

Population Dynamics

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1. Introduction

As organisms reproduce, die, and move in and out of an area, their populations change. In a closed population, organisms can not move in and out of an area. So, populations can change only through births and deaths of individuals.

2. Background

In this experiment, a population of yeast will be given a small amount of food and placed in a closed environment. Yeast are very small, rapidly reproducing organisms. Over a short period of time, yeast can experience huge population changes. The population of yeast is monitored by measuring the change in cloudiness, or turbidity, of the medium. The medium is the food and the yeast that are floating in the food. You will be able to compare the yeast population in both an open and closed environment.

To measure the yeast population, you will be using a Colorimeter shown in Figure 1. In the Colorimeter, light from an LED light source will pass through the medium and strike a photocell. Photons of light that strike the yeast cell will reflect away from the photocell. The computer-interfaced Colorimeter monitors the light reflected by the photocells as absorbance. The absorbance value is proportional to the yeast present in the medium.



Figure 1


3. Objective

- Use a computer and Colorimeter to monitor a closed population of yeast.
- Use a microscope to monitor two populations of yeast.
- Compare the population estimates from the two different methods.

4. Equipment

Computer	10 mL graduated cylinder
Vernier computer interface	Yeast mediums
Logger Pro Software	Dropper
Vernier Colorimeter	Microscope
Cuvette and lid	Microscope slide and cover slip

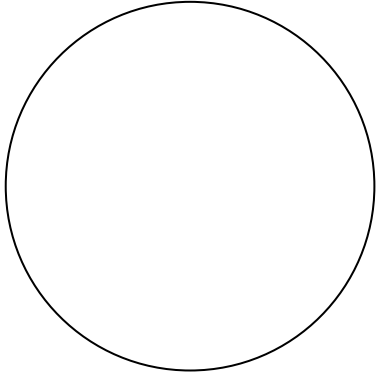
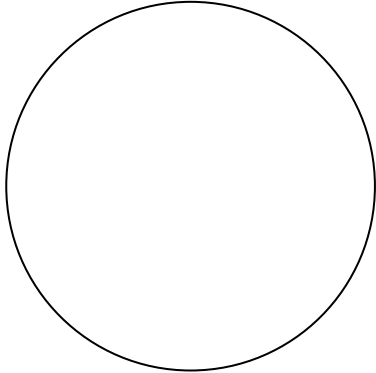
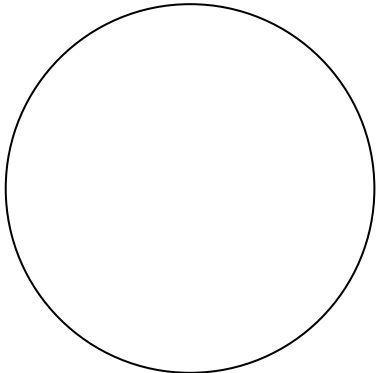
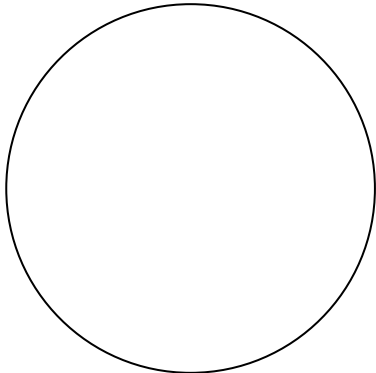
5. Experimental Procedure

