

Yeast Populations

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Introduction

A **population** is a group of individuals of the same species that live in the same place at the same time. The size of a population can change over a period of time. Increases or decreases in the size of a population may result from environmental conditions such as disease, predators, food supply, temperature, availability of space, migration, and pollution.

Biologists often use one-celled, microscopic organisms such as yeast to study the effect of environmental conditions on changes in populations. Biologists study yeast populations because yeast reproduce rapidly and can be grown in sealed test tubes, with sugar as their food supply. In this lab activity you will simulate experiments that biologists do with real yeast cells.

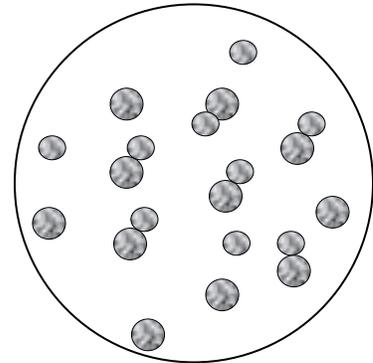
Yeast Population A was grown in a solution of water and sugar in a large container for 8 days. Small samples were drawn from the Yeast Population A on Days 0, 2, 4, 6, 8, and 10.

Tests on samples of the Yeast Population A for Days 0, 8 and 10 have already been performed.

You will perform tests on the Yeast Population A samples that were taken on Days 2, 4, and 6 to determine changes in the:

- pH of the environment due to carbon dioxide production
- Amount of sugar remaining
- Population size

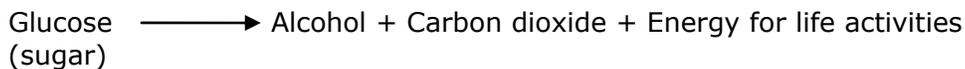
Yeast Cells Viewed at
1000X Magnification



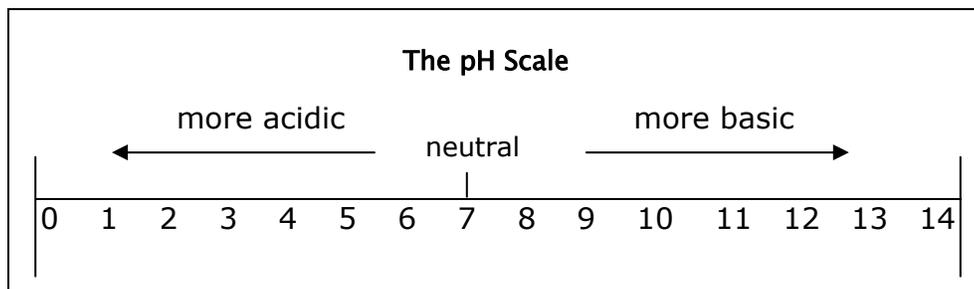
Test 1: pH of the environment due to carbon dioxide production

Yeast produce carbon dioxide as one of the wastes of anaerobic respiration (fermentation). Carbon dioxide dissolves in water to form carbonic acid. The carbonic acid will make the yeast environment more acidic.

Anaerobic Cellular Respiration (Fermentation) in Yeast



You will determine the pH of the Day 2, 4 and 6 Yeast Population A samples. **pH** is a measure of the acidic or basic nature of a solution. The more acidic the solution is, the lower the pH number will be on the pH scale.



1. The yeast may have settled to the bottom of the tubes. Shake the three tubes of Yeast Population A (Day 2, 4, and 6) to mix the yeast with the liquid in the tube.
2. Determine the pH of each sample by quickly dipping one end of a pH indicator paper strip into each of the Yeast Population A samples for Days 2, 4, and 6. Use a new indicator paper strip for each sample.
3. Compare the color of the pH indicator paper to the pH color chart. Complete Table 1 by recording the pH number in the appropriate box.

Table 1: pH of Yeast Population A

Day	0	2	4	6	8	10
pH	7				5	5

4. Plot all of the data in Table 1 on the grid in Graph 1 (on the last page of this lab). Connect the points with a dashed line (— — —) as shown in the key.

5. Describe how the pH changes over the 10 day period.

6. What substance produced during yeast respiration (fermentation) causes the change in pH?

Test 2: Sugar analysis

Yeast use sugar as a source of energy for their anaerobic respiration (fermentation). You will determine the amount of sugar present in the Yeast Population A samples for Days 2, 4, and 6.

