What Do Microbes Listen To?

I. Introduction

A. Background Information

Everyone knows that music and sound impacts our daily behavior and feelings. We also know that music even has an effect on animals as well, but does music have an effect on organisms from a different kingdom? That question is exactly what spurred me into creating this experiment. Although applied to bacteria, "...sound waves function as a growth-regulatory signal between cells." (Matsuhashi et al., 1998, p. 49-55).

Yeast are found everywhere around us. They are single-celled microorganisms that are classified in the Kingdom Fungi. As you may have known, yeast strains are a key ingredient in the making of breads and beverages such as beer and wine. In this experiment, we will be utilizing the strain, S. cerevisae, one of the most researched strains of yeast.

Although this experiment may not be extremely accurate, the knowledge gained from this experiment may be used to benefit the utilization of certain sound frequencies effect on cells. They could be used to change and/or balance the growth of microbial life. Also, there is the possibility that more concrete information on microbial growth may result from this experiment. The experiment may prove useful to microbiologists or anyone else interested with cell modification/relating topics.

B. Purpose

What is the effect of sound frequencies on the growth of yeast cultures?

C. Hypothesis

Increasing the sound frequencies will increase the growth of yeast cultures.

D. Parts of the Experiment

1. **Dependent Variable -** Growth/Response in microbes
2. **Independent Variable -** Sound frequencies
3. **Control Group -** Microbes not tested with sound frequencies
4. **Experimental Group -** Microbes tested with sound frequencies (100mHz, 1000mhz)
5. **Factors Held Constant**

    5a. microbes

    5b. basic growth conditions (temperature, area, time)

    5c. duration of experiment

II. Materials

- pairs of latex/latex-free gloves
- 3 glass measuring cups, 1-cup capacity each
- 1 teaspoon
- 1 bag/box of granulated sugar
- thermometer (to measure water temperature)
- warm water (~43°C)
- 3 packets of Active Dry Yeast (a packet is 1/4 ounce, or 2-1/4 tsp)
- yeast strain (Saccharomyces cerevisiae)
- 3 clean empty bottles (500mL) with 3 caps
- 2 pairs of headphones
- 2 computers/other devices that can output 100mHz-1000mHz
- sound frequency program http://www.audionotch.com/app/tune/
- pencil/writing utensil
- tape measure
- At least 3 balloons (12 is better - 3 per each day of testing)
- timer
- marker
- tape

III. Procedure

Part 1(yeast creation)

Make sure to be wearing the latex/latex-free gloves before handling the yeast cultures

On 1st run through, follow through the steps, but use the 'a' instruction when possible.

On 2nd run through, follow through the steps, but use the 'b' instruction when possible.

On 3rd and final run through, follow only the 'c' instructions.

- Get a small piece of tape (1 inch or so) and paste onto all 3 experiment bottles

- Mark the bottles with A, B and C (you should end up with an 'A' bottle, a 'B' bottle, and a 'C' bottle).

1. Make a yeast solution using 1/2 cup warm water (~43°C), 1 teaspoon sugar and 1/4 ounce package of Active Dry Yeast.

2. Open 'A' bottle and pour all of the yeast solution into it.

3. Close 'A' bottle, but make sure it isn't 'too' tight

4. Repeat steps 1-4 two more times except replace 'A' bottle with 'B' bottle on the first repeat and on the third repeat, use 'C' bottle. ('A' bottle, then 'B' bottle, then 'C' bottle) You should be ending up with 3 bottles of yeast solutions.

5. DAILY, add 1 teaspoon of sugar into the yeast solution

Part 2(experiment)

1. Have 2 computers ready at the desktop screen

1c. Locate the quietest location (perfect world=0mHz)

2. Open program (http://www.audionotch.com/app/tune/)

2c. Bring 'C' bottle to the quietest location

3a. Set to 100mHz (play test frequency without headphones)

3b. Set to 1000mHz (play test frequency without headphones)

3c. Remove the cap off of 'C' bottle and place a balloon over the 'C' bottle, stretching so that it fits snugly, then continue to steps 8-11.

- Tape down balloon to bottle to make sure it stays

4. Sterilize headphones using alcohol/wipes and plug in

5a. Remove the cap off of the 'A' bottle containing the yeast cultures.

5b. Remove the cap off of the 'B' bottle containing the yeast cultures.

6. Make sure play is still on and place headphones in the bottle

7a. Place a balloon over the 'A' bottle, stretching so that it fits snugly

- tape down balloon to bottle to make sure it stays

7b. Place a balloon over the 'B' bottle, stretching so that it fits snugly

- tape down balloon to bottle to make sure it stays

8. Secure lid back on bottle

9. Wait about 10-20 minutes for the balloons to inflate

10. Observe and measure the growth by measuring the diameter of the balloons on the bottles
11. Fill out data sheet

IV. Data

Control Group (0mHz)

	Day 1	**Day 2**	**Day 3**	**Day 4**
Diameter of Balloon after 15 minutes (cm.)				
Diameter of Balloon after 30 minutes (cm.)				
Additional Observation				

Experimental #1 (100mHz)

	Day 1	Day 2	Day 3	Day 4
Diameter of Balloon after 15 minutes (cm.)				
Diameter of Balloon after 30 minutes (cm.)				
Additional Observation				

Experimental #2 (1000mHz)

	Day 1	Day 2	Day 3	Day 4
Diameter of Balloon after 15 minutes (cm.)				
Diameter of Balloon after 30 minutes (cm.)				
Additional Observation				

V. Bibliography

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