Fungus Among Us!

Topic: Investigating Living Systems	**Overview:** Students will investigate the properties of yeast as a fungus.
Standards: 3.1 a, c, g, j 4.1 a, b, c, f, h 5.1 e, f, g, h; 5.5 b	**Objective:** The students will:: • Plan and conduct an investigation to test the properties of yeast.
Materials: 2 cups of flour (plus a little extra), 4 medium-sized bowls, 2 packages of rapid-rise yeast, access to warm water, 6 teaspoons of sugar, 24 clear drinking straws (must be clear), 24 clothespins, measuring spoons, ¼ cup measuring cup, spoon, metric ruler, permanent marking pen, notebook and pen or pencil, clock, watch or timer, a sweetener besides sugar such as honey or artificial sweetener	**Cooperative Learning:** Give One, Get One Stand Up, Hand Up, Pair Up Team Project All Write Round Robin Team Discussion Pairs Check Teammates Consult Class Discussion

Content Information:
Living things can be categorized into kingdoms: monerans, protists, fungi, plants, and animals.

Some fungi are made of one cell. Others have many cells. All fungi have a nucleus and a cell wall. Fungi are plant-like organisms that lack chlorophyll. Fungi are one of the five kingdoms of life.

Some cause problems (some fungi can injure plants and people) while many fungi are good and useful (edible mushrooms would be an example of these). There are over 100,000 species of fungi. Mycologists are the scientists who study fungus. Medical mycologists study drugs to cure fungal infections, while agricultural and research mycologists study the industrial uses of fungi.

Since they do not have chlorophyll, fungi must absorb food from others. Since they don't use light to make food, fungi can live in damp and dark places. Fungi are supposed to "eat" things when they are dead but sometimes they start eating when the organism is still alive. That is when mycologists come in to figure out what to give to the infected patient or plant to get rid of the fungus.

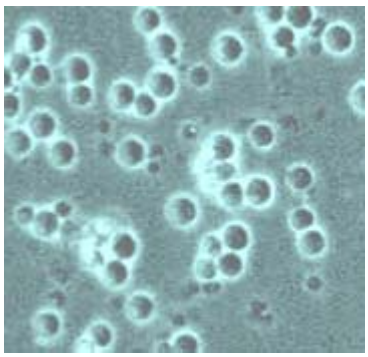
Bad fungus is just good fungus trying to do its job way too early to an organism. Most commonly, fungi cause something to happen on the skin of animals or people. This is sometimes called Ringworm, but there is no worm involved! Ringworm can be found all over

the world. It mostly forms on the foot and scalp. Some Ringworm is Anthropophilic. Anthropophilic means human (anthro- think of anthropology) loving (-philic), and you catch this fungus from other people. Ringworm can also be Zoophilic or Geophilic. Zoophilic means animal (zoo- just think of going to a real zoo) loving, and this is a fungus you may catch from your pet. Geophilic means earth (geo- as in geology, or the earth) loving, of course you get this one from the soil.

Some fungus just irritates the body. Fungus irritates the nose and causes allergies. Over 37 million people have allergies and many of them are caused by fungus. Buildings can also get sick. Buildings can get some fungi known as Penicillium and Stachybotrys. They float in the air and can cause watery eyes and breathing problems.

Good fungus can help with many things to make the world a better place. Without fungi, we would have piles of trash everywhere because fungi get food from our trash. They eat the trash and make it into soil. Out of the many kinds of fungi, the ones we love to eat are mushrooms. We put them on pizza, burgers, salads, and more. During Lent, for those who give up meat, restaurants serve mushroom balls instead of meatballs on spaghetti.

Fungi can even make some big things happen in food. For example, a yeast fungus is used to make the alcohol in beer. This same fungus is used when we make bread--without its help, we would have flat bread. In fact, if a piece of sandwich bread is examined closely, we can see a honeycomb texture in it where bubbles formed and burst. What causes the difference between pitas or tortillas and sandwich bread or dinner rolls?



The difference is caused by a single celled microbe called yeast, pictured here. Yeast is a kind of fungi. They reproduce by budding or sporing and can live in a variety of habitats. Yeast can be found plant leaves, flowers, and skin and in soil, saltwater, and the intestines of warm-blooded animals. In some conditions the multiply quickly. Other conditions prevent them from multiplying at all.

