Lesson Two

Where is glucose in food?

Overview
Students learn about different types of sugars and perform an experiment with two digestive enzymes to determine whether glucose is present in three types of milk. Students are introduced to Diastix as a method to measure glucose concentrations, and the use of digestive enzymes lactase and sucrase to demonstrate the release of glucose through the breakdown of carbohydrates in foods.

Enduring understanding:
Glucose is the major energy source for most living organisms, through the process of cellular respiration. The food we eat can either be broken down to glucose, a single-ring sugar, or converted to glucose through the action of enzymes.

Essential question:
Where is glucose in food and what does it have to do with type 2 diabetes?

Learning objectives
Students will be able to:

- Determine the presence of glucose in foods that they consume.
- Model how the enzymes sucrase and lactase act on sugars.

Prerequisite Knowledge
Students should have an understanding of the following terms: enzyme, glucose, digestion, molecule.

Time: Approximately 90 minutes

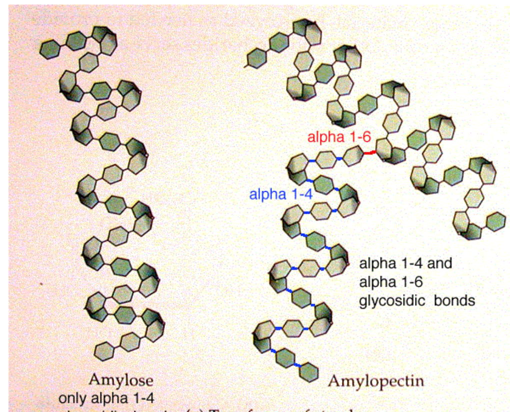
> This lesson connects to the Next Generation Science Standards in the following ways:
>
> **Performance Expectation**
> **HS LS1-6** Construct and revise an explanation based on evidence for how carbon, hydrogen and oxygen from sugar molecules may combine with other elements to form other large carbon-based molecules [and conversely, how large molecules may be broken down into simple sugar molecules].
>
> This lesson highlights the Practices of **Carrying out Investigations** and **Constructing Explanations,** and the Crosscutting Concept of **Energy and Matter**.

Background on Carbohydrates

Glucose, a **monosaccharide**, is the primary energy molecule of the body. Surprisingly, much of the food we eat is not in the form of glucose. More commonly, glucose is found as part of **disaccharides** like sucrose (found in fruit) and lactose (in milk) or as a starch. In this lesson, students use readily available digestive enzymes to digest sugars to simple sugars. They use Diastix to detect glucose in milk solutions before and after digestion. Other macromolecules, like amino acids and fats, can be converted to glucose by enzymes in the liver, but this is beyond the scope of this lesson.

How is starch digested to glucose?

Starch, a **polysaccharide**, is a natural **polymer** of glucose, formed in a variety of plants by the chemical linkage of hundreds or even thousands of individual glucose units. Corn, wheat, potatoes and rice are main sources of starch used in the U.S. Other plants with high starch content (*e.g., cassava, milo, sorghum)* are more abundant in other parts of the world. The common starches differ in that they contain different amounts of two types of glucose polymers. One of these polymers is **amylose** (see figure to the right), a linear chain of 500 to 2000 glucose units. The other starch polymer, **amylopectin** (see figure to the right), has a tree-like shape, with linear chains like those in amylose connected at branch points. Each branch contains about 20 to 30 glucose units and the molecule is made up of several hundred branches.



(a) Two forms of starch

Digestion of carbohydrates begins in the mouth. Saliva contains a large amount of alpha-amylase, an **enzyme** that breaks starch into smaller fragments. With the help of additional digestive enzymes, these fragments are broken down into **glucose.** Glucose molecules are then absorbed from the small intestine into the blood stream. Once in the blood stream, glucose is transported into cells with the help of **insulin**. Insulin is a small **protein hormone** that regulates the amount of glucose in the blood by stimulating cells to transport glucose in from the blood stream. Once in our cells, glucose can be broken down for energy. In addition to alpha-amylase, other digestive enzymes that are responsible for making glucose available to cells for energy include sucrase and lactase. Sucrase (also known as invertase) digests sucrose (*table sugar*; also found in foods containing high fructose corn syrup) to glucose plus fructose, and lactase digests lactose (*milk sugar*) to glucose plus galactose. Also, some foods contain glucose without enzyme digestion.

