Food Safety Lab - Part 3

Cross Contamination and Hygiene

Purpose
To learn about the effect of cross contamination and the importance of hygiene in kitchens and other facilities where food is prepared.

Overview
This activity is divided into 2 parts. In the first part, students will observe the effect of cross contamination as they inoculate orange juice with penicillin mold from the refrigeration lab and active yeast solution from the sterilization lab (the two previous labs). In the second part, students will experience a simulation of passing bacteria from hand to hand as students take the roles of restaurant workers and the food in which they come in contact.

Time
1 class period to do the initial inoculation of the orange juice and up to 2 weeks to observe the growth of mold colonies and yeast activity on a regular basis.

Key Concepts
Cross contamination has an exponential effect of spreading bacteria to previously clean or sterile environments. Bacteria can easily transfer throughout a kitchen making food potentially unsafe to eat.

Skills
Making observations
Measuring solutions
Collecting data
Tabulating data
Forming hypotheses
Testing hypotheses
Understanding and describing interrelationships in nature
Communicating observations and interpretations orally, in writing and graphically

Materials

<table>
<thead>
<tr>
<th>Part 1</th>
<th>Part 2</th>
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</thead>
<tbody>
<tr>
<td>50ml beakers - (9)</td>
<td>UV (UltraViolet) light</td>
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<tr>
<td>50ml graduated cylinder</td>
<td>Invisible UV ink or powder</td>
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<td>Orange juice</td>
<td>Dark garbage bag</td>
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<tr>
<td>Distilled water</td>
<td>Soap</td>
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<tr>
<td>Alcohol</td>
<td>Water</td>
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<td>Disposable pipettes</td>
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<td>Toothpicks</td>
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<td>Rubber bands</td>
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<td>Paper towels - cut in small pieces</td>
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Cross Contamination and Hygiene

Facilitator Preparation
Save some of the active yeast/sugar solution for this experiment. Scrape some of the blue penicillin mold from the test fruit in the refrigeration activity. If you have not already done either of the previous activities, you can make a yeast/sugar solution, following these simple steps: begin with 2 liters (or quarts) of warm water, stir in one cup of sugar, and one package of bakers' (or brewers') yeast. Make sure that you prepare the yeast/sugar solution a day before the lab activity. As for the penicillin, you may find some penicillin culture in the vegetable bin at home. Or you can leave some citrus out at room temperature and cultivate some penicillin mold approximately a week prior to bringing this experiment to the classroom. You will need to make a fresh penicillin solution by doing the following steps: use a toothpick to scrape mold from a contaminated fruit (citrus is best); place the mold scrapings in a small beaker with 10mls of water; stir with the toothpick; cover the beaker with a paper towel and rubber band. Prepare the solution a day or two ahead - it can be stored before the lab experience.

Background
Present this scenario to your students:

Celeste and Carmella invited Juan to go to lunch with them. But Juan said, "No thanks, I'm not very hungry, I think I'm getting the flu." In her humorous fashion, Carmella responded, "Well, we're going to the Chinese Restaurant near the school. You can order egg drop soup, sort of Chinese Penicillin!"
Juan accepted and they all went to the restaurant where they each ordered lunch - Juan ordered the egg drop soup and the girls shared a hot, spicy dish. At the end of the meal while Juan was paying the waitress, Carmella said, "Man, that dish really made me thirsty!" Her water glass was empty so she grabbed Juan's glass and took a drink. Celeste saw what she did and said, "Oh, no!!"

What did Carmella do that caused Celeste's response? Would Celeste have reacted that way if Carmella had grabbed her own glass? What if Carmella would have grabbed Celeste's glass?

