

WHAT IS LURKING IN YOUR **FAST FOOD?**



TGR FOUNDATION



MIDDLE
SCHOOL

LESSON OVERVIEW

Since its beginnings in the 1920's, Americans have depended on the fast food industry for quick, tasty and inexpensive meals. How often do you consume fast food on an average week? The U.S. Centers for Disease Control and Prevention's National Center for Health Statistics reported in a 2011–2012 study that nearly a third of children and adolescents are eating fast food on a given day.

The consumption of fast food has been linked to weight gain and the percentage of children with obesity in the United States has more than tripled since the 1970s. Today, about one in five school-aged children (ages 6–19) suffers from obesity. Fast food has been associated with higher caloric intake and poorer diet quality in children and adolescents. Why is this? What is lurking in fast food that may contribute to this increase in childhood obesity?

In this lesson students will synthesize information on the building blocks of life—carbohydrates, lipids and proteins—by conducting a series of chemical tests to determine which major biomolecules are found in common foods. After they have determined the nutrients that are in common foods, they will research and analyze the nutritional content of popular fast foods. Students will summarize the different types of essential nutrients that organisms need to support growth, form new molecules and release energy and the links that the overconsumption of biomolecules may have with the increase in obesity and other health conditions in children and adolescents.

THIS LESSON FOCUSES ON

ENGINEERING DESIGN CYCLE	21ST CENTURY SKILLS
<ul style="list-style-type: none"> <input type="radio"/> Defining the Problem <input type="radio"/> Designing Solutions <input type="radio"/> Creating or Prototyping <input type="radio"/> Refine or Improve <input type="radio"/> Communicating Results 	<ul style="list-style-type: none"> <input type="radio"/> Collaboration <input type="radio"/> Communication <input type="radio"/> Critical Thinking <input type="radio"/> Creativity

OBJECTIVES

Students will be able to:

- Analyze** various food items that may be found in fast food using chemical tests to discover which of the major biomolecules they contain.
- Examine** the link between fast food consumption, obesity and other health conditions.
- Propose** solutions for healthier fast food choices.

MATERIALS

- Teacher Resource Macromolecules Testing Station Signs
- Biuret reagent
- Benedict's reagent
- Iodine
- Water
- Glucose tablet
- Cooking oil
- Albumin
- Cornstarch
- Brown paper bag cut into 2-inch squares
- Hot plate
- Test tube holder
- Test tube clamp
- Pipettes
- Glass beaker
- Timer
- Thermometer
- Waste container

Each Lab Group Will Need

- Test tubes—2 per food sample that is being tested. Please note: number of test tubes needed may differ based on the size and layout of your classroom.
- 100 mL graduated cylinder
- Fast Food Nutrition Facts student handout
- Class Data Table for Biomolecules Testing Lab student capture sheet
- Macromolecules in our Body student capture sheet
- Analyzing Fast Food student capture sheet

HAVE YOU EVER WONDERED...

What is your food made up of?

You know that the food you eat is broken down in your digestive system, but broken down into what? Your food is made up of important and essential biomolecules such as proteins, carbohydrates and lipids (fats). Living things need these biomolecules to support growth, form new molecules and release energy.

How can eating too much fast food affect your body and health?

Fast foods typically contain a high number of calories and don't have as much nutritional value as other foods. A calorie is a unit of energy supplied by food and beverages, and if your body does not use calories, they are stored as fat. Having too much stored fat can lead to weight gain and health problems such as Type 2 diabetes and heart disease.

MAKE CONNECTIONS!

This section captures how this activity connects to different parts of our lives and frames the reason for learning.

