Growing One-Celled Organisms

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Topic

Reproduction in yeast

Time

1½ hours, with 20 minutes of observation 48 hours later

Safety

Please click on the safety icon to view the safety precautions. Do not drink the yeast mixture; dispose of it by flushing it down the toilet after use. Be careful using matches.

Materials

two petri dishes with covers
two packages yeast
16-oz soda bottle
sugar
small 6- or 8-oz jar with cover
matches
molasses
eyedropper
water
balloon
microscope

Procedure

Part A: Observing Yeast Grow

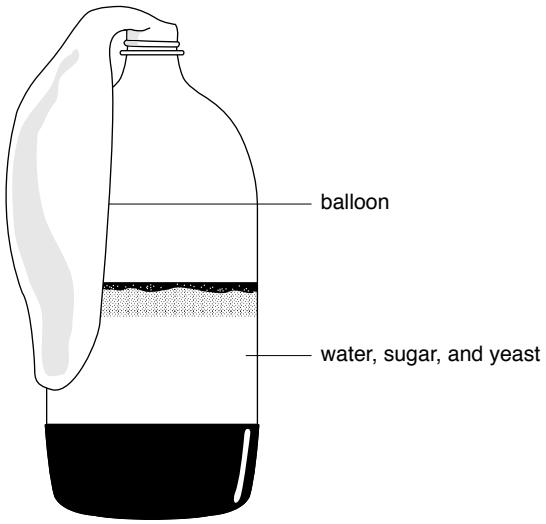
1. Fill the bottoms of the petri dishes half full with warm water. Dissolve 1 tsp sugar in one. Stir the ingredients.
2. Sprinkle ¼ tsp yeast in each dish and cover them. Allow the dishes to sit undisturbed for ½ hr in a warm place.
3. After ½ hr, observe the petri dishes, and record your observations on the data table.
4. Dispose of the contents of both dishes.

Part B: Respiration

1. Fill the soda bottle half full with warm water. Add to this 3 tbs sugar and one package of yeast. Stir the ingredients.
2. Cover the bottle top with the balloon (see figure 1). Observe after 15 min to ½ hr. Record what has happened to the balloon. If there is no observable difference, observe again in a few hours.
3. Remove the balloon and light a match. Place the match in the mouth of the bottle. Observe what happens, and record the results.

DATA TABLE		
Procedure	Time before observation	Observations
Yeast in dish with water	1/2 hr	
Yeast in dish with sugar water	1/2 hr	
Yeast in bottle with balloon		
Yeast in bottle with match	_____	
Yeast under microscope	initial	
Yeast under microscope	48 hr	

Figure 1



PART C: REPRODUCTION

1. Fill the small jar half full with warm water.
2. Dissolve 6 tsp molasses in the water.
3. Add 1/4 package yeast to the water and molasses solution, and stir.
4. Using the dropper, place a drop of this mixture on a microscope slide, and cover it with a cover slip.
5. Observe the slide under the microscope at high power.

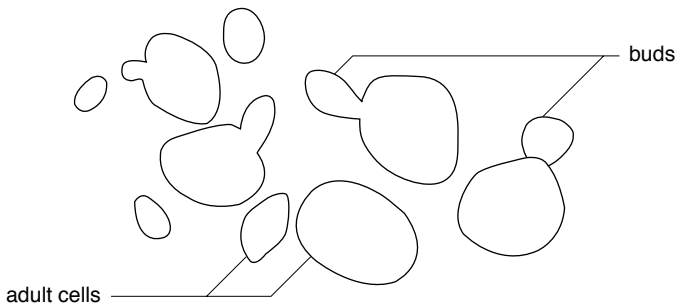
6. Draw a picture of what you observe.
7. Cover the jar and set it in a warm dark place for 48 hr.
8. After 48 hr, open the jar. Note the odor.
9. Prepare a microscope slide as you did in step 4 and observe.
10. Draw a picture of what you observe. Compare this to your observations and drawing from 48 hr earlier.
11. What happened in the two petri dishes? What do you think caused any observable differences?
12. What happened to the balloon? The match? Why do you think this happened?
13. Compare the first drop you observed under the microscope with the second drop. How are they different? What process is taking place in the cells in the second drop?
14. When you opened the jar, what did the odor remind you of?
15. What purpose do you think the sugar and molasses served?

What's Going On

In the petri dish containing only water and yeast, most of the yeast sank to the bottom of the dish. In the dish with added sugar, the yeast rose to the top of the dish and formed a bubbling mass of foam. The balloon expanded as it filled with gas from the respiration of the yeast. The match goes out in the presence of the gas which the yeast is respiring. The expanding balloon tells you that there is a gas present, which was not there in the bottle when you began. The fact that the match goes out tells us that the gas is not air or oxygen. The gas is carbon dioxide, which is the waste product that forms as yeast digests sugar. Because yeast produces carbon dioxide, it is used in the manufacture of bread. The yeast digests the sugar and some of the flour used to make bread, and the carbon dioxide formed fills the dough with little bubbles. This causes the bread to "rise" and forms the little air pockets you see when you look at a piece of bread.