1. To determine the amount of sugar present in each of the samples on the test strip.
 - Use the plastic Sugar Test Strip.
 - Use the dropper labeled “Sugar Indicator” to place 1 drop of Sugar Indicator on each of the circles on the Sugar Test strip.
 - Use the matching droppers to place 2 drops of the Yeast Population A samples for Days 2, 4, and 6 in the appropriate circles on the Sugar Test Strip.
 - Compare the color of the sugar test strip to the Sugar Color Chart. Complete Table 2 by recording the grams/L number in the appropriate box.

Table 2: Amount of Sugar for Yeast Population A (grams/liter)

Day	0	2	4	6	8	10
Sugar (grams/L)	5				1	1

2. Plot the data on the grid in Graph 1 (on the last page of this lab). Connect the points with a dotted line (•••••) as shown in the key.
3. Describe how the concentration of sugar changes over the 10 day period.

Test 3: Population size

Yeast are microscopic one-celled organisms. The illustrations on the right show samples of yeast populations viewed through a microscope. You will use these illustrations to determine the yeast population size in the Yeast Population A samples for Days 2, 4, and 6

1. Instead of counting all of the yeast cells in the illustrations, you only count the number of yeast cells that are in each of the **four boxes** on the counting grids.
2. Count and record the number of yeast cells in each of the **four boxes** of the counting grid for Day 2. Then calculate and record the average on Table 3.

_____ _____ _____ _____
Average _____

3. Count and record the number of yeast cells in each of the **four boxes** of the counting grid for Day 4. Then calculate and record the average on Table 3.

_____ _____ _____ _____
Average _____

4. Count and record the number of yeast cells in each of the **four boxes** of the counting grid for Day 6. Then calculate and record the average on Table 3.

_____ _____ _____ _____
Average _____

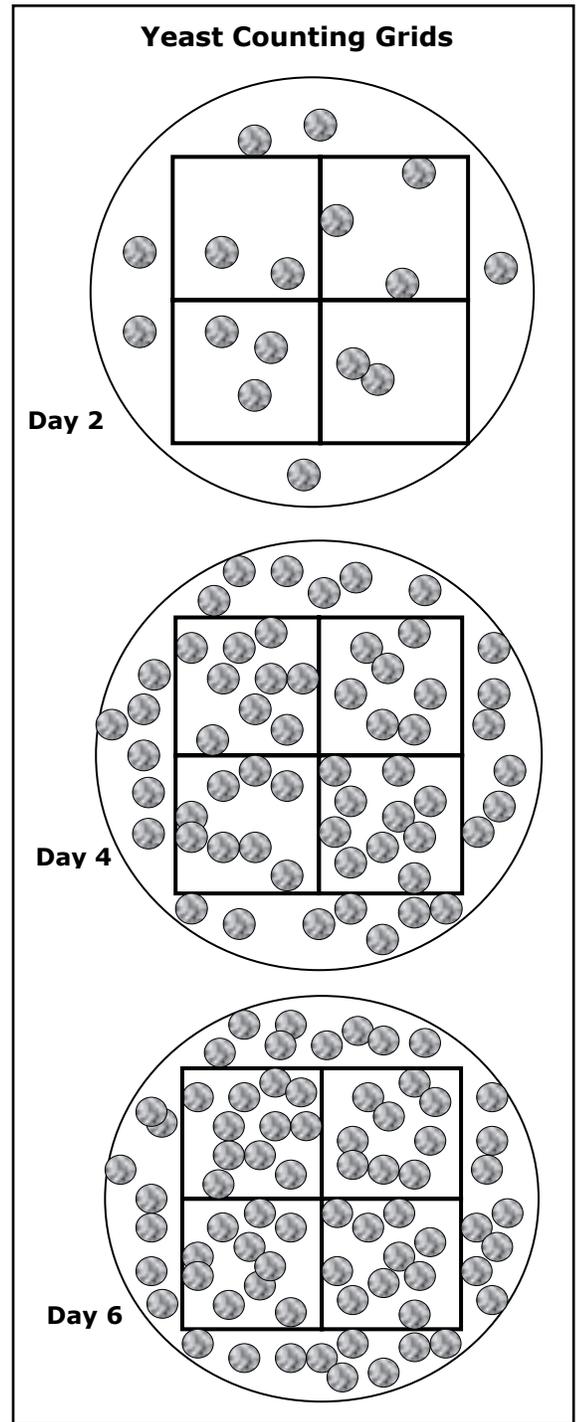


Table 3: Population Size for Yeast Population A
(Average number of “yeast cells” in the boxes on the counting grid)

Day	0	2	4	6	8	10
Population Size (Average)	0.5				0	0

5. Plot the population size data on the grid in Graph 1 (on the last page of this lab). Connect the points with a solid line (————) as shown in the key.

