**What Kills Germs?**

**I. Introduction**

 Bacteria are prokaryotic (having no nucleus), one-celled organisms. Individual bacterial cells are visible only with the aid of a high-powered microscope. Under proper nutritional and environmental conditions, bacteria can be grown in a laboratory. They are usually cultivated in sterile petri dishes containing a gelatin-like nutrient called agar.

 Bacteria reproduce rapidly. Each single cell divides about every twenty minutes. When a population of bacteria has multiplied to a thousand or more cells, a pattern of growth called a colony can be seen with the naked eye. The specific shape and color of a bacterial colony can be used to identify the species of bacteria that form it.

 Bacteria are important in many ways. Some bacteria break down organic materials from dead organisms and wastes, returning nutrients to the environment. Nitrogen-fixing bacteria convert nitrogen gas from the air into forms of nitrogen that can be used by plants and animals. Some bacteria are used in making food, such as vinegar, yogurt, butter, cheese, pickles, and sauerkraut. A few bacteria cause disease and are known as pathogens. Some examples of diseases caused by bacteria include tuberculosis, pneumonia, strep throat, and ear infections.

 Because bacteria multiply so rapidly, it is often necessary to control their growth in the human body, in food, and in the kitchen. Several varieties of products are used to control bacterial growth, including antibiotics, disinfectants, and antiseptics. All these products are antimicrobial agents. Different kinds of bacteria are sensitive to some chemicals and insensitive to others. Thus, different types of antimicrobial agents vary in the way they affect bacterial growth.

 In this Virtual Lab you will determine the effectiveness of different antimicrobial agents by inoculating agar in a petri dish with different pathogenic bacteria, adding various antimicrobial agents, and measuring the bacterial growth around each antimicrobial agent.

**II. Procedure**

 1. Start the activity by going to the following website :

<http://www.glencoe.com/sites/common_assets/science/virtual_labs/LS08/LS08.html> .

 2. Inoculate the agar in the petri dish by clicking one of the test tubes containing pathogenic

 bacterial stock culture-Staphylococcus aureus, Hemophilus influenzae, or Streptococcus

 pneumoniae.

 3. Vials 1 through 7 contain filter paper disks that have been soaked in antimicrobial agents such

 as antibacterial soap, household bleach, household disinfectant, penicillin, amoxicillin, and

 erythromycin, or in sterile water (as a control). Drag a disk from each vial and place it in the

 petri dish. Note: To avoid contamination, disks should not be moved after they have been

 dropped into the petri dish.

 4. At any time in the Virtual Lab, click the Microbiology book to find out about specific

 pathogenic bacteria and antimicrobial agents. Click the fingers pointing left and right to page

 through the information.

 5. Click the incubator to place the petri dish in it.

 6. Click the red button on the incubator to turn it on. When the timer shows that 24 hours have

 passed, click the incubator to remove the petri dish.

 7. Examine the patterns of bacterial growth. The colored area that covers most of the surface of

 the petri dish is the lawn culture of the bacteria-a visible layer of thousands of bacterial cells.

 8. Drag the ruler to measure the diameters of the zones of inhibition around the disks (the tan

 areas). Some disks may be surrounded by large zones of inhibition, where no bacteria grew

 due to the strong inhibitory effect of the antibiotic, antiseptic, or disinfectant on the disks.

 Other disks may have caused little or no inhibition-meaning that the bacteria are partially or

 completely resistant to the antimicrobial agent on them. To find out which antimicrobial

 agent corresponds to a specific number, move the cursor over the number. In the Table, enter

 the measurement for each antimicrobial agent.

 9. Click the Reset button and repeat the Virtual Lab until you have tested all the antimicrobial

 agents on all three types of pathogenic bacteria.

 10. Use the data in the Table to compare the effectiveness of different antimicrobial agents on

 different bacteria.

**III. Data**

 1. Record the data in the Table below.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Bacteria****Species** |  **Sterile** **Filter** **Paper****(Control)** |  **Anti-****Bacteria** **Soap** | **Household** **Bleach** |  **Household****Disinfectant** | **Penicillin** | **Amoxicillin** | **Erythromycin** |
| *Hemophilus**influenzae* |  |  |  |  |  |  |  |
| *Staphylococcus**aureus* |  |  |  |  |  |  |  |
| *Streptococcus**pneumoniae* |  |  |  |  |  |  |  |

**IV. Analysis & Conclusions**

 **1. Describe the effects of the various antibiotic drugs you used. Were they all equally**

 **effective at controlling bacterial growth?**

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 **How do you know?**

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 **2. Describe the effects of various chemical disinfectants you used. Were they all equally**

 **effective at controlling bacterial growth?**

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 **Would you use them to halt the growth of bacteria in your home or on your body?**

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 **3. Compare the effectiveness of the different antibiotic drugs and chemical disinfectants.**

 **Which seem to be better at controlling bacterial growth?**

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 **Why do you think this is so?**

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 **4. If you were a doctor treating a patient infected with Staphylococcus aureus, a bacterium**

 **that causes mild to moderate skin infections, which antibiotic would you prescribe? Why?**

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 **5. Can you think of any limitations of this technique of testing the effectiveness of**

 **antimicrobial agents?**

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 **If a real person were involved, what other tests might give you more confidence in your**

 **results?**

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