Starch is broken down to glucose in two stages, each requiring specific enzymes that act upon different portions of the molecule. Due to the size of the starch molecule and the specificity of the enzymes, starchy foods can take longer to digest than foods containing a predominance of mono- or di-saccharides (such as foods containing high fructose corn syrup). Foods that are digested more slowly release glucose into the blood stream more slowly.

Most **fiber** is also a polysaccharide and a natural polymer of glucose. **Fiber** is plant matter such as cellulose that cannot be broken down by human digestive enzymes, though bacteria in the human digestive tract can digest some types of fiber. Fiber is important to the diet because the roughage aids in digestion, and a high fiber meal can provide a feeling of fullness without adding calories. Fiber also slows down the rate of sugar absorption by the body.

Nordqvist, C. (2013, November 4). "What is fiber? What is dietary fiber? Fiber rich foods." *Medical News Today*. Retrieved from http://www.medicalnewstoday.com/articles/146935.

Materials

Materials	Quantity
8.5 x 11 inch sheet of paper	1 per student
Scissors	1 per student
Tape	1 per group
Colored pencils in turquoise and brown to represent Diastix colors	1 per group
Student Resource: *Lesson 2 Student Lab Instructions* (can be re-used)	2 per group (in sleeves)
Student Sheet 2: *Is there glucose in milk?*	1 per student
Consumable materials for the class (enough for 8 lab groups)	
2 Diastix strips for the class demonstration	1 per class
100 ml 1.0 % glucose solution (1 g glucose / 100 ml H_2O)	1 per class
30 ml regular milk (non-fat, 1%, 2% or whole)	1 per class
30 ml chocolate milk	1 per class
30 ml lactose-free milk	1 per class
30 ml 1% sucrose solution (1 g sucrose / 100 ml H_2O)	1 per class
12 ml sucrase (aka invertase) enzyme solution, 1:10 dilution	1 per class
12 ml lactase enzyme solution (1 tablet diluted to 12 mls with H_2O)	1 per class
Lab Materials for each group	
9 x 1.5 ml microfuge tubes:	per group
3 tubes with 1 ml (20 drops) of regular milk in each	
3 tubes with 1 ml (20 drops) of chocolate milk in each	
3 tubes with 1 ml (20 drops) of lactose-free milk in each	
1 x 1.5 ml microfuge tube filled with water	1 per group
1 x 1.5 ml microfuge tube filled with sucrase enzyme solution	1 per group
1 x 1.5 ml microfuge tube filled with lactase enzyme solution	1 per group
9 Diastix glucose test strips	per group
3 x 2 ml plastic transfer pipettes	per group
Diastix container *or* glucose concentration color chart printed in color	1 per group
32^oC water bath with microfuge tube floats (optional)	1 per group

Lesson Preparation

- Diastix reagent strips can be purchased from any drugstore. Amazon.com carries containers of 100 strips for $14.00 (as of January, 2014)
- Sucrase is also known as invertase. It can be ordered from a biological supply house in powder form. You may also find it in shops that specialize in cake decoration.
- Lactase tablets can be found over the counter in most drugstores
- Lactose-free milk can be found in the dairy case at grocery stores. One brand name is Lactaid.

Presenting the Lesson

Point out for students some of the questions generated in the previous lesson that had to do with glucose and how elevated glucose levels play an important role in type 2 diabetes. Where does the glucose in our body come from? Tell students that today's lesson asks, *"Where is glucose found in food?"* and involves a lab activity in which students look for glucose and other sugars in three kinds of milk (regular milk, chocolate milk and lactose-free milk). First, students are going to create a paper model of simple and complex sugars.