HOW DOES THIS CONNECT TO STUDENTS?	HOW DOES THIS CONNECT TO CAREERS?	HOW DOES THIS CONNECT TO OUR WORLD?
<p>Nearly one-third of children and adolescents are consuming fast food on the average day. With its low cost and good taste, fast food is a popular choice for students at mealtime. This lesson will help students understand that many of the foods that fast food restaurants serve are high in fat, sugar and calories. They will learn that consuming excess calories leads to weight gain, and that there are healthier choices they can make at popular fast food restaurants by examining the nutritional content of foods on these menus.</p>	<p>Nutritionists study how diet affects a person's metabolism and the association between diet, disease and health. They provide health advice and promote healthy eating by advising about special diets and educating health professionals and the public about nutrition.</p> <p>Chemists that specialize in food are responsible for studying the various effects of processing and preserving food. They may test samples of food and beverage to ensure that laws regulating food are followed and check ingredients used in food for safety.</p> <p>Food Scientists study the elements and nutritional value of food. They may ensure that food processing centers meet health guidelines, or they may do research to improve a food's taste while adding to its health benefits.</p> <p>Marketing that is focused on the food industry aims to develop strategies that will persuade consumers to buy specific food products through the creation of marketing campaigns, conducting research and analyzing data about consumer preferences, and devising and presenting sales strategies to food companies.</p>	<p>The consumption of fast food has been recognized as a contributing factor to the rise in obesity rates. Obesity can lead to health problems such as Type 2 diabetes and heart disease. It is important that students understand that maintaining a healthy weight can lead to a longer, healthier life; and that they can and need to make healthy choices even when eating fast food.</p>

BLUEPRINT FOR DISCOVERY

WHOLE GROUP (15–20 min):

1. Go to www.polleverywhere.com or Google Forms (forms.google.com) and create a survey for students that includes the following questions:
 - a. How often do you eat fast food?
 - b. What do you typically order?
 - c. Why do you eat fast food?
2. Share your survey with your students and have them respond using a device (laptop, cell phone, iPad, etc.). Share the responses with students. Note: If students do not have devices or access to technology, record their responses on the board or chart paper.
3. Ask students if they have ever heard that fast food might not be a healthy nutritional choice for them, or that they should limit how much fast food they eat. Why do they think this is? What is lurking in their fast food?
4. Have students get into small groups (2–3 students) and ask them to do some research (5 min) to determine why limiting fast food consumption is important—how can fast food be detrimental to a person's health? Have students record their answers informally on paper or their device. They can use their own devices, computers, or any means necessary to find their information. Remind students that they should confirm they are using credible sources.
5. Have student groups choose a representative to verbally share their findings about fast food with the class. Findings might include:
 - a. Heavily processed
 - b. High in calories
 - c. High in fat/sugar content
 - d. Large portion sizes
 - e. Linked to obesity and other health problems
6. Explain to students that food, and all living things, are made up of biomolecules. Today's lesson will focus on three of the major groups of biomolecules: carbohydrates, lipids and proteins. (Nucleic acids are the fourth group, but will not be a part of this lesson.) These biomolecules can be taken in and broken down by our bodies to release energy. They can then be rearranged and re-built in different ways to create other molecules our bodies need. This is why they are often referred to as the "building blocks" of life. (An analogy that can be used for this is LEGO bricks or building blocks. The individual bricks/blocks can be made into one thing—a castle or a spaceship—and then can be broken down and used to create something different—a pirate ship or a house.)
7. Tell students that for the next part of the lesson they are going to be using chemical tests to determine which of the biomolecules are present in various foods and ingredients found in fast food. The chemicals that they will be using in their tests are called indicators. Indicators show a color change when a particular molecule is present. This is called a positive test, while a negative test would show no color change.

- Group Member 3: Protein—they will perform the Biuret solution test.
 - Group Member 4: Lipid—they will perform the brown paper bag test or Sudan IV.
5. Assign groups different food items to test. They should record their results on the Class Data Table for Biomolecules Testing Lab student capture sheet. Students will later share out their data as a class.
 6. Direct students to add 50 mL of the assigned substance into each of the four test tubes. Alternatively, reaction plates can be used in place of test tubes, to reduce the amount of substance and indicator needed, as well as being able to test more substances simultaneously.
 7. Each group member should bring their test tubes in the rack to their assigned station (no more than 2 teams should be at any one station at a time). Direct students to follow the directions at the station to complete their test. When students have finished their test, they will follow the clean-up procedures listed.
 - Dump any remaining liquid from the beakers into a "Waste" container.
 - Rinse the test tubes thoroughly with water. They do not need to use soap.
 - Bring the rack with the clean test tubes to their lab table.
 8. Students should share the results of their test with their group and record the results on the Class Data Table for Biomolecules Testing Lab student capture sheet.