If we open a package of baker's yeast, we see tiny brownish grains. These are clumps of dehydrated yeast cells (dehydrated means most of the water has been removed). If we let the yeast sit for a while and observe, we get bored because they don't do much. But put yeast in bread dough and we can definitely see that this fungus is doing something. But what exactly are they doing?

Instructional Sequence:
Introduction:

1. **GIVE ONE, GET ONE**: Access prior knowledge by having students generate a list of the kingdom of living things and examples of each. Have students fold a piece of paper lengthwise (hot dog style). When they open the paper, they should draw a line down the fold creating 2 columns. At the top of the left column, students write GIVE ONE; on the top of the right column, they write GET ONE. Tell students that they have one minute to make a list of five the kingdoms of living things and as many examples as they can.

2. **STAND UP, HAND UP, PAIR UP:** Tell students to stand up, put their hand up, and find a partner. One student gives an answer. If the partner has the same answer, he/she checks it off on his/her paper. If it's a new idea, he/she add it in the GET ONE column. Repeat with the other student giving an answer. Students thank each other and raise hand to find a new partner. Continue for several minutes.
3. Signal student to return to their seats. Have them work with teammates to check accuracy of list while teacher circulates through room. Teacher should address any incorrect answers or misconceptions.
4. Give each team flat bread and sandwich bread. Ask students to discuss what differences they see and what they think caused the difference.
5. Tell students that they will be working with a fungus that caused the differences. The fungus is called yeast.

Procedure

TEAM PROJECT - Assign lab roles: Principal Investigator who directs others to follow procedures; Materials Manager who does experiment; Reporter who records data; Timekeeper / Clean Up Captain who keeps time and helps clean up. Distribute lab reports and materials.

PART ONE – CREATE THE CONTROL:

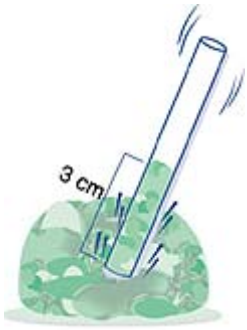
1. Using the ruler, measure the point 3 centimeters from one end of each straw and mark that point with a line using the permanent marker.

1. Put ¼ cup of flour into one of your bowls.

2. Measure 1 teaspoon of sugar and add it to the flour in the bowl.

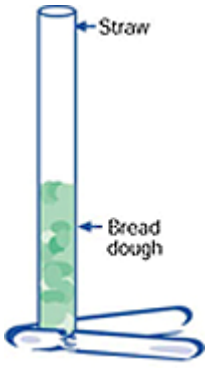
3. Pour ¼ of a package of yeast (or ¼ teaspoon) into the bowl. Using the spoon, stir together the ingredients in each bow

4. Fill a cup with warm water from your faucet. Carefully add the water to the Control bowl about a teaspoonful at a time and begin to knead the mixture. Your dough should eventually feel kind of like Play-Doh—it should be damp, not wet. It'll be sticky at first, but should eventually reach a point where it's just damp enough that it no longer really sticks to the bowl or your hands. If it's too sticky still, add a little bit more flour. Form the dough into a ball.



5. Working quickly, push 3 straws into the dough until the dough inside the straws reaches the 3-centimeter mark.

6. Now pinch the bottoms of each straw, pushing the dough up from the bottom enough to clip a clothespin to the end of each straw. Mark the new height of the dough on each straw. Stand the straws upright using the clothespins as bases.



7. Mark the time on your clock or watch or set your timer for 10 minutes. Wait 10 minutes. Then measure and mark the heights of the dough in these straws and record the heights and the time in your notebook on the "Control" Dough Data Table. Repeat this step 10 minutes later (20 minutes). Repeat after another 10 minutes has passed (30 minutes).
8. **ALL WRITE ROUND ROBIN**: While students are waiting for dough to rise, have them brainstorm ways that they could change the materials to affect what the dough does. Each student has own paper. Students go around table saying what can be changed. Teammates write. Continue until there are no new ideas.
9. **TEAM DISCUSSION**: Students discuss as team what they could describe or measure to determine if the thing they change affects how the dough reacts. Team works together to determine the independent (amount of sugar) and dependent (height of dough rising) variable.
10. **RALLY COACH**: Students work in pairs to complete experimental design - one student works the problem while the other coaches. After first problem, students switch. Upon completion of the testable question and hypothesis, **PAIRS CHECK** their answers with another pair. Continue checking after every 2 problems until design is complete.