Procedures

Part 1 (Engage): Modelling Carbohydrates (*15-30 minutes*)

If students do not have any background with macromolecules and/or enzymes, teachers may choose to spend an entire class on this pencil and paper activity before beginning the lab.

1. Hand out a blank 8.5 x 11 inch piece of paper to each student.
2. Have students fold the paper down about an inch along the short side. "Accordion" the paper by folding it back and forth to the end (Figure 1).
3. Once flat, have students cut the paper into squares (Figure 2).
4. Lastly, have students snip the corners off the top and bottom of each square to create connected *6-sided* shapes to represent single-ring sugars such as glucose (Figure 3). ***Be careful*** to leave the midsection intact.

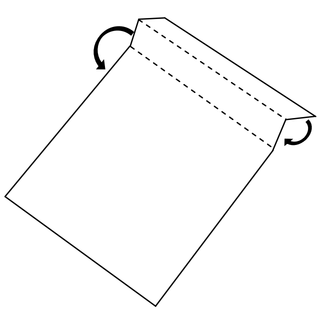


Figure 1

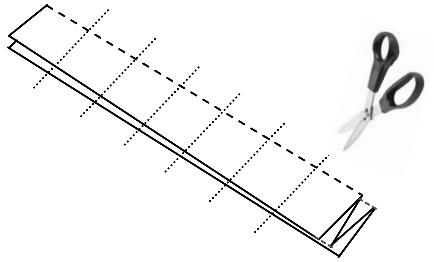


Figure 2

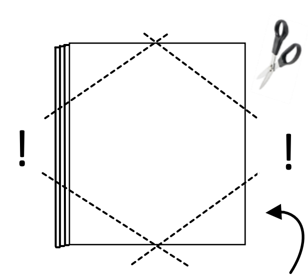


Figure 3

5. Have students unfold their paper models into chains. Tell students that these chains represent ***carbohydrates*** in the form of ***polysaccharides*** (poly = many; saccharide = sugar)**.**

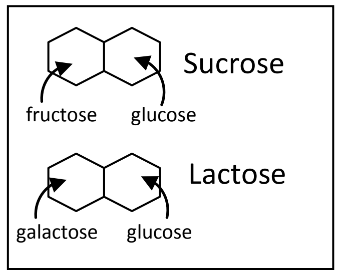
6. Ask each student to take *one* of his or her chains and cut or tear it into individual hexagons. Tell students that each hexagonal piece they just cut represents a single sugar, or ***monosaccharide,*** (mono = one) when detached from the chain. Explain that ***glucose*** is a monosaccharide.

7. Have students label a few monosaccharide pieces as glucose. Students can tape these in their notebooks, if desired.

8. Tell students that *all food* eventually must be digested or converted to ***glucose*** in order for the body to gain energy from the food through the process of cellular respiration. This lab will look at sugars found in a common food—milk—but doesn't address the conversion of proteins and fats into glucose.

9. Ask students to break another chain into groups of two hexagons. Each of these represents a ***disaccharide*** (di = two). ***Sucrose*** (table sugar) and ***lactose*** (the sugar found in milk) are both disaccharides.

10. Have students label a few disaccharides sucrose and lactose.



11. Not all single ring sugars are glucose, however. Sucrose is made of two monosaccharides, ***fructose*** and ***glucose.*** Students can turn over their labeled sucrose molecule and label one monosaccharide as fructose and the other as glucose.

12. Likewise, lactose is made up of the monosaccharides ***galactose*** and ***glucose***. Have students turn over their labeled sucrose molecule and label one monosaccharide as galactose and the other as glucose.

13. Explain that in the body ***enzymes*** are the "molecular scissors" that break the sugars apart. Enzymes often end with the suffix *–ase* and are often named after the molecule they act upon. Ask students to name the enzymes that split sucrose and lactose in to monosaccharides. (***sucrase*** and ***lactase***)

14. Have students tape the remaining chains of sugar together to make longer chains. Encourage them to join chains with other individuals or groups to make both straight chains and branched chains.

15. Choose one group of students to make colored lines using a marker between the glucose molecules of one of the larger chains. (This will represent fiber.)