Teachers should follow instructions on Material Safety Data Sheets (MSDS) for first aid measures and disposal of chemicals. Students should be aware of the hot plate. They should be sure to use the test tube holder when taking their tube in and out of the hot water. The glass will be hot and they should allow the test tube to cool before rinsing it out in the sink under cold water.

If lab materials are not available, teachers may have students complete a virtual lab using the following link:

<http://www.occc.edu/biologylabs/Documents/Organic%20Compounds/Organic%20Compounds.htm>

WHOLE GROUP (10 min):

1. Have students share the results of their tests with the class. Data for each food tested should be added to each group's data sheet and/or a class results sheet by the teacher. Ask students to compare their predictions to the results of each test. Were any of them surprising?
2. Guide students to use the Macromolecules in our Body student capture sheet to research how our body use fats, proteins and sugars and where they go in our body once consumed. Also have students make a connection to how the excess consumption of fats, proteins and sugar may directly or indirectly lead to diseases in the body.
3. Next, ask students to review a nutrition fact label to identify where the macromolecules they investigated are displayed. Ask students:
 - Which nutrients on the label should be limited?
 - Which nutrients should be prioritized?Students should use evidence from their lab investigation and Macromolecules in our Body student capture sheet to support their answer.
4. Explain to students that many of the foods they were testing are high in calories. A calorie is unit of energy supplied by food and beverages, and if your body does not use calories, they are stored as fat. Ask students if they know about how many calories the average person should consume per day and have them share their ideas.
5. Tell students that biomolecules contain different amounts of calories. Carbohydrates (like starch and sugars) contain 4 calories per gram. Proteins also contain 4 calories per gram. Fats contain 9 calories per gram—more than twice that for proteins and carbohydrates.
6. Discuss the average number of calories and types of nutrients the average person should consume daily using the information in Fast Facts. Display these facts on the overhead projector, or record them on a board or chart paper so the students can reference them while they are completing the next activity.

FAST FACTS

Everybody's caloric intake is different depending on their height, weight, gender and activity level. However, on a daily basis the average person should be consuming:

- 2,000 calories
- 65g of fat
- 300mg of cholesterol
- 2400mg of sodium
- 300g of carbohydrates

Fast food meals are often very high in calories, fat, cholesterol and sodium.

7. How do we know how many calories are in the fast food we eat? Many fast food restaurants have begun posting the number of calories in items on their menu and websites. Note: Below is a short video you may want to show students (if you have time) to give them additional background information before they begin the individual activity:
[Tech Insider: How many calories are in fast food?](#)
8. Explain to students that they will apply what they learned about macromolecules to nutritional information in fast food by analyzing nutrition facts that are posted online. Distribute the Analyzing Fast Food student capture sheet and Fast Food Nutrition Facts student handout for students to record their work. Invite students to summarize their research using the questions below.

Note to Teacher:

There are plenty of popular fast food nutrition facts available on the Fast Food Nutrition Facts Website (www.fastfoodnutrition.org), but many more are available on the internet. If time and access permits, allow students to go to the website of their favorite fast food restaurant and search the nutrition facts of their favorite meal.

Summary Questions:

- Is it necessary to stop eating fast food altogether?
- Is it possible to eat healthy at fast food restaurants? If so, how?
- When do you find yourself eating fast food?

TAKE ACTION!

EXTENSION ACTIVITY #1

- Break students into small groups and ask them to create a poster that includes tips and suggestions for ordering healthy options at fast food restaurants. They should also include an example of a healthy meal. As a resource, students can go to the restaurants' websites to discover healthy menu items and nutrition information. Ask the groups to share their posters. Hang the posters around the classroom for others to see. Challenge the students to practice healthy ordering and eating even when they are eating fast food.

If students have access to 1-to-1 technology, they can create an infographic in place of a poster. Below are links to websites that students can use to make their infographic. (Both of these also have an app if students are using iPads.)

