

## Why Does Fruit Turn Brown?

### Experimental Procedure

This project follows the  [Scientific Method](#). Review the steps before you begin.

#### Testing Different Liquids on Apple Slices

1. Use a piece of masking tape to label each plate: "control," "water," "apple juice," "vinegar," "lemon juice," and "poked apple slices."
2. On a clean cutting board, carefully cut both apples in half through the middle. Then cut the apple halves into 18 equally-sized apple slices.
3. Immediately after cutting the apple, place three apple slices on each plate. Put the slices on their sides as shown in Figure 1.
  - a. Testing three apple slices separately for each treatment will show that your results are reproducible.



Image Credit: [Svenja Lohner, Science Buddies / Science Buddies](#)

**Figure 1.** On each plate, place three apple slices.

4. Start with your treatment right away, so your apples do not have time to turn brown!
  - a. For each plate, sprinkle about one teaspoon of the corresponding liquid onto each apple slice. Make sure to completely cover the top of each apple slice with the liquid.
  - b. Do not put any liquid on the apples on the control plate. These will show how the apples turn brown without any treatment.
  - c. Take a fork and poke each of the apple slices on the "poked apples slices" plate several times, so that each slice has many holes in it. Do not apply any liquid.
5. Prepare a data table as shown in Table 1 in your lab notebook.

Treatment	Apple Slice	How does the apple slice look?	How brown is the apple slice? (1 = not brown at all; 5 = very brown)	Average for treatment group? (1 = not brown at all; 5 = very brown)
Control	#1			
	#2			
	#3			
Poked	#1			
	#2			
	#3			
Water	#1			
	#2			
	#3			
Apple Juice	#1			
	#2			
	#3			
Lemon Juice	#1			
	#2			
	#3			
Vinegar	#1			
	#2			
	#3			

**Table 1.** Record your results and observations in your lab notebook in a data table like this one.

- Set your timer to two hours and start it. Check in on the apple slices every half an hour to have a look at them. After two hours, write down how the apple slices look in your data table.

- a. Make a note of how each of the apple slices looks. Are they turning brown yet? Where are they brown? Do they look dry or wet? Write down anything you notice. If you have a camera, take a picture of each plate. If you take a picture, make sure that the lighting conditions are always the same, so the coloring is similar in each picture.
  - b. Rate how brown each of the apples slices is. On a scale of 1 to 5, try to rate each apple slice by how brown it seems, with 1 being the least brown and 5 being the brownest. Write the ratings in your data table.
7. Optional: Leave the apples slices on the plates overnight. Then repeat the rating for each of the apple slices the next day. Make a second data table for your new data.

## Analyzing Your Data

1. Look at your data table. Overall, which treatment group has the freshest-looking apple slices? Which treatment group has the brownest apple slices?
  - a. Calculate the average rating for each of the treatment groups. Add the rating number for each of the three apple slices within a treatment group and divide it by three.
  - b. Write this number into the last column of your table.
2. Make a bar graph using your rankings for the different treatment groups from your data table.
  - a. You can make a bar graph by hand or use a website like [Create a Graph](#) to make a graph on the computer and print it.
  - b. Put the name of each treatment on the x-axis (the horizontal axis going across) and its overall group rank, from 1 to 5, on the y-axis (the vertical axis going up and down).
3. If you left the apple slices overnight and have data for the next day as well, make another graph for that data. How does this graph compare to the graph after two hours?
4. Why do you think the treatment that had the freshest-looking apple slices overall was able to keep the apple slices the freshest? Why do you think the treatment that had the brownest apple slices did not keep the apple slices fresh?
  - a. *Tip:* Re-read the [Introduction](#) and think about what conditions the enzyme PPO needs to function.
5. When you are done analyzing the apple slices, you can compost them or throw them in the trash. Do not eat the apple slices, even if they look edible, because they might have an unpleasant taste after having been treated with the liquids such as vinegar.

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