16. Show students some of the longer, more complex polysaccharide chains. These represent large carbohydrates such as starch and cellulose. The chains without colored lines represent starches in our diets found in foods such as corn, rice, wheat, and potatoes. These can be made up of hundreds or even thousands of individual glucose units, which eventually get broken down through the action of enzymes into glucose.

17. The chains with colored lines between glucose units represent dietary ***fiber***. Fiber is plant matter such as cellulose that cannot be broken down by human digestive enzymes—we don't have the molecular scissors to cut the colored bond—though bacteria in the human digestive tract can digest some types of fiber. Fiber is important to the diet because the roughage aids in digestion, and a high fiber meal can provide a feeling of fullness without adding calories. Fiber also slows down the rate of sugar absorption by the body.

18. Tell students that we will be working with glucose, sucrose and lactose in the upcoming lab, as well as the enzymes that break the disaccharides into monosaccharides. Instruct students to keep their paper models, but put them away.

Part 2 (Explore): Testing glucose with Diastix Demonstration (*5 minutes*)

19. Show students the Diastix container and explain that the Diastix are testing strips used to detect glucose in urine. Explain that type 2 diabetes is the result of chronic high blood sugar, and excess sugar is excreted through the urine. The presence of sugar in the urine has been an indicator for diabetes for thousands of years, long before there was any treatment for the condition.

20. Demonstrate the use of the Diastix by dipping one stick in water, and one stick in the 1.0% glucose solution, and comparing the stick with the scale on the Diastix container shown below. Show students how the color corresponds to the glucose concentration, as measured in mg/dL.

Food or Drink	**Glucose?** *Yes **or** No*	**Diastix: Color***	**Diastix Container: Glucose concentration**
Water	***No***		***0%; 0 mg/dL***
1.0% glucose	***Yes***		***1%; 1,000 mg/dL***

Part 3 (Explore): Testing Milk Types with Diastix *(40 minutes)*

21. With students in lab groups, pass out Student Sheet 2: *Is there glucose in milk?* to each student. Make sure that student groups have access to *Lesson Two Lab Instructions*, which can be put in plastic sleeves and re-used with multiple classes.

Throughout the curriculum, ***Student Sheets*** are designed to be written on by students and should be copied one per student. ***Student Resources*** are informational and can be reused with groups of students.

22. Using the labels from the milk containers (or the Nutrition Fact labels from the lab sheet) have students look for any sugars listed on the labels. Have students write this in the appropriate column in Table 1.
23. Have students follow the procedures found on Student Resource: *Lesson Two Lab Instructions*. Students should record their results on Student Sheet 2 as they proceed.
24. When students have finished the lab, have groups report out on the types of sugar(s) found in each type of milk, using the Diastix results as evidence.

Closure (Elaborate and Evaluate): (*10 minutes*)

25. Return to the paper models students made at the beginning of the class. Using the models, have students explain what they did during the lab to a neighbor, using the correct vocabulary (glucose, lactose, sucrose, monosaccharide, disaccharide, enzyme, lactase, sucrase).
26. Once students have practiced explaining the lab to a neighbor, you may wish to have them glue the paper models and record the steps and in their notebooks for assessment.
27. Using the large, branched carbohydrate chains, make sure that students understand that glucose molecules are the building blocks of carbohydrates such as the starch in corn, potatoes, rice and wheat. These large carbohydrates get broken down into glucose in a number of stages, also involving specific enzymes.
28. Show students the fiber molecule again. It is also a large carbohydrate built of glucose molecules, but the bonds between glucose molecules in fiber are different than those found in starch. Humans do not have the specific enzymes to break the bonds between glucose units that occur in fiber.

Note: Even though humans do not have the needed enzymes to digest fiber, bacteria which live in our guts do. When bacteria digest fiber using their own enzymes, we gain some nutritional benefit. We also end up with the gas the bacteria produce.