- <https://www.canva.com/create/infographics/>
- <https://piktochart.com/>

Alternatively, ask students to look at similar foods from different companies, comparing the nutrition facts labels, selecting the healthiest option and justifying their choice. For example, students could look at different bread types (white vs. whole-grain), snacks (candy, chips, fruit, etc.), drinks (Starbucks coffee, tea, soda, etc.) and select the best option for each. This would give them the opportunity to apply their skills to make informed food choices.

Note to Teachers: The next extension activity works best with older students.

EXTENSION ACTIVITY #2

1. Ask students to take inventory of the number of fast food restaurants in their neighborhood. You may want to use the internet to help guide your findings by using site locators and your zip code, or take class time to walk around a local neighborhood.
2. Have students record the following information while conducting their inventory:
 - Names of fast food restaurants
 - Number of each type of fast food restaurant
 - Location in neighborhood (it may be helpful to draw a quick sketch of their neighborhood and chart the locations of the fast food restaurants)
3. After students have investigated fast food restaurants, ask them to take inventory of healthy restaurants or fast food restaurants that have a healthy menu option. Students will be recording the same information they did above.
 - Names of health/healthy options restaurants
 - Number of each type of fast food restaurants
 - Location in neighborhood (it may be helpful to draw a quick sketch of their neighborhood and chart the locations of the health/healthy option restaurants)
4. Once students have completed their research on both fast food and health/healthy option restaurants, bring the class together to discuss the following:
 - How many fast food restaurants did you find?
 - How many health/healthy option restaurants did you find?
 - Why do you think our neighborhood has that amount of different types of restaurants?
 - Do you think every neighborhood in the U.S. has the same amount of fast food or healthy restaurants? Why? Why Not?

Note to Teachers: You may want to encourage students to research if other neighborhoods around the country share similar findings.

EXTENSION ACTIVITY #3

1. Have the class research a list of healthy grocery store options in their neighborhood.
 - Nationwide examples: Trader Joe's, Whole Foods, Fresh and Easy, Harris Teeter, Hannaford, Publix, Pathmark and certified Farmer's Markets.
 - Have students record the following information while conducting their inventory:
 - Names of healthy grocery store/market options*
 - Number of each type of grocery store/market
 - Location in neighborhood (it may be helpful to draw a quick sketch of their neighborhood and chart the locations of the fast food restaurants)
2. After students have finished gathering their data, bring the class together and lead a discussion using the following prompts:
 - Do your parents shop at any of these stores? Why or why not?
 - Would you like to shop at any of these stores? Why or why not?
 - What would prevent you from shopping at these stores? What would encourage you to shop at these stores?
 - What are the benefits of shopping at these types of stores?
 - Can you find the same items at a national chain supermarket? What are some of the differences? What are some similarities?

**If the research proves that there are no healthy options for shopping in your neighborhood, this might be a good idea for an Action for Advocacy Project. You could also encourage students to write letters to companies explaining their findings.*

NATIONAL STANDARDS

Next Generation Science Standards

MIDDLE SCHOOL

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
<p>Developing and Using Models</p> <p>Develop a model to describe unobservable mechanisms.</p>	<p>LS1.C: Organization for Matter and Energy Flow in Organisms</p> <p>Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy.</p>	<p>Energy and Matter</p> <p>Matter is conserved because atoms are conserved in physical and chemical processes.</p>

RECOMMENDED LINKS

<https://www.cdc.gov/healthyweight/calories/index.html>

<http://www.npr.org/sections/thesalt/2015/09/17/440951329/about-a-third-of-u-s-kids-and-teens-ate-fast-food-today>

<https://www.cdc.gov/nchs/data/databriefs/db213.htm>

<http://americanhistory.si.edu/food/new-and-improved/drive-thru>

<https://www.hhs.gov/fitness/resource-center/facts-and-statistics/index.html>

<https://blog.centerforinnovation.mayo.edu/2016/04/07/fast-food-nation-around-the-world/>

CLASS DATA TABLE FOR BIOMOLECULES TESTING LAB

Indicator References:

Indicators are chemicals that react or change color in the presence of another compound.

