Title: Bacteria the Board Game *Lesson Plan designed by Nushrat Hoque and Olivia Fraser*	
Goal:	The goal of our project is to identify basic facts about bacteria and address misconceptions surrounding human-bacterial interactions.
Age/Grade Band:	This lesson is formatted for age 11+, and would be appropriate from middle school through high school students.
Vocabulary:	Bacteria, Cells, Antibiotic, Probiotic, Prebiotic, Biofilm, Flagella, Quorum Sensing, Natural Products, Enzyme, Gene, Bacteriophage, Siderophore
Learning Objectives:	1. Participants will be able to describe bacteria's roles in the ecosystem. 2. Participants will be able to distinguish between specific bacteria which are helpful or harmful to humans. 3. Participants will be able to describe ways in which bacteria respond to the environment.
Anticipated Misconceptions	1. Bacteria are not important to the environment, because they are too small to see. 2. Bacteria are "bad" or "good". 3. Antibiotics are a good treatment when you have any illness.
Materials:	Board game: craft board/poster board, printer paper, 3 types of tokens, dice Agar/gelatin plate: Plates can either be pre-purchased, made with LB/agar, or with gelatin/Jell-o as described below 1. Make the plate solution by mixing the following in a saucepan on medium heat until it boils: • 1 teaspoon of beef stock powder • 1 cup of water • 1 tsp gelatin/3 tsps. Jell-O powder • 1 tsp sugar (sugar may be decreased if using Jell-O) 2. Pour this mixture into a small paper cup or bowl and cover it with plastic wrap to promote sterility. (Add more gelatin to the mixture if the solution does not set and re-boil) 3. You can sterilize the cotton swabs or toothpicks by placing them in a pressure cooker for 15 minutes. This should be done with extreme caution and is not highly recommended.

Lesson Plan		
Time Segment	**Instructors will…**	**Learners will…**
Introduction 10-15 min	The instructors will open the lesson by recording student responses to the discussion question: 1) What do you know about bacteria? Instructors will then present some background and definitions of antibiotics, probiotics, and prebiotics and introduce the bacteria “characters”.	Enter the space and look at the bacteria fact sheets that are displayed throughout the space. Engage in dialogue about bacteria with the instructors and each other.
Board Game Lesson ~35 min	Instructors will explain the rules of the board game and help participants form groups of 3-5 people. Instructors will prompt groups to compare/contrast their characters. Instructors will join groups to assist learners in the game model, or circle between groups depending on the size of the class.	Participants will move into small groups of their own choosing. Participants will share the bacteria character they chose, by reading or passing around its information card. Participants will play the game by rolling the dice and moving their character forward. Landing on certain squares will either gain them a bonus or lose ground depending on how their bacteria responds to the stimulus described.
Closure 10 min	Instructors will ask participants to describe what they now know of bacteria. One instructor will facilitate the conversation, while the other writes on a large paper board. Instructors will model swabbing an agar plate for bacteria on a surface and pass out materials for the participants to take home.	Participants will regroup and share out what they took away from the board game (verbal concluding assessment)
Accessibility:	For participants to be able to access all game pieces, text is formatted in large print, and physical manipulatives (dies, tokens) can be increased in size and varied in shape.	
Formative Assessment:	Instructors will prompt learners to discuss the bacteria as they play the game.	

Summative Assessment:	Instructors will collect and document what the participants learned at the end of the lesson.
Extension activities:	1. Test how your bacteria react to different stressors/different environments. Consider adding one of the following to your petri dishes. These ingredients cause bacterial stress by increasing salinity, pH and reactive oxygen species. A pH indicator could also be added to the agar solution. • table salt • lemon juice • baking soda • baking powder • hydrogen peroxide • isopropyl alcohol 2. Record your observations, and research how bacteria react to environmental stressors.
Assessment Questions:	1. What are bacteria? 2. What evidence in the game suggests bacteria are living things? 3. How do bacteria impact human life? 4. What is an example of a beneficial bacteria? What is an example of a harmful bacteria? 5. Why might some bacteria survive stressors, while others perish?