29. Ask students:
    "If you needed quick energy during a soccer game, what sort of food would be best?"

Students might say that foods with simple sugars will provide quicker energy since they are more easily broken down or converted into glucose. Foods like fruit (with the monosaccharides fructose), milk, soda or candy can increase blood glucose relatively quickly.

"If you eat an early breakfast, what sort of food might keep you satisfied until lunch?"

Students might say that foods containing starches such as potatoes or rice will take longer to break down than foods containing mono- and disaccharides, supplying you with a steadier supply of glucose throughout the morning. They may also say that food containing fiber will be broken down more slowly. Students may mention non-carbohydrates, such as fat and proteins, which add to a feeling of fullness. Fats and proteins will be addressed in the next lesson.

"Why is fiber important to a diet?"

Fiber adds to a feeling of "fullness" after a meal, but does not add calories. It also slows down the rate of sugar absorption by the body.

30. Ask students if this lesson has helped them answer any part of the driving question: ***How can the growth of type 2 diabetes in the Yakima Valley be slowed?,*** and check the Question Wall to see if any questions have been answered by today's lesson. Ask students if they have any new questions to add to the wall.

31. Remind students of the *Call to Action* product and have them write down any ideas they might have about incorporating concepts from this lesson into a final project. Lab-oriented students may be interested in exploring the extensions below.

Extensions

This lesson lends itself to numerous extensions and further study, such as exploring the following ideas and lab resources:

- Having students bring in their own liquids to test, such as soda or fruit juice.
- Having students compare sugars and rates of digestion for different types of sugars. For example, fructose is often marketed as a "healthy" or "natural" sugar found in fruit juices. How does fructose compare to high fructose corn syrup found in many sodas?
- Using yeast to detect the presence or absence of certain sugars; if yeast can metabolize the sugar, CO_2 will be produced and can be measured.
- Detecting Sugar: An Everyday Problem When Facing Diabetes. http://www.scienceinschool.org/print/597
- How Sweet It Is! Measuring Glucose in Your Food. http://www.sciencebuddies.org/science-fair-projects/project_ideas/FoodSci_p049.shtml

- Sucrose & Glucose & Fructose, Oh My! Uncovering Hidden Sugar in Your Food. http://www.sciencebuddies.org/science-fair-projects/project_ideas/HumBio_p035.shtml

Preparing for Lesson Three
Lesson Three requires having a selection of food labels on hand for students to use. Ask students to bring in food labels from home, or prepare to provide the labels for them. Food labels can also be found online at Super Tracker (https://www.supertracker.usda.gov/default.aspx).

Glossary
Carbohydrate: Types of sugar, starch, and cellulose that are made of carbon, hydrogen and oxygen, usually in a ratio of 1:2:1

Disaccharide: di- (two) + saccharide (sugar). A sugar composed of two single sugars (monosaccharides). Examples are sucrose, lactose and maltose.

Dietary Fiber: A carbohydrate found in plant matter (such as cellulose) that cannot be broken down by human digestive enzymes. Fiber can be soluble and insoluble in water, and is sometimes referred to as roughage.

Enzyme: A biological molecule (a protein) that speeds up the rate of a chemical reaction.

Fructose: A simple, single-ringed sugar found in many plants that often bonds with glucose to make up the two-ringed sugar sucrose (table sugar).

Galactose: A simple, single-ringed sugar often found bonded with glucose to make up the two-ringed sugar lactose, found in milk.

Glucose: A simple, single-ring sugar that is the main source of energy for living organisms through the process of cellular respiration. It also is the building block of many carbohydrates.

Lactose: A two-ringed (disaccharide) sugar made of glucose + galactose sugars. It is the major sugar in milk. It can be broken down by the enzyme lactase.

Monosaccharide: mono- (one) + saccharide (sugar). A simple, one-ring sugar such as glucose or fructose. Monosaccharides are the building blocks of more complex sugars.

Polysaccharide: poly- (many) + saccharide (sugar). A carbohydrate made by repeating units; a complex sugar made of a chain of monosaccharides joined together by bonds.

Starch: A carbohydrate made of many glucose units joined together.