Macromolecule	Indicator Solution	Negative Control	Positive Control
Glucose	Benedict's		
Complex carbohydrate	Iodine		
Protein	Biuret		
Lipid	Sudan IV		

Data Table

Substance Being Tested	Prediction		Protein Test		Complex Carbohydrate Test		Simple Carbohydrate Test		Lipid Test	
	Which macromolecule(s) will this substance have?		Biuret test color	+/-	Iodine test color	+/-	Benedict's Solution color	+/-	Bag test results or Sudan IV color	+/-

CLASS DATA TABLE FOR BIOMOLECULES TESTING LAB

Indicator References:

Indicators are chemicals that react or change color in the presence of another compound.

Macromolecule	Where are they found in the body?	How does our body use them?
Protein		
Lipid		
Sugar		
Carbohydrate		

Eating foods that are high in protein, fat or sugar can be harmful to our body when consumed in excess and can even lead to disease. Read through the following diseases and identify the macromolecule(s) that would most likely be responsible.

Disease	Macromolecule(s) consumed in excess that may directly or indirectly lead to this disease
Lactose intolerance: lacking the lactase enzyme which degrades lactose (glucose + galactose) in the small intestines.	
Diabetes: high fat and cholesterol levels can cause cells to lose their ability to respond to insulin.	
Kidney disease: high levels of protein can make your kidneys work too hard leading to a decline in their function.	
Cancer: high-sugar diets can lead to obesity which may indirectly increase your cancer risk over time.	
Cardiovascular disease: the buildup of fat in blood vessels can lead to a heart attack, chest pain, or stroke.	

ANALYZING FAST FOOD

Introduction

Mmmmm...fast food; so delicious, but do you really know what you are putting into your body when you eat a cheeseburger and french fries? Do you ever feel lazy and bloated after a fast food meal? Fast food is very cheap, convenient and tasty, but the food is loaded with empty calories, fat, sodium and sugar —nutrients that can alter mood and cause stomach pains if eaten in excess. The following activity will help show you what is lurking in your favorite fast food meals!

Finding out the Facts

Using the nutrition facts or the internet, record the amount of calories, fat, sodium and sugars from each of your food items in the data table below.

ANALYSIS

Food Item	Calories	Total Fat (g)	Sodium (mg)	Sugar (g)
Total:				

1. What do you think about the amount of calories, fat, sodium and sugar in your fast food meal?

2. Look at the total amounts of calories, fat, sodium and sugar in your meal. How do these numbers compare to the recommended daily amounts for the average person?

FAST FOOD NUTRITION FACTS

LARGE HAMBURGER

Calories 540
 Total Fat 29g
 Sodium 1040mg
 Sugar 9g

SMALL CHEESEBURGER

Calories 300
 Total Fat 12g
 Sodium 750mg
 Sugar 6g

LARGE CHEESEBURGER

Calories 400
 Total Fat 23g
 Sodium 1150mg
 Sugar 7g

SMALL FRENCH FRIES

Calories 250
 Total Fat 13g
 Sodium 140mg
 Sugar 0g

MEDIUM FRENCH FRIES

Calories 380
 Total Fat 20g
 Sodium 220mg
 Sugar 0g

LARGE FRENCH FRIES

Calories 570
 Total Fat 30g
 Sodium 330mg
 Sugar 0g

CHICKEN SANDWICH

Calories 500
 Total Fat 17g
 Sodium 1150mg
 Sugar 10g

GRILLED CHICKEN SANDWICH

Calories 420
 Total Fat 10g
 Sodium 1190mg
 Sugar 11g

CHICKEN NUGGETS (4PCS)

