



# *Good Eats*

INTEGRATED  
CURRICULUM UNIT  
ON NUTRITION  
AND HEALTH

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## **Idaho**

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## **Illinois**

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Dunbar Career Academy (Chicago)  
New Millennium School of Health (Chicago)

## **Indiana**

Owen Valley High School (Spencer)

## **Minnesota**

John Marshall High School (Rochester)

## **New York**

Gorton High School Academy of Medical Professions (Yonkers)

## **South Carolina**

Beaufort High School (Beaufort)

## **Texas**

Ben Barber Career and Technology Academy (Mansfield)

## **Utah**

Northridge High School (Layton)

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# Good Eats

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### National Healthcare Foundation Standards that apply to this unit include:

- Academic Foundations
- Communications
- Health Maintenance Practices
- Information Technology Applications
- Teamwork





# Good Eats

## UNIT OVERVIEW

### **Essential Question for This Unit**

Should we care about what we eat? Why?

### **Unit Summary**

In this unit, students will learn about the connection between nutrition and health. Through interdisciplinary study in Biology, Health Science, Interpersonal Relations, English Language Arts, Mathematics, and World History, they will explore the questions of why we should care about what we eat and how food is produced. Students will explore concepts ranging from the body's physical requirements in terms of calories and nutrients to the physiological and psychological outcomes resulting from various levels of nutrition and health. They will be introduced to cellular respiration, recombinant DNA technology, and ethical issues raised by using—or withholding the use of—biotechnology to increase food production.

The students will examine the issue of adequate nutrition at both the individual and societal levels, reflecting on their own diet and health status and the importance of making good choices. They will also analyze issues connecting nutrition and food production to the welfare of the global community—by exploring the impact of recent famines in Africa—and apply this research to decisions about their own roles.

In this year-long curriculum unit, classroom work and homework include:

- A long-term experiment with laboratory animals on the physiological and behavioral effects of varying caloric intake; work will include setting up and conducting the experiment and collecting, graphing, and analyzing experimental data. (Biology and Statistics)
- A biometrics lab to analyze body types and fitness, including assignments on calculating basal metabolic rates (BMR) and body mass index (BMI) scores. (Biology, Algebra I, and Statistics)
- Collaborative research on nutrition issues in a global context, including examining the historical and contemporary effects of large-scale famines and agricultural innovations (from artificial selec-

tion to genetic engineering) on health and nutrition status and population parameters. (English Language Arts and World History)

In addition to laboratory work and cooperative group learning, this unit will also include direct instruction and classroom discussion. In the Health Science course, students will explore many of the key questions addressed in their academic courses. The Health Science course and academic courses will introduce students to a wide range of careers in the health and biomedical sciences. This will be accomplished through classroom instruction; presentations by nutrition scientists, demographers, and science writers; and work-based learning activities.

Throughout the instructional period, students will reflect on their findings and synthesize their acquired knowledge. At various points, they will present conclusions to their peers and to biomedical and healthcare professionals who will visit their school. Students will demonstrate both their academic and technical learning in a variety of ways, including expository essays, PowerPoint presentations, collages, speeches, and other written and applied work.

### **Culminating Event**

Working in teams, students will participate in a culminating activity that will serve as a multi-disciplinary, performance-based assessment. Possible culminating activities include conducting a session of the United Nations General Assembly, requesting foundation funding for research on a nutrition-related intervention in a Third World country, or launching a healthy-nutrition campaign at a high school.

