

dormant: inactive

fermentation: a chemical process in which microorganisms, like yeast or bacteria, break down sugars to form carbon dioxide, water, and alcohol

control: a test group in an experiment in which a variable is not changed; used as a basis for comparison

There are hundreds of species of yeast. Baker's yeast and brewer's yeast are the two types most commonly used in the kitchen. Yeast can be found naturally in soil and on plant leaves and flowers. It can also be found on the skin and in the intestines of warm-blooded animals, including human beings.

A gram of yeast contains about 25 billion cells. Each cell is only approximately $\frac{3}{100}$ of an inch in diameter.

The ancient Egyptians first used yeast for baking bread thousands of years ago.

How can you inflate a balloon without blowing into it?

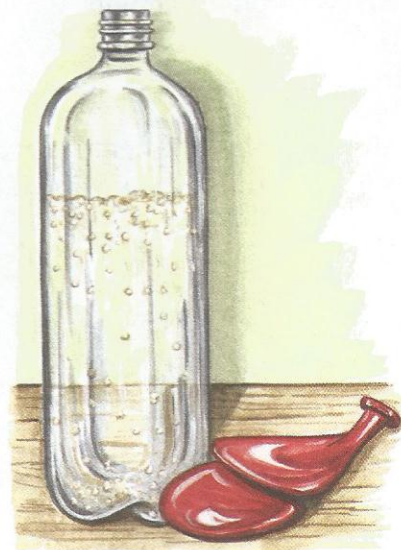
Have you ever baked bread before or watched someone else make it? If you have, you probably know that most types of bread contain yeast. Yeast looks similar to other powdery baking ingredients, but it's actually alive. Yeast, a type of fungus, is a microscopic organism. When it is dry, it is **dormant**, but when it becomes moist and warm, it comes to life.

Yeast is a plantlike organism, but it can't make its own food the way plants do. Instead, it feeds on sugar. As yeast breaks down the sugar to make energy, a chemical reaction called **fermentation** takes place. In the process, it creates alcohol and carbon dioxide as waste. The carbon dioxide appears as little bubbles of gas. These bubbles are what cause bread dough to rise and baked bread to have its light, spongy texture.

Experiment: Rising to the Challenge

Materials: two packets of yeast, two plastic bottles, two balloons, warm water, granulated sugar, a tablespoon, a funnel

- Pour a cup of very warm (but not hot) water into each bottle. Place a funnel over the mouth of bottle 1 and add two tablespoons of sugar. Place the cap on the bottle and shake it until the sugar dissolves.
- Open the bottle and put the funnel over the mouth again. Add the yeast and replace the cap. Swirl the mixture around in the bottle until the yeast dissolves. The water will be cloudy and have turned a light brown color. Follow the same procedure to add yeast—but not sugar—to bottle 2, the **control** bottle.
- Open each bottle and slide the end of a balloon over the bottle's mouth. Make sure that the balloons create a tight seal. If the seals aren't tight enough, use some string, a rubber band, or packing tape to create a better seal.
- Put the bottles someplace warm, like on a sunny windowsill. In about 20 minutes or so, you will notice that the balloon on top of bottle 1 has inflated. It trapped the carbon dioxide that the yeast produced during fermentation. Balloon 2 will not have inflated because yeast does not ferment and produce carbon dioxide without sugars to feed on.



In each scenario below, a variable in the experiment has been changed. On the line that follows each scenario, write a hypothesis that contains your prediction for the outcome of the experiment. Remember, a hypothesis is written in the form of a statement.

1. Boiling hot water is used in place of the warm water in the bottles.

2. Ice-cold water is used in place of the warm water in the bottles.

3. Instead of adding sugar to the bottles, a sweet liquid, such as grape juice, is added to the warm water.

4. Instead of adding sugar to the water, two tablespoons of salt are added.

5. Now, give examples of two more ways in which you could change the variables in this experiment.

Write your answers on the lines below.

6. Why is it important to have a tight seal between the balloon and the neck of the bottle?

7. What is the purpose of using a funnel in this experiment?

8. How is dry yeast different from yeast that has been combined with warm water and flour to make bread?

9. What does yeast produce during fermentation?