Calories 170
 Total Fat 10g
 Sodium 450mg
 Sugar 0g

FISH SANDWICH

Calories 380
 Total Fat 18g
 Sodium 660mg
 Sugar 5g

CHICKEN SALAD W/ DRESSING

Calories 320
 Total Fat 9g
 Sodium 970mg
 Sugar 11g

WATER

Calories 0
 Total Fat 0g
 Sodium 0mg
 Sugar 0g

REGULAR ICED TEA

Calories 0
 Total Fat 0g
 Sodium 15mg
 Sugar 0g

SMALL SODA

Calories 150
 Total Fat 0g
 Sodium 10mg
 Sugar 40g

MEDIUM SODA

Calories 210
 Total Fat 0g
 Sodium 15mg
 Sugar 58g

LARGE SODA

Calories 310
 Total Fat 0g
 Sodium 20mg
 Sugar 86g

HARD TACO

Calories 170
 Total Fat 10g
 Sodium 350mg
 Sugar 1g

SOFT CHICKEN TACO

Calories 270
 Total Fat 14g
 Sodium 820mg
 Sugar 3g

LARGE BURRITO

Calories 390
 Total Fat 13g
 Sodium 1360mg
 Sugar 5g

BEAN & CHEESE BURRITO

Calories 470
 Total Fat 20g
 Sodium 1400mg
 Sugar 5g

MEDIUM SHAKE

Calories 550
 Total Fat 13g
 Sodium 190mg
 Sugar 72g

ICE CREAM

Calories 330
 Total Fat 10g
 Sodium 180mg
 Sugar 48g

BAKED APPLE PIE

Calories 270
 Total Fat 12g
 Sodium 190mg
 Sugar 14g

COOKIE

Calories 160
 Total Fat 7g
 Sodium 90mg
 Sugar 15g

FRUIT YOGURT

Calories 130
 Total Fat 2g
 Sodium 55mg
 Sugar 19g

NACHOS

Calories 330
 Total Fat 21g
 Sodium 530mg
 Sugar 3g

TEACHER RESOURCE MACROMOLECULES TESTING STATION SIGNS

Please note: Lab results may vary based shelf life of materials, size of lab equipment, sample size and environment. Please ensure all labs are tested prior to performing with students.

PROTEINS

Your muscles are mostly made of this molecule. Proteins are important for many things in our bodies including transporting molecules and helping chemical reactions happen.

INDICATOR

Biuret solution is used to identify the presence of proteins. Biuret solution is a blue solution that will react with proteins to make a purple color.

DIRECTIONS:

1. Add 20 drops of Biuret solution to a test tube.
2. Check for any color change and record data.

GLUCOSE

All living things (that we know of so far) use glucose as their primary food source. It's the simplest type of sugar.

INDICATOR

Benedict's solution is used to test for glucose. It is a clear blue solution that will react with glucose to make an orange color depending on how much sugar is present.

DIRECTIONS:

1. Add 20 drops of Benedict's solution into the test tube with your sample.
2. Place the sample and control test tubes in a hot water bath.
3. Check for any color change and record data.

Safety Note: Be aware of the hot plate. Utilize the test tube holder when taking the tube in and out of the hot water. The glass will be hot and the test tube should be allowed to cool before rinsing it out in the sink under cold water.

STARCH

Starch is one way living things store glucose for use later on. A long string of glucose molecules makes a starch molecule. It's the main ingredient in potatoes, wheat, corn and other grains.

INDICATOR

Iodine is a yellow-brown solution that will react with starch to make a purple, black color.

DIRECTIONS:

1. Add 5 drops of Iodine solution to the test tube.
2. Check for any color change and record data.

LIPIDS

Lipids include fats, oils, some hormones and waxes. They have many jobs in living things such as long-term energy storage and insulation. They are found in large amounts in plant oils, butter, and nuts.

INDICATOR

The Brown paper test is the simplest way to test for the presence of lipids—just think of the grease stains on the bag you get french fries in!

Sudan IV is a clear or weak reddish-orange chemical that will turn a dark reddish-orange in the presence of lipids

DIRECTIONS:

Paper Bag Test

1. Use a dropper or pipette to add three drops of the food sample on a piece of brown paper bag.
2. Check for any grease stains.

Please note: The visible indicator of a lipid may vary based on the food product. Some may need a longer wait time. Label your samples and check back later to see if any results have updated.

OR

Sudan IV Test

3. Add 20 drops of Sudan IV to your test tube.
4. Check for any color change and record data.