PART TWO – DIFFERENT AMOUNT OF SUGAR EXPERIMENT

Teams continue TEAM PROJECT

1. Using the ruler, measure the point 3 centimeters from one end of each straw and mark that point with a line using the permanent marker.

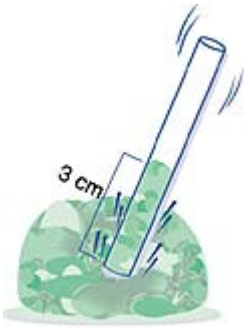
2. Put ¼ cup of flour into each of your 3 bowls. Mark the others as 1, 2, and 3. (Your "control" dough is already done.)

3. Measure 2 teaspoons of sugar and add it to the flour in the bowl marked 1. Put 3 teaspoons of sugar into bowl 2. Put 4 teaspoons of sugar into bowl 3.

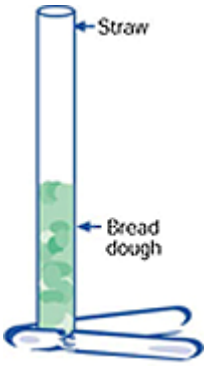
4. Pour ¼ of a package of yeast (or ¼ teaspoon) into each of the three bowls. Using the spoon, stir together the ingredients in each bowl.

5. Fill a cup with warm water from your faucet. The water should be warm, not hot and steaming. Dust your hands with a little flour. Carefully add the water to the bowl 1 about a teaspoonful at a time and begin to knead the mixture. Your dough should eventually feel kind of like Play-Doh—it should be damp, not wet. It'll be sticky at first, but should eventually reach a point where it's just damp enough that it no longer really sticks to the bowl or your hands. If it's too sticky still, add a little bit more flour. Form the dough into a ball.

6. Repeat step 5 with each of the remaining bowls, working as quickly as you can. (If you have friends or classmates or parents helping out, each person should take a bowl and everyone should do step 5 at the same time.)



7. Working quickly, push three straws into dough 1 until the dough inside the straws reaches the 3-centimeter mark. Lay these straws by bowl 1. Repeat this step with each of the remaining bowls. Be sure to keep the straws beside the right bowls and don't mix them up. (Again, if you've got more people working with you on this activity, each person should take a ball of dough and everyone should do this step all at the same time.)



8. Now pinch the bottoms of each of your straws, pushing the dough up from the bottom enough to clip a clothespin to the end of each straw. Mark the new height of the dough on each straw. Stand the straws upright using the clothespins as bases. Do the same with the rest of the straws. Label the batches of straws as 1, 2 and 3.

9. Mark the time on your clock or watch or set your timer for 10 minutes. Wait 10 minutes. Then measure and mark the heights of the dough in each straw and record these heights and the time in your notebook. Repeat this step 10 minutes later. Repeat after another 10 minutes has passed.

10. During the 10-minute intervals while waiting for the dough in the straws to do its thing, discard your first batches of dough from each bowl and wash the bowls out. Dry them thoroughly. Be sure to keep an eye on the clock while you're doing this so that you don't miss the 10-minute deadline to check and measure your straws.

11. Graph your results.

12. Throw away all the straws when you're done. You might want to save the clothespins for another project in the future. Discard the dough in the bowls and wash them out. Clean up any spilled flour, sugar or yeast.

Observations and Conclusions

1. Students collect data and record observations.
2. **TEAMMATES CONSULT:** Students answer questions on lab report.

a. In the first batch of straws you made, which straws showed the greatest change in dough height? Why?

The straws containing dough from bowl 3 showed the highest rising. Since everything-the amount of flour, the amount of yeast, the temperature of the water-stayed the same except for the amount of sugar, the height of the dough rising is connected to the larger amount of sugar in this dough. Why is that? See the next question.

b. Can you guess what effect the sugar had and why?