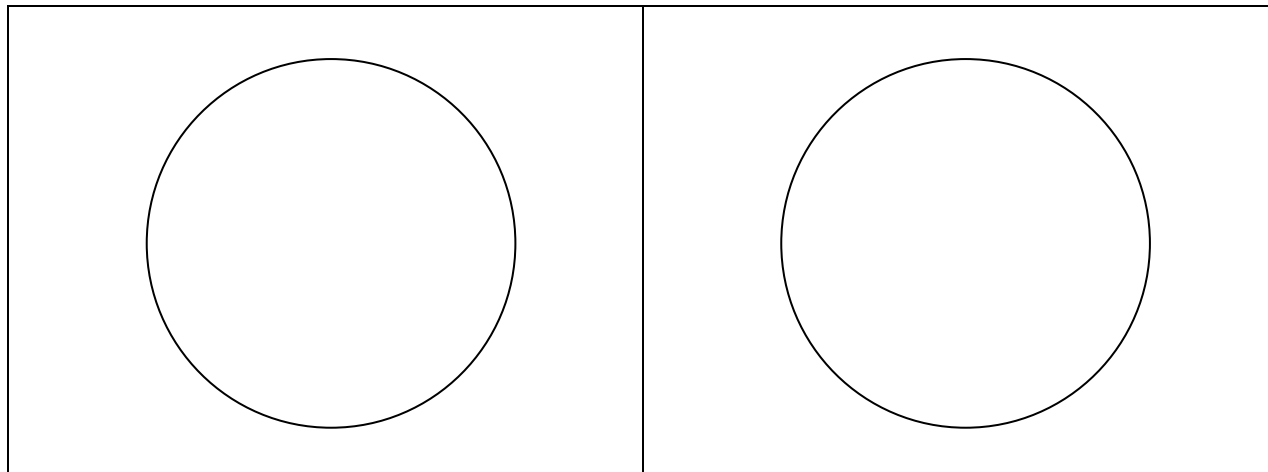
1. Connect the colorimeter to the computer interface. Prepare the computer for data collection by opening the file “Population Dynamics” in the *Biology with Computers* folder of *LoggerPro*.
2. Prepare a blank by filling the cuvette $\frac{3}{4}$ full with distilled water and wipe the cuvette with a tissue to clean and dry it. Open the Colorimeter lid and place it in the slot and close the lid
3. Press the < or > button on the Colorimeter to select a wavelength of 565 nm (Green)
4. Press the CAL (calibration) button until the red LED begins to flash. Then release the CAL button. When the LED stops flashing, the calibration is complete.
5. Obtain yeast medium for Day 1 from your instructor. Mix and transfer 2.5 mL of the yeast medium into a clean, dry cuvette. Then place a cuvette lid on the cuvette.
6. Stir the cuvette until there are no air bubbles on the clear sides of the cuvette and place it into the colorimeter
7. Close the lid and click on the Collect Data button, . The file is set up to collect data for 1 minute.
8. The absorbance value is the value where the data is stable. Record the absorbance value in column 1 of Table 1.
9. Once the data stops collecting, remove the cuvette from the Colorimeter. Then move your data to a stored run. To do this, choose Store Latest Run from the Experiment menu.
10. Mix the yeast medium in the cuvette
11. Using a dropper, withdraw a small amount of the yeast medium.
12. Place one drop of the yeast medium onto a clean microscope slide. Place a clean cover slip over the medium. Do not allow air bubbles to get trapped. The liquid should not ooze out from under the cover slip.

13. Place the slide on a microscope and focus it under low power. Refocus near the center of the slide under high (40x-50x) power.
14. Count the number of yeast cells in one field of view. If you see a clump of cells, estimate the number of cells in the clump. Record the yeast count in column 3 of Table 1.
15. Record the appearance of the yeast cells in the appropriate field of Table 2.
16. Move the slide to a different field of view and have another team member count the number of yeast cells in this field. Record the yeast count in column 4 of Table 1.
17. Discard the unused yeast medium.
18. Repeat steps 4 thru 16 with yeast medium for Day 5 of the open environment and Day 5 of the closed environment.
19. Share your data with the class by recording the absorbance value and the microscopic counts that your group obtained.

6. Results

Table 1: Data					
	Absorbance		Microscopic Count		
	Group Data	Class Average	Field 1	Field 2	Class Average
Day 1					
Day 5 (open)					
Day 5 (closed)					

Table 2: Appearance of Yeast	
Field 1	Field 2
Day 1	
	
Day 5 (closed environment)	
	
Day 5 (open environment)	