### **Key Questions/Issues**

- What is “good” nutrition and why is it important? (Biology, English Language Arts, and Interpersonal Relations)
- What is a healthy weight and how is it measured? (Biology and Algebra I)
- Are there statistical differences in weight (and other health indicators) among different populations around the world? What factors might

contribute to those differences? How have perspectives on desirable body weight and size changed over the course of history, and why? (Statistics, Biology, and World History)

- What are the physical, behavioral, and psychological effects of a healthy diet and a “junk food” diet on humans and other animals (such as laboratory rats)? (Biology and Algebra I)
- How is research on laboratory animals used to inform our understanding of human nutrition and health? What are the issues/limitations of using small mammals to model human biochemical responses and how can they be addressed? What are the ethical issues involved in conducting research on animals? (Biology and Algebra I)
- Is good nutrition solely a personal issue, or do we have a larger obligation to the community? To the world? (English Language Arts and Interpersonal Relations)
- How has historical food production in different regions shaped the world we live in today? How has scientific research influenced production capacity, and what are the costs and benefits of such advances? (World History and Biology)

### ***Learning Scenario to Kick Off the Unit***

News of state funding for the new football stadium made the front page of the newspaper today. Owen Valley High School would finally have the new facility everyone had been waiting for. Students, teachers, and members of the community should have been happy, but controversy broke out almost immediately. The President of Crispy Munchy Snacks announced

that he would pay for new uniforms for the football team—and all other school sports—for the next 5 years in exchange for naming rights to the new stadium. The school district really needs these funds and would be pleased to name the new facility for a major corporate donor. But there is a catch. To receive this money for uniforms, the high school will have to sell Crispy Munchy potato chips and other snacks at all sporting events and in school vending machines. This will create a problem. Last year, the school district removed Crispy Munchy products, other fried snacks, and sweetened beverages from the campus as part of a Healthy Nutrition Campaign. What should be done? School leaders have decided to leave the decision about accepting the donation, using the Crispy Munchy name, and continuing or modifying the Nutrition Campaign up to a vote by students.

### ***Biomedical/Healthcare and Education Partner Roles***

In addition to the professional partnerships listed in the unit you should also include as resource speaker or culminating event participant:

- Genetic Counselor
- Diabetic Counselor
- Registered Dietician
- Nutritionist
- Respiratory Therapist
- Polysomographer (performs sleep studies)
- Athletic Trainer



### SUBUNITS AND MAJOR TOPICS (ACROSS ACADEMIC AND TECHNICAL SUBJECT AREAS)

<b>Subunit 1</b> <i>Nutrition and You</i>	<b>Subunit 2</b> <i>Nutrition and Society</i>	<b>Subunit 3</b> <i>Nutrition in the World</i>
ALGEBRA I · BIOLOGY · CHEMISTRY · ENGLISH LANGUAGE ARTS · STATISTICS · HEALTH SCIENCE	ENGLISH LANGUAGE ARTS · HEALTH SCIENCE · SPANISH I · INTERPERSONAL RELATIONS · U.S. GOVERNMENT	ALGEBRA I · BIOLOGY · ENGLISH LANGUAGE ARTS · WORLD HISTORY · GEOGRAPHY
<ul style="list-style-type: none"> <li>• Function and processes of the digestive system</li> <li>• Composition and role of biological macromolecules in nutrition</li> <li>• Biochemical metabolism</li> <li>• Single-variable linear equations</li> <li>• Nonlinear relationships</li> <li>• Descriptive statistics (mean, median, and mode)</li> <li>• Scientific writing</li> <li>• Line graphs</li> </ul>	<ul style="list-style-type: none"> <li>• Healthy eating habits</li> <li>• Human development and puberty</li> <li>• Factors influencing self-image</li> <li>• Cultural perspectives on nutrition</li> <li>• Food production and distribution in the United States</li> <li>• Oral presentation skills</li> </ul>	<ul style="list-style-type: none"> <li>• Perspectives on hunger from various countries</li> <li>• Genetic engineering in agriculture</li> <li>• Multiple causes of hunger and famine throughout the world</li> <li>• Exponential functions</li> </ul>



# Nutrition and You

## SUBUNIT 1 OVERVIEW

### Essential Question for This Unit

Should we care about what we eat? Why?

### Subunit Goals

Subunit 1 provides the basis for understanding the effects of diet on individuals. Students learn that food provides three major nutrients as well as vitamins and minerals that are necessary for survival. They explore how the body breaks down biological macromolecules into components that can be used as the building blocks for growth. Students also learn about the consequences of an unhealthy diet through both research on obesity and observing experimental animals. Students take biometric measures of their own health and learn how to closely analyze their food intake.