The first drop you observed under the microscope contained adult yeast cells, which were very much alike. The drop observed several days later contained cells in various stages of reproduction. The cells that have small projectors coming off their bodies (see figure 2) are in the process of budding. The odor you smelled on opening the jar was alcohol. As yeast digests sugar, it produces carbon dioxide and alcohol as waste products. This process, called *fermentation,* is used to make beer and other alcoholic beverages. The sugar and molasses provide food for the yeast.

Figure 2



Connections

All organisms must reproduce themselves in order to survive. Single-celled organisms reproduce asexually. That means, each individual reproduces without any contact with another organism. Some organisms split in two. This is called *fission*, which occurs when an organism divides equally in half. Some types of fungus reproduce by *sporulation*. They produce one-celled fragments called *spores*, from which mature organisms can grow. Yeast, which is a form of fungus, reproduces differently from other single-celled fungi. Yeast cells reproduce by *budding*. A small fragment, called a *bud*, begins to grow on a parent cell. As the bud grows, the cell wall of the parent begins to close between the parent and the bud, and the bud separates, becoming a new yeast cell. In this experiment you observed how yeast cells grow and divide.

Safety Precautions

READ AND COPY BEFORE STARTING ANY EXPERIMENT

Experimental science can be dangerous. Events can happen very quickly while you are performing an experiment. Things can spill, break, even catch fire. Basic safety procedures help prevent serious accidents. Be sure to follow additional safety precautions and adult supervision requirements for each experiment. If you are working in a lab or in the field, do not work alone.

This book assumes that you will read the safety precautions that follow, as well as those at the start of each experiment you perform, and that you will *remember* them. These precautions will not always be repeated in the instructions for the procedures. It is up to you to use good judgment and pay attention when performing potentially dangerous procedures. Just because the book does not always say "be careful with hot liquids" or "don't cut yourself with the knife" does not mean that you should be careless when simmering water or stripping an electrical wire. It *does* mean that when you see a special note to be careful, it is extremely important that you pay attention to it. If you ever have a question about whether a procedure or material is dangerous, stop to find out for sure that it is safe before continuing the experiment. To avoid accidents, always pay close attention to your work, take your time, and practice the general safety procedures listed below.

PREPARE

- Clear all surfaces before beginning work.
- Read through the whole experiment before you start.
- Identify hazardous procedures and anticipate dangers.

PROTECT YOURSELF

- Follow all directions step by step; do only one procedure at a time.
- Locate exits, fire blanket and extinguisher, master gas and electricity shut-offs, eyewash, and first-aid kit.
- Make sure that there is adequate ventilation.
- Do not horseplay.
- Wear an apron and goggles.
- Do not wear contact lenses, open shoes, and loose clothing; do not wear your hair loose.
- Keep floor and work space neat, clean, and dry.
- Clean up spills immediately.
- Never eat, drink, or smoke in the laboratory or near the work space.
- Do not taste any substances tested unless expressly permitted to do so by a science teacher in charge.

USE EQUIPMENT WITH CARE

- Set up apparatus far from the edge of the desk.
- Use knives and other sharp or pointed instruments with caution; always cut away from yourself and others.
- Pull plugs, not cords, when inserting and removing electrical plugs.
- Don't use your mouth to pipette; use a suction bulb.
- Clean glassware before and after use.
- Check glassware for scratches, cracks, and sharp edges.
- Clean up broken glassware immediately.

- Do not use reflected sunlight to illuminate your microscope.
- Do not touch metal conductors.
- Use only low-voltage and low-current materials.
- Be careful when using stepstools, chairs, and ladders.

USING CHEMICALS

- Never taste or inhale chemicals.
- Label all bottles and apparatus containing chemicals.
- Read all labels carefully.
- Avoid chemical contact with skin and eyes (wear goggles, apron, and gloves).
- Do not touch chemical solutions.
- Wash hands before and after using solutions.
- Wipe up spills thoroughly.

HEATING INSTRUCTIONS

- Use goggles, apron, and gloves when boiling liquids.
- Keep your face away from test tubes and beakers.
- Never leave heating apparatus unattended.
- Use safety tongs and heat-resistant mittens.
- Turn off hot plates, bunsen burners, and gas when you are done.
- Keep flammable substances away from heat.
- Have a fire extinguisher on hand.

WORKING WITH MICROORGANISMS

- Assume that all microorganisms are infectious; handle them with care.
- Sterilize all equipment being used to handle microorganisms.

GOING ON FIELD TRIPS

- Do not go on a field trip by yourself.
- Tell a responsible adult where you are going, and maintain that route.
- Know the area and its potential hazards, such as poisonous plants, deep water, and rapids.
- Dress for terrain and weather conditions (prepare for exposure to sun as well as to cold).
- Bring along a first-aid kit.
- Do not drink water or eat plants found in the wild.
- Use the buddy system; do not experiment outdoors alone.

FINISHING UP

- Thoroughly clean your work area and glassware.
- Be careful not to return chemicals or contaminated reagents to the wrong containers.
- Don't dispose of materials in the sink unless instructed to do so.
- Wash your hands thoroughly.
- Clean up all residue, and containerize it for proper disposal.
- Dispose of all chemicals according to local, state, and federal laws.

BE SAFETY-CONSCIOUS AT ALL TIMES