7. Describe how size of the yeast population changes over the 10 day period.

Comparing Two Yeast Populations

Another biology researcher conducted a similar experiment to study the growth of Yeast Population B. The data from his research is shown in Graph 2 (on the last page of this lab).

Base your answers to the questions below on the information in Graph 1 and Graph 2.

- Graph 1 shows the changes in Yeast Population A that you investigated.
- Graph 2 shows the changes in Yeast Population B studied by another researcher.

1. Which type of line (dashed, dotted, or solid on both of the graphs) represents the changes in yeast population size in both of the experiments? _____

2. The pH decreased in Graphs 1 and 2. Explain what caused the pH to decrease. *Hint: Refer back to the information in Test 1.*

3. Compare the amount of sugar present on Day 0 for Yeast Populations A and B.

4. The amount of sugar decreased in both Graph 1 and Graph 2. Explain what caused this decrease in the amount of sugar.

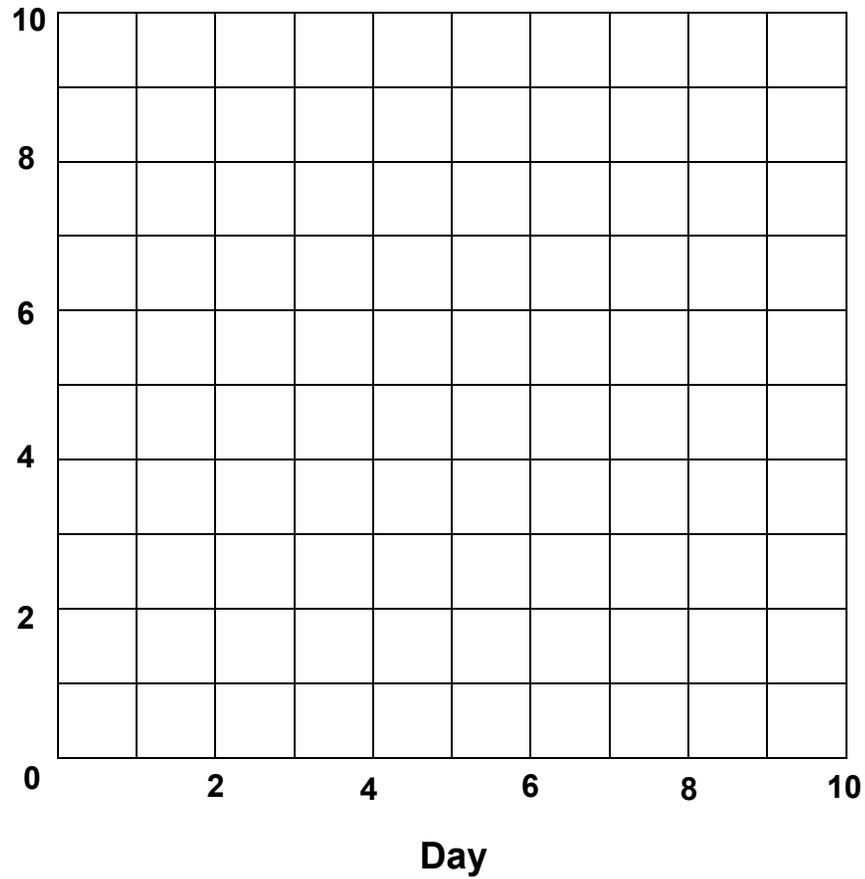
5. Describe one similarity between the growth of Yeast Population A and Yeast Population B.

6. Describe one difference between the growth of Yeast Population A and Yeast Population B.

7. Based on the information in the graphs, which pH level appears to be toxic (poisonous) to yeast cells?

8. What evidence do you have from the two graphs that a lack of sugar is NOT the cause for the death of the yeast populations?

Graph 1: Changes in Yeast Population A



Graph 2: Changes in Yeast Population B