Sucrose: A two-ringed sugar (disaccharide) that is made up of glucose + fructose. It is used widely as a sweetener and made from sugar beets and sugar cane. It can be broken down by the enzyme sucrase.

POSSIBLE ANSWERS

Student Sheet 2: *Where is glucose found in milk?*

1. Fill in the sugars listed on the food labels, if any, for each type of milk on Table 1.

Table 1 – Types of sugars

Sample	Type of sugar(s) Listed on Label	Do you think the Diastix strip will turn a color with no enzyme? Why or why not?
Milk (regular)	Sugars in Nutritional Facts section, but none under ingredients	***Predictions will vary***
Chocolate Milk	Sugar (sucrose) Sugars	
Lactose-free milk	Sugars in Nutritional Facts section, but none under ingredients	

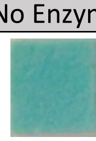
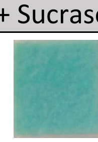
2. Proceed with the lab, as instructed on *Lesson Two Student Lab Instructions*. After completing the first part of the lab (mixing the milk and enzymes), make predictions about which solutions will test positive for glucose after incubation. If you think the solution will test positive, darken the corresponding rectangle on Table 2.

Table 2 – Prediction

Sample	No Enzyme	+ Sucrase	+ Lactase
Milk (regular)	***Predictions will vary***		
Chocolate Milk			
Lactose-free milk			

3. Complete the lab and record your results on Table 3. Using the Diastix results as evidence, record which types of sugar(s) were present in each milk.

Table 3 – Results

Sample	**Diastix Color / Glucose Concentration**			**Sugar(s) Present**
	No Enzyme	+ Sucrase	+ Lactase	
Milk (regular)				Lactose
Chocolate Milk				Sucrose and Lactose
Lactose-free milk				Glucose

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Answer the following questions:

1. How did your results compare to your prediction?
   Answers will vary.

2. Which solutions contained glucose before adding either of the two enzymes?
   Only lactose-free milk.

3. What is glucose?
   Glucose is a monosaccharide (simple, single-ring sugar). It is the only type of sugar the body can digest for energy.

4. Do you have to eat pure glucose to raise glucose levels in your blood? Why or why not?
   No. Glucose is the building block of sugars and carbohydrates such as starch. Since starches are made of hundreds or thousands of glucose units, eating these will release glucose into the blood after the starch has been broken down with enzymes.

5. What are examples of other carbohydrates you could eat? Are they all sweet?
   Any kind of sugar (such as sucrose or fructose) or starch such as rice, potatoes, corn or wheat. Not all food that contain glucose taste sweet.

6. Based on your experimental results and the sugars listed the food labels, are there any surprises or unexpected differences (e.g., lactose is milk sugar, but is lactose listed on the food label for milk)? If so, please explain.
   One thing that is very misleading about the labeling of sugar within product ingredients labels is how to determine the type of "sugar" that is contained within a product. For example, some sodas that have "sugar" listed in the ingredients contain sucrose, but for others contain high fructose corn syrup. Therefore, it can be difficult to predict the outcome of glucose testing before and after enzyme treatment. Note, this may raise some very interesting questions by students, and may trigger some potentially interesting and rewarding class discussions. In addition, the marketing of sugar in foods may interest some students for their "call to action" products.

Name: ______________________________________ **Date:** ___________ **Period:** _____

Student Sheet 2: *Is there glucose in milk?*

1. Fill in the sugars listed on the food labels, if any, for each type of milk on Table 1.

Table 1 – Types of sugars

Sample	Type of sugar(s) Listed on Label	Do you think the Diastix strip will turn a dark with no enzyme? Why or why not?
Milk (regular)		
Chocolate Milk		
Lactose-free milk		

2. Proceed with the lab, as instructed on *Lesson Two Student Lab Instructions*. After completing the first part of the lab (mixing the milk and enzymes), make predictions about which solutions will test positive for glucose after incubation. If you think the solution will test positive, darken the corresponding rectangle on Table 2.

