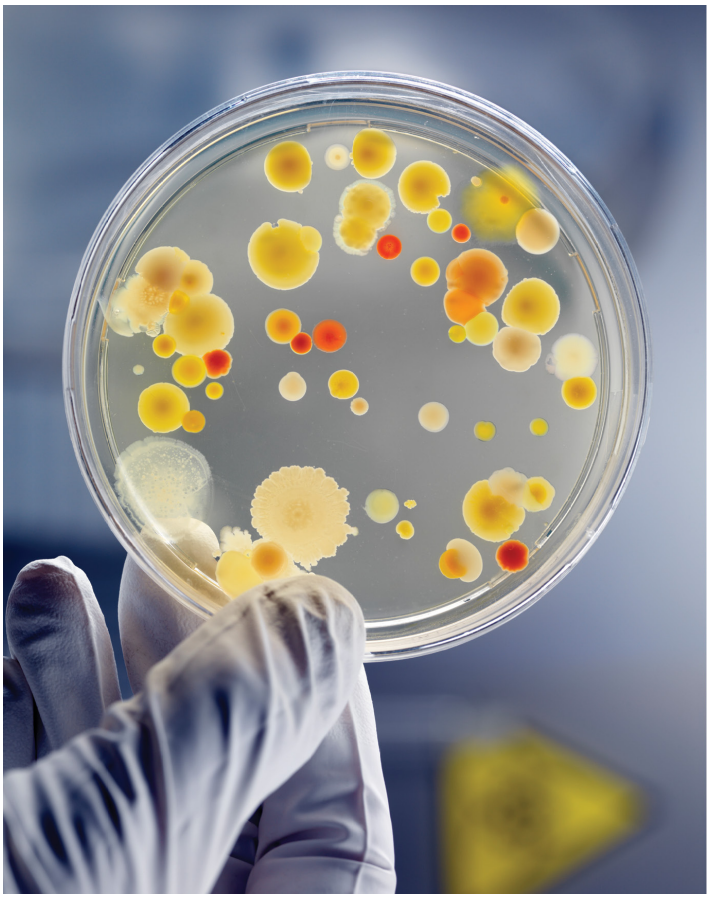
Microbial Me



Science of Systems
Grade Level: Intermediate

Strand: Biological Systems
Skill Focus: Language of the Discipline/Paradox

NISD GT Process Standards

GT Process Standards provide guidance on what GT students should know, understand, and do as part of GT program services. Each lesson makes a connection to specific standards; however, teachers are encouraged to incorporate every standard where applicable.

I. **Creative Thinking**
Ability to look at problems or situations from a unique perspective through the use of imagination and/or innovative ideas

II. **Critical Thinking**
Ability to demonstrate clear, rational, open-minded thinking, informed by evidence

III. **Depth & Complexity**
Ability to dig deeper into a concept and to understand that concept with greater complexity

IV. **Scholarly Inquiry & Research**
Ability to interpret information that leads to new understandings and connects to the world beyond the classroom

V. **Effective Communication**
Ability to convey new learning through the use of written, spoken, and technological media

VI. **Leadership & Responsibility**
Demonstrates initiative, task commitment, and the elements of compromise and diplomacy

Language of the Discipline

microscope

electron

microbiology

microorganism

microbiologist

microbiome

bacteria

microbes

Scholarly Habits

- Scholars utilize varied resources
- Scholars exhibit curiosity
- Scholars demonstrate academic humility
- Scholars save ideas
- Scholars ponder the big idea
- Scholars see from different perspectives
- Scholars are always prepared
- Scholars display perseverance
- Scholars set goals
- Scholars take intellectual risks