Procedure
Part 1 - Inoculation of Orange Juice
1. Pour 30mls of orange juice into nine 50ml beakers.
2. Label 3 beakers as CONTROL, 3 beakers as PENICILLIN, and 3 beakers as YEAST.
3. Divide students into 9 teams - each team will inoculate one of the 9 beakers.
4. Three student teams will use a pipette to carefully spread 1ml of distilled water over the surface of the beakers marked, CONTROL.
5. Three student teams will use a pipette to carefully spread 1ml of penicillin solution over the surface of the beakers marked, PENICILLIN.
6. Three student teams will use a pipette to carefully spread 1ml of yeast solution over the surface of the beakers marked, YEAST.
7. Cover all samples by placing paper towels over the beakers.
8. Set up a data table.
9. Observe for mold colonies, yeast activity, and any other signs of microbial growth in all sample sets, including the CONTROLS. Any unexpected microbial observations should be recorded.
10. Graph the timeline for appearance of mold or observation of yeast activity.
Part 2 - Cross Contamination Game
1. Select 4 students at random from your class. Expose one hand of each student to the UV ink or powder. At this time, explain to the entire class that the UV ink or powder represents the bacteria found on our hands. It is important for students to understand that, like bacteria, we cannot see the UV ink or powder with the naked eye.
2. Send the 4 students out of the view of the rest of the class with the directions that they must decide which one of them will wash their hands while the other three DO NOT wash their hands.
3. When they return to the classroom, explain to the class that the 4 students are RESTAURANT WORKERS that prepare food. The rest of the class will be the FOOD that the workers will come in contact with in the restaurant kitchen.
4. Divide the rest of the class into 4 groups representing different foods (examples of groups could be: steak, shrimp, potatoes, broccoli, chicken, for etc.).
5. Have the first group of students come up and shake hands with the first chef. The second group will shake hands with the second chef and so on until each chef has had contact with each of the food learners.
6. Ask each chef and all students who were in the individual food groups to examine their hands for contamination by placing their hands in a black garbage bag containing a UV light.

Student Assessment
1. Orange Juice Inoculation
   Have students describe what they see happening in each set of beakers. Students should sketch each set of beakers and write a brief description of what's going on within each set. Students are to keep Observation Logs or Journals to record observations at regular intervals during the two week period. After observing the various sets of beakers over the two week period, ask students to write examples of how this experiment may have been flawed? What are some variables that may not have been controlled?(maybe the glassware or pipettes were not truly sterile; students’ may have cross contaminated their samples if their hands were contaminated)
2. Observing the Yeast and Penicillin
   How do they know the yeast is active? How do they know the penicillin is growing? Have students list their observations. (bubbling, smell, foaming, crust developing). Ask students why they think the beakers were covered after the experiment.(to prevent contamination)
3. Graphing the Results
   Choose appropriate dates for graphing the timeline for appearance of mold or observation of continued yeast activity through the two week period. Assign points for the following components of the graph:
   Rubric for the Graph:
   ❖ Is the graph labeled?
   ❖ Are the x and y axes labeled?
   ❖ Is data graphed and spaced properly?
   ❖ Were conclusions made that match the data?
4. **Data Table and Conclusion**
   Assign points for the following components of the student lab:
   Rubric for the Data Table:
   - Is the table labeled?
   - Are the columns labeled correctly?
   - Were conclusions made that match the data?

5. **Orange Juice Inoculation Lab**
   Assign points for the following components of the student lab:
   Rubric for the Lab:
   - Did all participate as a team?
   - Was behavior conducive to safety?
   - Were team members careful with equipment?
   - Was clean up appropriate?

6. **Orange Juice Lab Reflection**
   Ask students, "Who has heard the axiom, "It only takes one bad apple to spoil the whole bunch?"" Ask students if they understood the meaning of that axiom before? Do they think they understand it better now? Have students explain the axiom using science terms based on their new understanding from this cross contamination lab.

7. **Cross Contamination Game**
   Ask students to describe what they learned from this experience. This activity should have made them aware that even the chef who washed his hands became contaminated when he touched food contaminated by one of the other food workers who did not wash their hands. What does this mean to them? How do they feel about eating in restaurants now - does this change their opinion of the safety of eating out? Ask them if they always washed their hands before eating or preparing food in the past. Will they be more diligent about washing their hands now? Why?