

### Lesson 3-1: Engagement Question

Time	Engaging the Student (entry Task)	Developing the Ideas--Lesson			Checking for Understanding (exit ticket)
		Student Handout	Teacher/Lecture Notes	Materials	
~45 minutes	<p>1. Break students into teams of 3 or 4. We recommend that you decide between random or assigned teams. You may want to put students into teams that balance their skills, interests, and abilities to work together, therefore encouraging positive team dynamics.</p> <p>2. Pose to teams the Engagement</p>	<p><a href="#">Solutions Worksheet</a></p>	<p>This question is intentionally arguable from both perspectives. The point of asking this question is to get students thinking about when antibiotics are a valid option, when they are not, and solutions to slow antibiotic resistance.</p> <p>Allow students to discuss in teams and then report their team consensus back to the entire class. Discuss and write their evidence to the engagement question on the board. Have the students categorize the evidence listed on the board into “yes”, “no”, and “further questions” categories.</p> <p>Anticipated answers to this question include:            Yes: Only one person had the disease in the US.            CDC prevents the spread of disease.            Antibiotics still work on most infections.            There is not one bacteria resistant to them all yet.</p> <p>No: Diseases spread quickly.            Each infected person can spread resistance genes to bacteria in multiple people.            It has spread to the US.            The gene for resistance can spread to other bacteria.            The more we use them the more cases of resistance will form</p>	<p>Students' journals</p> <p>Good sources to read:  <a href="#">Source 1</a>  <a href="#">Source 2</a>  <a href="#">Source 3</a>  <a href="#">Source 4</a>  <a href="#">Video explaining the effects of antibiotic resistance</a>  <a href="#">Video explaining the process of antibiotic resistance</a></p>	<p><i>Journal check-in</i>            Spend a few minutes answering reflection questions in journals. “What did you learn today? Who does antibiotic resistance impact? What questions do you still have about the process of antibiotic resistance?”</p> <p>Have them complete the solutions worksheet for homework</p>

	<p>question:  “Can we still use colistin and other antibiotics to fight off bacterial infections?”  Allow students to discuss in teams and then report their team consensus back to the entire class. An effective engagement question is an open-ended either/or question that stimulates further discussion and questions about the topic.</p>		<p>Further Questions: Why was colistin considered the last resort drug?  How did the e.coli form a resistance to colistin if it wasn't really used?  Can't we just make another antibiotic?  How quickly does a resistance gene spread through bacteria populations?</p> <p><b>Lecture</b>  This is a time where you can lecture to your students about bacteria and how they become resistant to antibiotics. If your class is already knowledgeable about this topic, then you can skip this lesson.  Ideas to include:</p> <ul style="list-style-type: none"> <li>● Antibiotics kill bacteria by targeting specific structures in bacterial cell walls and/ or metabolic processes that do not exist in human cells. This stops the bacterial cells from being able to function but does not affect human cells.</li> <li>● Bacteria have genes in plasmids, which they can exchange.</li> <li>● Antibiotic resistance genes can be exchanged between bacteria of the same and different species.</li> <li>● Bacteria randomly mutate and can develop resistance to antibiotics, so these genes do not necessarily have to come from a bacteria that is already resistant.</li> <li>● Bacteria are different than viruses structurally and biologically. Antibiotics only work on bacterial infections, not on viral infections.</li> </ul>		
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			<p><i>For homework:</i> research 5 bullets on possible solutions to antibiotic resistance.</p> <p>This would be a good time to have a discussion about sources. (This is a time to gauge whether your class has enough experience to judge the reliability of sources.)</p> <ul style="list-style-type: none"><li>● What makes a good source?</li><li>● Was the author biased? If so how could you confirm the information given by that source?</li><li>● Is the source you're looking at a scientific source or one person's theory that probably isn't supported?</li></ul>		
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## Solutions Worksheet

Name:

Directions: Research five solutions to antibiotic resistance. These can be ways to avoid developing and spreading resistance or possible alternatives to antibiotics. Cite your sources for each piece of information you find. Make sure to use **reputable** sources based on scientific facts.

Example: Overuse of antibiotics increases the chance of bacteria developing antibiotic resistance.

Source: [http://emerald.tufts.edu/med/apua/about\\_issue/about\\_antibioticres.shtml](http://emerald.tufts.edu/med/apua/about_issue/about_antibioticres.shtml)

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