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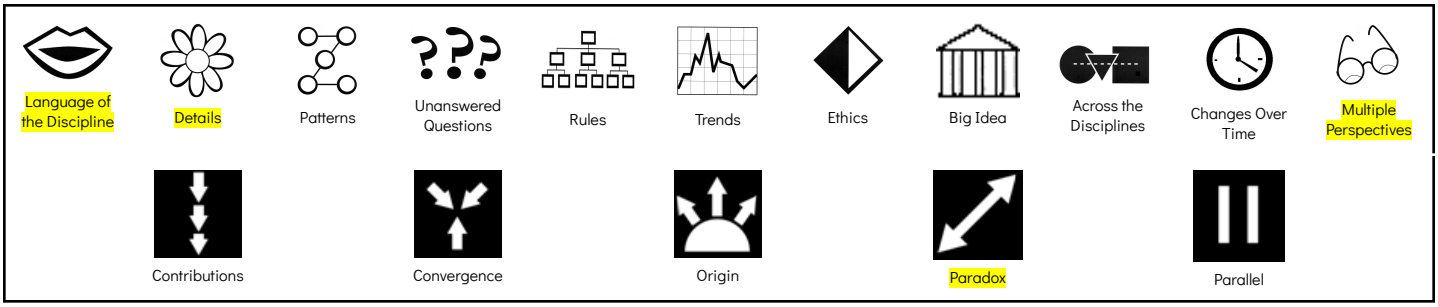
Depth and Complexity & Content Imperatives



Thinking like a Disciplinarian

Thinking like a ***microbiologist*** (a scientist who studies bacteria, viruses, and other microbes that are invisible to the eye).

Universal Generalizations

- Systems have parts that work to complete a task
- Systems are composed of subsystems
- Part of systems are interdependent upon one another and form symbiotic relationships
- A system may be influenced by other systems
- Systems interact
- Systems follow rules

Essential Questions

- What is a system?
- How are the parts of a system related to the entire system?
- How are system models used to predict and understand real world situations?

Supported TEKS

<u>Science</u>
3.1, 4.1, 5.1 (Scientific investigation and reasoning. The student conducts classroom and outdoor investigations following home and school safety procedures and environmentally appropriate practices.)
3.1A, 4.1A, 5.1A (demonstrate safe practices as described in the Texas Education Agency-approved safety standards during classroom and outdoor investigations using safety equipment as appropriate, including safety goggles or chemical splash goggles, and gloves)
3.4, 4.4, 5.4 (Scientific investigation and reasoning. The student knows how to use a variety of tools and methods to conduct science inquiry.)
3.4A, 4.4A, 5.4A (collect, record, and analyze information using tools, including cameras, computers, hand lenses, metric rulers, Celsius thermometers, wind vanes, rain gauges, pan balances, graduated cylinders, beakers, spring scales, hot plates, meter sticks, magnets, collecting nets, notebooks, and Sun, Earth, and Moon system models; timing devices; and materials to support observation of habitats of organisms such as terrariums and aquariums)
4.9, 5.9 (Organisms and environments. The student knows and understands that living organisms within an ecosystem interact with one another and with their environment.)
5.9C (predict the effects of changes in ecosystems caused by living organisms, including humans, such as the overpopulation of grazers or the building of highways)

# Instructional Plan	# Date: Weeks 9-10
Microbial Me (2 weeks)	
Objectives: Students will understand... • that microorganisms can only be seen under a microscope. • our own microbiome has a symbiotic relationship with us. • a microscope and a microbiome are both systems.	
Learning Experiences	**Resources/Materials**
<u>Week 1 (Slide 2)</u> **Skill Stations (Slide 3)** **Let's Get Curious (Slide 4)** Everyday Objects Under an Electron Microscope Show the curiosity • What do you notice? • What do you wonder? **Scholarly Habits (Slide 5)** Review the scholarly habits students will be focusing on in this lesson: Save Important Ideas, Curiosity **Systems Generalizations (Slide 6)** Review the Systems Generalizations. **Skill Focus (Slide 7)** Explain that the skill focus for this week is the Language of Discipline thinking tool. Review this thinking tool and view the Byrdseed.tv video. **How Does It Spread? (Slide 8)** Just before students enter the classroom for the day, apply Glo-Germ gel to your hands. Shake hands with students as they enter. Be sure to touch several other places in the classroom as well. (You may have to covertly re-apply gel.) As students settle in, tell them that you felt like being generous today, and that you have given them something very "special." Turn off the lights and shine the black light around the room and on their hands. Discuss how germs are microorganisms	BI_Microbial Me Lesson Slides Everyday Objects Under an Electron Microscope Byrdseed.tv: Language of Discipline Materials: • Glo-Germ • Black light