You will notice that the dough from the other bowls also rose some in their straws; the height was connected to how much sugar was in the flour. The more sugar, the higher the dough rose. What can you figure out from this? Well, you've already read that

yeast makes bread rise and become puffy instead of flat and this has something to do with yeast activity. What makes living things active? Food energy. The sugar is food for the yeast cells. The more sugar there is the more active the yeast cells are.

c. Did the Control dough rise at all or not? Why or why not?

You probably saw some rising happen in the straws containing Control dough. This is because flour is a starch. Starches contain glucose, a form of sugar (this is why a saltine cracker tastes a little sweet if you let it sit on your tongue for a while; the enzymes in your saliva break the cracker starch down into glucose and other simpler molecules). Even though you didn't add any sugar to the Control dough, it already contained some for the yeast to feed on. However, because the amount of sugar in this dough was much less than in the others, less carbon dioxide could be made by the yeast in this batch and the dough couldn't rise as much in comparison.

3. **CLASS DISCUSSION:** Discuss lab results and questions.

Sample Assessment:

- Students write conclusion including three key parts:
  - Statement saying if the results support or do not support the hypothesis.
  - Summary of the results and data
  - Explanation of results

Extension:

- Encourage students to try experiment at home using different artificial sweeteners. Do artificial sweeteners have the same affect on yeast as sugar?

Fungus Among Us!

Activity 1 for Students:

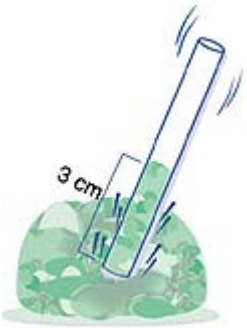
2. Using the ruler, measure the point 3 centimeters from one end of each straw and mark that point with a line using the permanent marker.

11. Put ¼ cup of flour into one of your bowls.

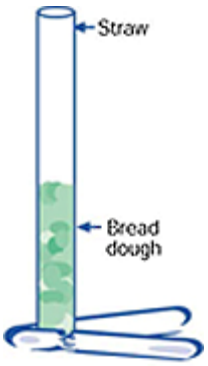
12. Measure 1 teaspoon of sugar and add it to the flour in the bowl.

13. Pour ¼ of a package of yeast (or ¼ teaspoon) into the bowl. Using the spoon, stir together the ingredients in each bow

14. Fill a cup with warm water from your faucet. Carefully add the water to the Control bowl about a teaspoonful at a time and begin to knead the mixture. Your dough should eventually feel kind of like Play-Doh—it should be damp, not wet. It'll be sticky at first, but should eventually reach a point where it's just damp enough that it no longer really sticks to the bowl or your hands. If it's too sticky still, add a little bit more flour. Form the dough into a ball.



15. Working quickly, push 3 straws into the dough until the dough inside the straws reaches the 3-centimeter mark.



16. Now pinch the bottoms of each straw, pushing the dough up from the bottom enough to clip a clothespin to the end of each straw. Mark the new height of the dough on each straw. Stand the straws upright using the clothespins as bases.

17. Mark the time on your clock or watch or set your timer for 10 minutes. Wait 10 minutes. Then measure and mark the heights of the dough in these straws and record the heights and the time in your notebook on the CONTROL DOUGH Data Table. Repeat this step 10 minutes later. Repeat after another 10 minutes has passed.

Material Tested	Height of the dough			
CONTROL Dough	Straw 1	Straw 2	Straw 3	Average

3 How could we change these materials to affect how the dough reacts?

Dough

#4 What will we observe or measure to see if changing

_____ affects how the dough reacts?

INVESTIGATION PLANNING SHEET
My Own Investigation

Testable question:

I am going to investigate the effect of _____

on _____.

My hypothesis is

If _____is changed then the dough will

_____.

What one thing will I change on purpose?

_____

_____
Scientists call this the **independent variable** or the **manipulated variable.**

What are we measuring or observing? (What's my data?)

_____

_____
Scientists call this the **dependent variable** or the **responding variable.**

What things will I need to keep exactly the same in order to conduct a fair test? (Constants)

_____

_____

Run for each group

Procedure:

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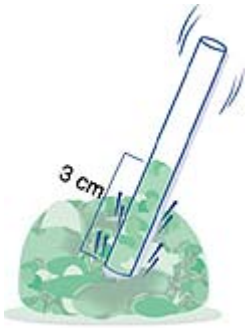
6. Repeat step 5 with each of the remaining bowls, working as quickly as you can. (If you have friends or classmates or parents helping out, each person should take a bowl and everyone should do step 5 at the same time.)