Table 2 – Prediction

Sample	No Enzyme	+ Sucrase	+ Lactase
Milk (regular)			
Chocolate Milk			
Lactose-free milk			

3. Complete the lab and record your results on Table 3. Using the Diastix results as evidence, record which types of sugar(s) were present in each milk.

Table 3 – Results

Sample	**Diastix Color / Glucose Concentration**			**Sugar(s) Present**
	No Enzyme	+ Sucrase	+ Lactase	
Milk (regular)				
Chocolate Milk				
Lactose-free milk				

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Answer the following questions:

1. How did your results compare to your prediction?

2. Which solutions contained glucose before adding either of the two enzymes?

3. What is glucose?

4. Do you have to eat pure glucose to raise glucose levels in your blood? Why or why not?

5. What are examples of other carbohydrates you could eat? Are they all sweet?

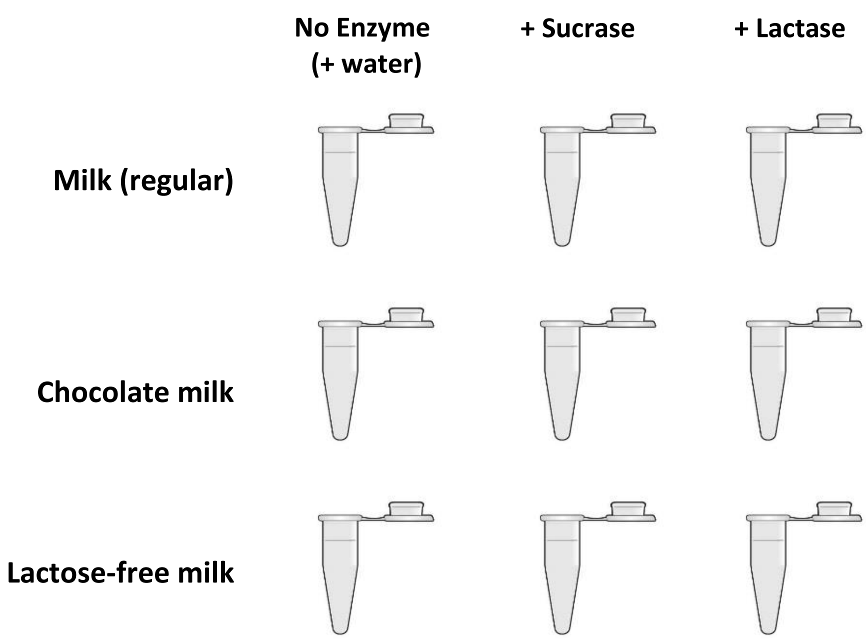
6. Based on your experimental results and the sugars listed on the food labels, are there any surprises or unexpected differences (e.g., lactose is milk sugar, but is lactose listed on the food label for milk)? If so, please explain.

Lesson Two Student Lab Instructions

Testing foods with Diastix before and after enzyme digestion

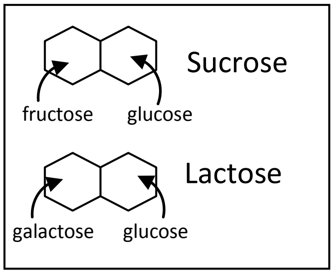
Materials for each group
9 x 1.5 ml microfuge tubes:
3 tubes with 1 ml (20 drops) of regular milk in each
3 tubes with 1 ml (20 drops) of chocolate milk in each
3 tubes with 1 ml (20 drops) of lactose-free milk in each
1 x 1.5 ml microfuge tube filled with water
1 x 1.5 ml microfuge tube filled with sucrase enzyme solution
1 x 1.5 ml microfuge tube filled with lactase enzyme solution
9 Diastix glucose test strips
3 x 2 ml plastic transfer pipettes
Diastix container *or* glucose concentration color chart printed in color
32^{o}C water bath with microfuge tube floats

1. As shown in diagram below, transfer 1 ml (20 drops) of milk, chocolate milk, and your assigned solution into three separate microfuge tubes. Make sure to label your tubes.