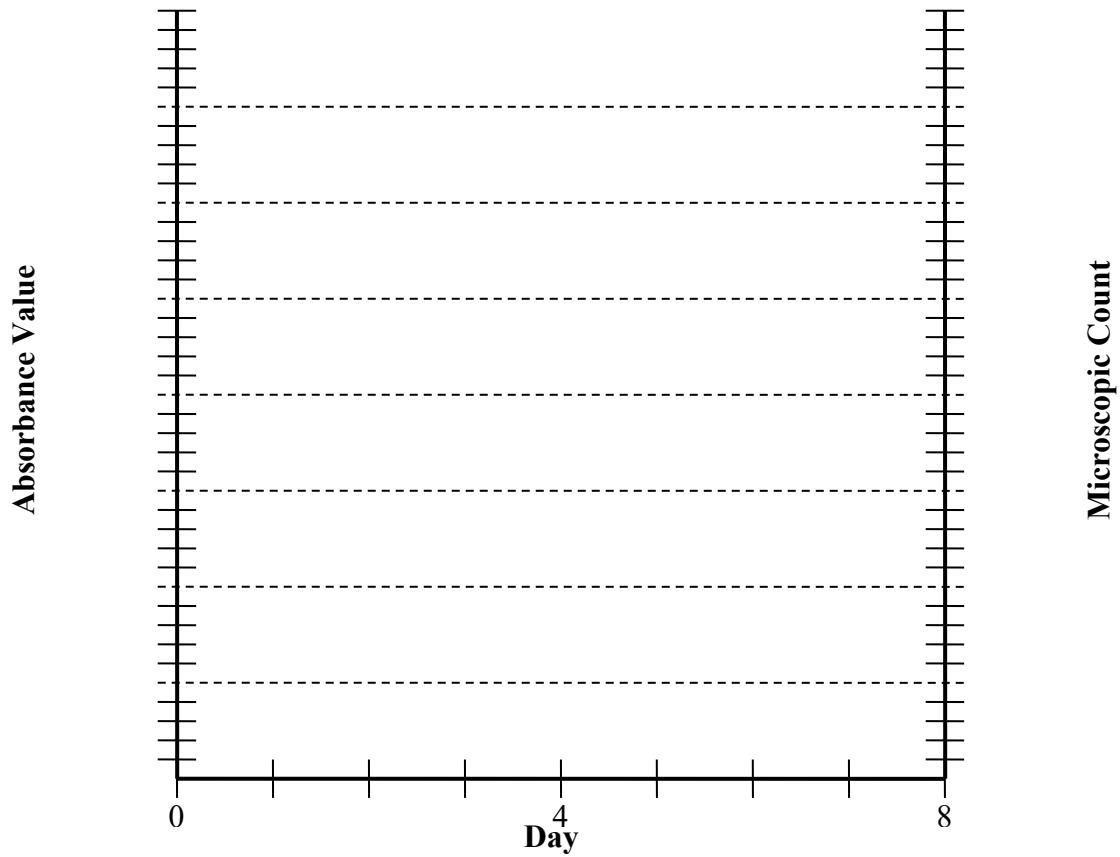


7. Analysis

1. Could you tell whether a yeast cell was dead or alive? How might this affect your results?

2. Plot the class average absorbance value (column 2 of Table 1) vs. Day. On the same graph plot Microscopic count (column 5 of Table 1) vs. Day. The absorbance value and microscopic count should be plotted on the y-axis, and Day on the x-axis.

Yeast Population Study



3. Compare the plot of the yeast population obtained from the absorbance readings with the population obtained from the microscopic count. Describe the similarities and differences of the two plots.

Population Dynamics

Teacher Information

1. To Prepare Yeast Medium 1 for Day 1: Dissolve 1 teaspoon of yeast for every 100 mL of high sugar content media (fruit juice, or glucose solution). Place the yeast medium in a sterile flask, and fit the flask with a cap. Incubate the suspension in 37 - 40 °C water for at least 10 minutes. The solution is now ready for Day 1 samples.
2. To Prepare Yeast Medium 5 for Day 5 open: Prepare the yeast medium as above 5 days in advance. Then leave the yeast medium in an uncapped flask in a secure location at room temperature.
3. To Prepare Yeast Medium 5 for Day 5 closed: Prepare the yeast medium as above 5 days in advance. Then leave the yeast medium in the capped flask in a secure location at room temperature.

On the day of the experiment:

4. Obtain three sterile test tubes for each group. Label one test tube 1 and the other two 5O and 5C.
5. For Day 1 sample: Dilute yeast medium 1 to 50% with distilled water, and pour about 5 mL of the sample into the test tubes labeled 1 for each group.
6. For Day 5 samples: Dilute yeast medium 5 to 50% with distilled water, and pour about 5 mL of the sample into the appropriate test tubes labeled 5O (open) and 5C (closed) for each group.