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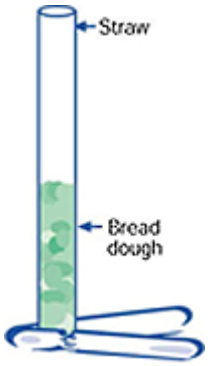

8. Now pinch the bottoms of each of straw, pushing the dough up from the bottom enough to clip a clothespin to the end of each straw. Mark the new height of the dough on each straw. Stand the straws upright using the clothespins as bases. Do the same with the rest of the straws. Label the batches of straws as 1, 2, and 3.

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10. During the 10-minute intervals while waiting for the dough in the straws to do its thing, discard your first batches of dough from each bowl and wash the bowls out. Dry them

thoroughly. Be sure to keep an eye on the clock while you're doing this so that you don't miss the 10-minute deadline to check and measure your straws.

11. Graph your results.

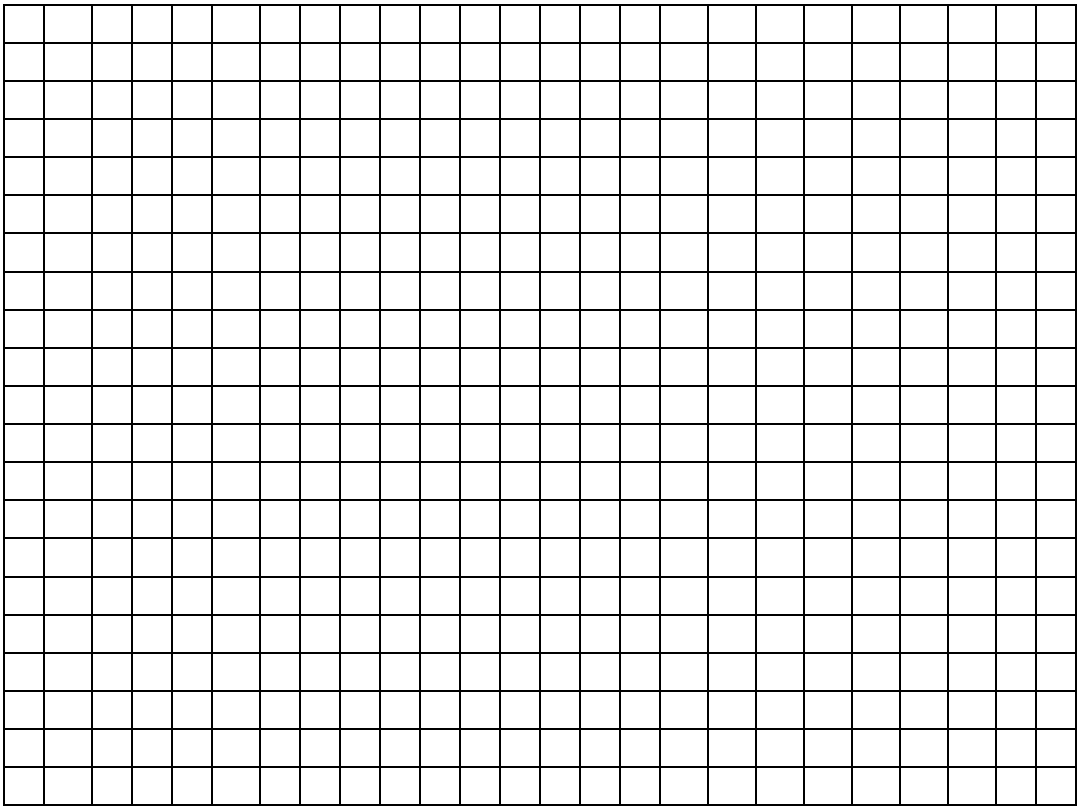
12. Throw away all the straws when you're done. You might want to save the clothespins for another project in the future. Discard the dough in the bowls and wash them out. Clean up any spilled flour, sugar or yeast.

My Data

Material Tested	Height of the dough			
	Straw 1	**Straw 2**	**Straw 3**	**Average**
Dough 1				
Dough 2				
Dough 3				

Other Observations:

Graph of My Results



What I learned (My Conclusion)