and can spread very quickly from person to person, and the importance of washing hands. **What is Microbiology? (Slide 9)** Review the Language of the Discipline that is necessary to communicate about microbiology as an expert. • Microbiology is the study of microorganisms. • A microorganism is a living thing that cannot be seen with your eyes because they are so small. • A person who studies microbiology is a microbiologist. • micro=small • bio=life • ology=study of	
Microscope Exploration (Slides 10-12) Microorganisms are all around us, on us, and in us. And not all are bad. They can only be seen with a microscope. Show the Parts of a Microscope diagram. Teach students how to put a prepared slide under the microscope and focus to see the slide. Give students time to explore the prepared slides under the microscope. Have them draw what they see in their journals. Students can compare notes to see what others noticed. Systems test for a microscope: • What happens when you do not use a microscope properly? • What if it is missing a part or not plugged in? Can it complete its task? Microscope as a system: it is a tool that has parts that work together to complete a task.	Microscopes Prepared Slides (All campuses should have these in science labs. If you do not have these supplies, have your campus science facilitator reach out to the science department.) CI_Parts of a Microscope
Bacteria in the Cafeteria Game (Slide 13) Where can microorganisms be found? Everywhere! Introduce the Bacteria in the Cafeteria game and give students time to play.	Bacteria in the Cafeteria

Microbial Me Preparation (Slide 15)
There are alternatives to this part of the lesson in Week 2 if you are unable to get the agar plates or if you would prefer to explore the microbiome in a different way.

If you are choosing to swab your own microbiome using the agar plates from Region 20, you will need to do this step this week:

- Each student swabs their fingerprints onto an agar plate (do not have them wash their hands first). Put a finger(s) down on the agar plate. Press gently, and roll the fingertip side to side.
- Tape them shut and label them with students' names. The tape should completely secure them and they should not be opened once closed.
- Complete the first page of the lab sheet.
- Leave the petri dishes for a week (preferably in a sunny spot).

Agar Plates
They will last 1-2 months in the refrigerator.
Agar plates on Amazon
Carolina Biological
School Specialty

Teacher background from Steve Spangler

DI_Microbial Me Labsheet

Reflection (Slide 16)
What systems did we explore today?
How do they fit the systems test?

The Picture Game

Week 2 (Slide 16)

Skill Stations (Slide 17)

Let's Get Curious (Slide 18)
The Picture Game

- What do you notice?
- What do you wonder?

Scholarly Habits (Slide 19)
Review the scholarly habits students will continue to focus on in this lesson: Save Important Ideas, Curiosity

Systems Generalizations (Slide 20)
Review the Systems Generalizations and remind students to keep these generalizations in mind as we continue our Microbial Me experiences. How are the things we are experiencing an example of a system?

Paradox

Skill Focus: Paradox (Slide 21)
Explain to students what a Paradox is and view the Paradox video on Byrdseed.tv. Guide students to connect that this type of thinking matches well with Yellow and Black Hat thinking.

A Garden in Your Belly (Slide 22)
Read A Garden in Your Belly by Masha D'Yans.

- What is a microbiome?
- Do you recognize any of the roots from last week? (micro, bio)

Microbial Me (Slide 23-24)
This is where you will follow your choice.

Choice 1 - Swabs
If you chose to swab in the previous week, you will hand back the petri dishes to the students. DO NOT OPEN THEM. Once sealed the dishes should NEVER be opened again.

