LESSON GOALS

1. Students will comprehend the importance of bacteria, both beneficial and detrimental, and be able to describe methods of control.
2. Indications from coliform bacteria counts, decomposition, disease, sampling techniques, general characteristics, distinguishing characteristics, and staining techniques; and after reviewing characteristics of scientific method, students will get into groups of 5 (one from each discipline) to complete the investigation.

### Title

<table>
<thead>
<tr>
<th>Title</th>
<th>Which solution is most effective in killing/controlling bacterial growth sampled from a creek environment?</th>
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</thead>
<tbody>
<tr>
<td><strong>Age Group</strong></td>
<td>10th-12th Grade</td>
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<tr>
<td><strong>Lesson Duration</strong></td>
<td>One Week</td>
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<tr>
<td><strong>Year</strong></td>
<td>1999</td>
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<tr>
<td><strong>Cost</strong></td>
<td>$10-100</td>
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</tbody>
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### MATERIALS

- Microscope slides
- Microscope slides with grids
- Various antibacterial agents (Students may bring their own also)
- Microscopes
- Nutrient agar
- Petri dishes
- Autoclave/Incubator
- Filter paper discs
- Measuring tape
- Metric rulers
- Collection jars

### INQUIRY QUESTIONS

- “What is it you want to find out, exactly? What are you asking?” (Which antibacterial solution best kills bacteria)
- “Okay, so you’re making a comparison, what is it about the solutions you want to compare?” (Ability to kill/keep away bacteria)
- “Which solution do YOU think is most efficient?” (Any given - H₂O₂, isopropyl alcohol, witch hazel, Neosporin, etc.)
- “How will you know?” “If ____ is the most efficient antibacterial agent, then what will happen? To what? When you do what?” “How can you find out which solution is most efficient at killing or keeping away bacteria?” And, “You’re comparing how different solutions kill or keep away bacteria, so you have to have some bacteria to kill or keep away, right?”
If no control, could prompt with, “Well, if it ends up with no bacteria on any of them, I wonder if all the bacteria were going to die anyway?

If no replicates, perhaps something like, “I wonder if all of them end up keeping away bacteria, were the solutions contaminated, or maybe the sample isn’t bacteria?” How do you know it’s not fungi?” Or, “are they populations of extremely resistant bacteria?” “How can you rule out some of these possibilities?”

**PROCEDURE**

- **Day One:** After teachers have finished final review with their own classes, the students will meet with their groups at the outdoor classroom. Preliminary ideas will be shared, explored, etc., to state their problem, form their hypothesis, make a prediction, and set up their experimental design.

- **Day Two:** Students will be given a wide array of equipment and materials from which to choose. They do not have to use all of them. These young people will meet with their groups at preassigned stations at the creek. They will collect their bacteria samples in the fashion they deem most efficient, (They have had labs on various sampling techniques previously, and reviewed), and prepare them to be placed in incubator/autoclave at the end of class.

- **Day Three:** Students go outside classroom/creek to work on their presentation/advertisements. Any students that need to make observations (to see if any bacterial colonies are developing) may do so.

- **Days Four and Five:** Final data collection, measurements, summaries, mathematical data statistically analyzed, results, conclusions, and commercial rehearsal.

- **Day Six:** Commercials presented on ROCK T.V. news on classroom televisions.