2. For each of the solutions (using a different transfer pipette for each enzyme):
   - Add **10 drops of water (*no enzyme*)** to the first set of tubes (***left***)
   - Add **10 drops of sucrase** enzyme solution to the second set of tubes (***center***)
   - Add **10 drops of lactase** enzyme solution to the third set of tubes (***right***)

3. Mix samples by closing lids, and inverting the tubes several times.
4. Incubate samples for **15-20 minutes** at **32^{o}C (*sucrase samples*)** and **room temperature (*lactase samples*)**.
5. While samples are incubating, use Table 2 on Student Sheet 2 to make predictions about the outcome.



Remember, *sucrose* (table sugar) is made up of one fructose and one glucose molecule.

Lactose (milk sugar) is made up of one galactose and one glucose molecule.

6. After incubation, test each of the samples with a Diastix by dipping the Diastix into the sample and removing immediately. Place the Diastix on a paper towel, and wait 30 seconds before recording the color change in the results table on Student Sheet 2.
7. In addition, check the food labels for each sample, and list all sugars present in each sample in the far-right column labeled "Sugars listed on food label."
8. After obtaining your results, prepare to share your results with the rest of the class.

1% HALF GALLON LABEL

Nutrition Facts
Serving Size 1 cup (240mL)
Servings Per Container about 8

Amount Per Serving	
Calories 110	Fat Cal 20
	% Daily Values
Total Fat 2.5g	4%
Saturated Fat 1.5g	8%
rans Fat 0g	
Cholesterol 15mg	5%
Sodium 130mg	5%
Potassium 410mg	12%
Total Carbohydrates 13g	4%
Dietary Fiber 0g	0%
Sugars 12g	
Protein 9g	
Vitamin A 10% •	Vitamin C 0%
Calcium 35% •	Iron 0%
Vitamin D 25%	

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

INGREDIENTS: LOWFAT MILK, VITAMIN A PALMITATE, VITAMIN D3.

A GLUTEN FREE PRODUCT.

CHOC CARTON - Regular

Nutrition Facts
Serving Size 1 cup (240mL)
Servings Per Container about 4

Amount Per Serving	
Calories 190	Fat Cal 25
	% Daily Values
Total Fat 2.5g	4%
Saturated Fat 1.5g	9%
Trans Fat 0g	
Cholesterol 15mg	4%
Sodium 230mg	10%
Potassium 460mg	13%
Total Carbohydrates 31g	10%
Dietary Fiber 1g	3%
Sugars 29g	
Protein 10g	
Vitamin A 10% •	Vitamin C 0%
Calcium 35% •	Iron 4%
Vitamin D 25%	

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

INGREDIENTS: LOWFAT MILK, SUGAR, NONFAT MILK, COCOA PROCESSED WITH ALKALI, SALT, CARRAGEENAN, VANILLIN, VITAMIN A PALMITATE, VITAMIN D3.

A GLUTEN FREE PRODUCT

LACTOSE FREE - 1%

Nutrition Facts
Serving Size 1 cup (240ml)
Servings Per Container 8

Amount Per Serving	
Calories 110	Calories from Fat 20
	% Daily Value*
Total Fat 2.5g	**4%**
Saturated Fat 1.5g	**8%**
Trans Fat 0g	
Cholesterol 15mg	**5%**
Sodium 130mg	**5%**
Potassium 410mg	**12%**
Total Carbohydrate 13g	**4%**
Dietary Fiber 0g	**0%**
Sugars 12g	
Protein 9g	
Vitamin A 10% •	Vitamin C 0%
Calcium 30% •	Iron 0%
Vitamin D 25%	

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

		Calories: 2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

INGREDIENTS: LOWFAT MILK, VITAMIN A PALMITATE, VITAMIN D3, LACTASE ENZYME*.

*NOT FOUND IN REGULAR MILK.

*Half Gallon

According to FDA regulations:

Sugar (singular) listed in the INGREDIENTS specifically refers to sucrose.

Sugars (plural) listed in the Nutrition Facts section are the total amounts of *any* type of sugar present.