Use the Microbial Me Lab sheet to record new observations

- What do they notice has changed over time?
- Have students use hand lenses or digital microscopes to observe the plates
- Have students draw and date the petri dish
- Show the video and website to help students interpret what they see.
- If these are microorganisms, why can we see them now? (Because more have grown on the agar plate. We can see them now because there are more, not because they are bigger.)
- Compare petri dishes. Are there similarities and differences?
  To dispose: use the provided biohazard bag or put them in a baggie with some bleach, shake, and dispose. Under NO CIRCUMSTANCES should the plates be sent home or taken by students.

Choice 2 - Microbiome Model (Slide 24 Speaker Notes)
Add the ingredients on the right to the baggie. Each ingredient represents a different microorganism.

- small pom poms - the bacteria Bacteroides Fragilis - helps the body produce immune cells that destroy

A Garden In Your Belly

DI_Microbial Me Labsheet
Interpreting Plates
Bacterial Colony Morphology with Live Examples

To make your own microbiome you will need:

- A little ziplock bag (your gut)
- 2x small pom poms (the bacteria Bacteroides Fragilis)
- 1x strand of Spaghetti (the bacteria Bifidobacterium animalis)
- 1 x Kidney Beans (the bacteria Enterococcus faecalis)
- 3 x Chickpeas (the bacteria Escherichia coli)
- 2x Googly eyes (the probiotic – Lactobacillus)

harmful bacteria, but if there are too many of these organisms or if they escape the gut, you can get an infection • strand of Spaghetti - the bacteria Bifidobacterium animalis - helps improve digestion • Kidney Beans - the bacteria Enterococcus faecalis - used as probiotic to destroy bad bacteria, but too much can cause other infections • Chickpeas - the bacteria Escherichia coli - helps the body break down foods, but too much makes you very sick • Googly eyes - the probiotic – Lactobacillus - helps break down food, absorb nutrients, and fight off harmful bacteria • Colored craft stick - the Probiotic Bifidobacterium - helps balance the gut microorganisms and reduces inflammation	• 1 x Coloured craft stick (the Probiotic Bifidobacterium) You Are Your Microbes Gutsy
Video (Slide 25) Play the You Are Your Microbes video and discuss how microorganisms help us. **Gutsy Game (Slide 26)** Download and print ahead of time the cards and instructions for playing Gutsy. Give students time to play to help them understand how bacteria are both good and bad for us. **Paradox/Yellow and Black Thinking Hats (Slide 27)** Discuss Yellow Hat and Black Hat. Discuss how that relates to Paradoxical thinking. Brainstorm how your gut microbiome works for and against you with the Paradox of the Microbiome graphic organizer. • How is your microbiome a paradox? **Follow-up Discussion (Slide 28)** • Do you need these microorganisms? • What would happen if you had more or less of one kind? (Think when you get the stomach flu or have to take an antibiotic for an ear infection or strep throat.) • What if a different microorganism was introduced? (Think if you touched something covered in bacteria or ate something bad.)	EI_Paradox of the Microbiome

Systems Test (Slide 29) Review today's learning and ask students "How is the microbiome a system?"	

Reflection/Metacognition (Slide 30)
What systems did we explore today?
How do they fit the systems test?

Extension (Slide 31)
Use RAFT for students to extend their thinking about microorganisms.

- R(ole) - Take on the perspective of a microorganism or a microscope.
- A(udience) - Other students.
- F(ormat) - narrative story or a comic strip
- T(opic) - Tell what a day in your life is like. Be sure to include a problem and solution.

Additional Optional Extension Activities
https://www.amnh.org/explore/ology/microbiology - additional videos and links to games; some are included in the plans
Your Microbial Friends - really good interactive website
**DISCLAIMER* There is a small section that mentions microbes in the vagina. Use as a teacher demonstration only.*