Ubiquity of Microorganisms

Bacteria and other microorganisms are found to inhabit every possible niche on our planet. Your body is covered with microorganisms, the surfaces of the lab, your home, and other inanimate objects you frequently come into contact with are also home to many diverse types of microorganisms. It is important to remember that although microorganisms are ubiquitous in nature the species found in one environment may significantly differ from the species found in another environment. How can bacteria inhabit so many different environments? Although all bacteria are similar in cellular structure individual species are extremely diverse in their metabolic abilities. It is this diversity that allows different bacteria to inhabit in many cases inhospitable environments.

Many of the microorganisms that we will encounter in this laboratory are free-living—meaning that they do not grow in or on another organism whether plant, animal, or other microorganisms. Many of the microorganisms you regularly encounter are nonpathogenic or do not cause disease. However, a significantly smaller number of organisms exist to only cause disease and these are considered pathogens. Still those organisms that inhabit our bodies and exist in a symbiosis can be considered opportunistic pathogens—and can cause disease if they gain entry into sterile compartments of our bodies such as the bloodstream.

In this laboratory we will investigate the ubiquitous nature of microorganisms and we will demonstrate straightforward approach to cultivation of specimens. (It is important to remember that researchers estimate that over 90% of microorganisms present in our environment cannot be cultivated to date)

Ubiquity lab part 1:

Materials: per lab group
1 tube of nutrient broth
6 sterile cotton swab
6 petri dishes of trypticase soy agar (TSA)
2 petri dishes of Blood Agar

In the laboratory

Day 1
Today we will be sampling the environment and our bodies to obtain specimens we will then use to inoculate TSA plates and Blood agar plates to determine which locations contain larger numbers of microorganism contamination.

1) Obtain the materials listed above and bring them back to your bench.

2) Number the TSA plates 1 through 6 and also include your group number on the bottom portion of the plate (this is the side that contains the agar)

3) Expose you plates according to your student number:

<table>
<thead>
<tr>
<th>Exposure method*</th>
<th>Student Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Swab the (any) floor* for 10 seconds</td>
<td>1, 10, 19, 28</td>
</tr>
<tr>
<td>2) Swab cell phone* for 10 seconds</td>
<td>2, 11, 20, 29</td>
</tr>
<tr>
<td>3) Swab the bottom of your shoe* for 10 seconds</td>
<td>3, 12, 21, 30</td>
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<tr>
<td>4) Swab some money* (coins or paper) for 10 s</td>
<td>4, 13, 22, 31</td>
</tr>
<tr>
<td>5) Swab your hair* for 10 s then streak onto plate</td>
<td>5, 14, 23, 32</td>
</tr>
<tr>
<td>6) Swab between your toes* for 10 s</td>
<td>6, 15, 24, 33</td>
</tr>
<tr>
<td>7) Swab your lips* for 10 s</td>
<td>7, 16, 25, 34</td>
</tr>
<tr>
<td>8) Swab the skin of your forearm* for 10 s</td>
<td>8, 17, 26, 35</td>
</tr>
<tr>
<td>9) Swab a door knob* for 10 s</td>
<td>9, 18, 27, 36</td>
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* for these samples please dip your sterile swab into the nutrient broth (wring around the edge of the tube to remove most excess liquid) and use this damp swab to obtain your sample
4) Once you have obtained your sample on the swab, streak the surface of your TSA plate by pressing the swab to the surface of the agar very lightly and rolling the swab as you streak back and forth.

5) Next pick two members from your group to inoculate the Blood agar plate. When these volunteers have been selected expose a blood agar plate by coughing onto the surface for 10 seconds. When you have finished label the bottom of the plate with the initials of the volunteers.

6) Once inoculated invert all plates (so the agar side is facing up) and incubate them at the appropriate temperature (25°C for inanimate objects and 37°C for body swabs) for 24-48 hours.

**Day 2**

7) Once the incubation period is over remove the plates and inspect for growth. Are all of the colonies the same size, shape, and color? If not what does this tell you?

8) Count the number of colonies on each of your 6 plates and record them in your lab notebook. Once you are finished you will be required to record this on the front board for the class data.

**Questions**

1) Which habitat sampled by the class appears to be the most contaminated one?

2) Why do you think this particular habitat has such a large amount of microorganism contamination?

3) Do you notice any colonies that appear to be molds instead of bacteria? What do you notice about the color of the colony from the top compared to the color of the colony when viewed from the bottom?

4) Do you think that the numbers of microorganisms obtained were higher, equal, or less than the real number of organisms present on the particular environment you sampled, and why?
Ubiquity Lab Part 2

**Materials per group:**
6 TSA plates

**Day 1**
1) Obtain the necessary materials. Turn the Petri dishes upsidedown and label the bottom of each plate with the following labels: plate 1: 0, plate 2: 10 min, plate 3: 20 min, plate 4: 30 min, plate 5: 40 min, and plate 6: 60 min.

2) Once you have labeled your plates place plate 1 off to the side. Then open the lids for each of the remaining plates so that the agar side is facing up.

3) Expose the agar for the appropriate length of time. Once the time is up replace the lid and place the plate off to the side with plate 1.

4) Once all plates have been exposed for the appropriate length of time tape the six plates together and incubate them inverted (so the agar side is facing up) at room temperature for 24 to 48 hrs.

**Day 2**
5) Retrieve plates 1-6.

6) Remove all lids, and be careful not to touch the surface of the agar to disturb the colonies.

7) Count the number of isolated colonies present on the agar surface. An isolated colony is a colony that you can see the edges all the way around the perimeter.

8) **All laboratory group members must count each plate.** Keep a running tally so you can then use this information to determine the average number of colonies on each plate.

9) Once you have counted all of the colonies then you can graph the results using excel.

Questions:
1) What was the purpose of the plate labeled time 0?

2) What is the expected result for the plate labeled time 0?

3) What is the hypothesis of this experiment?

4) Do your results support this hypothesis