### Subunit Key Questions

- What biological macromolecules are found in foods? How are they used by the human body? (Biology, Chemistry)
- What is “good” nutrition and why is it important? (Biology, Health Science)
- What are the potential consequences of an unhealthy diet? (Biology, English Language Arts, Health Science)
- What is a healthy weight and how can it be measured? (Algebra I)
- How can caloric intake and expenditure be tracked and analyzed for health purposes? (Algebra I, Statistics)

### Lesson Summaries

Lesson	Subject	Description
1.1	Biology, Chemistry, or Health Science	<b>Food Fundamentals</b> Students test a variety of foods for the presence of the three major biological macromolecules and learn their roles in human nutrition and health.
1.2	Biology, Chemistry, or Health Science	<b>Nutrition and Growth</b> Students observe and interpret a simulation of nutrients traveling through the digestive system to understand how macromolecules are broken down into component parts and rebuilt in cells. Students also track and analyze their own diets.
1.3	Health Science	<b>Obesity: An Expanding Problem</b> Students study the causes and health consequences of obesity in the United States.
1.4	Algebra I or Statistics	<b>Biometrics Lab</b> Students assess their current health status by taking a variety of biometric measures of themselves and their classmates and interpreting the results.
1.5	Biology and Statistics	<b>Effects of Diet on Rat Weight and Activity Lab</b> Students conduct a month-long experiment with laboratory rats to determine the effects of various types of diet.
1.6	English Language Arts	<b>Writing a Lab Report</b> Students practice scientific/technical writing using the laboratory report associated with their rat investigation.
1.7	Algebra I	<b>Am I Gaining or Losing Weight?</b> Students use graphs to analyze their intake and expenditure of calories.



Subunit 1—Nutrition and You

# Food Fundamentals

## LESSON 1.1

### BIOLOGY, CHEMISTRY, OR HEALTH SCIENCE

#### Time

120 minutes

#### Materials

##### Equipment

- Small test tubes
- Test tube rack
- Test tube brush
- Masking tape
- Markers
- Medicine droppers
- Hot plates
- 250 ml beakers
- Indicators
  - #1—Sudan IV
  - #2—Biuret reagent
  - #3—Iodine
  - #4—Benedict's reagent
- Distilled water
- Safety goggles
- Food solutions A–I
  - A. Apple juice
  - B. Butter
  - C. Cooking oil
  - D. Diet soda (colorless)
  - E. Egg white
  - F. Flour
  - G. Green beans
  - H. Ham
  - I. Ice cream (vanilla)

#### Resources

- Food Fundamentals Lab worksheet
- Organic Compounds in Foods worksheet
- What's in Food, What's in People? worksheet

### Essential Question for This Unit

Should we care about what we eat? Why?

### Objectives

After completing this lesson, students should be able to

- Identify the three major biological macromolecules present in food: carbohydrates, lipids, and proteins.
- Identify the smaller organic molecules that make up macromolecules.

### Lesson Activities

#### Teacher Preparation for Food Fundamentals Lab

Purchase and prepare the nine food solutions. Apple juice, cooking oil, diet soda, and raw egg white can be used as they are, but you may choose to dilute them slightly with water to stretch your supplies and to make handling them in the medicine droppers easier. Be sure you purchase a colorless diet soda so students will be able to observe the color of the indicator. Butter and ice cream should be melted prior to the lab. Have a hot water bath prepared in case the butter solidifies during the class. Prepare a flour solution by mixing flour with a small amount of water. Green beans and ham will need to be pureed with a small amount of water. These can be purchased pre-pureed as baby food, but be sure that no additives (like sugar) are included among the ingredients.

Check to make sure you have enough lab supplies for each lab group. Each station requires 10 small test tubes, 10 medicine droppers or disposable pipettes, a hot plate, test tube tongs, and a 250 ml beaker. Indicators and food solutions can be placed at each lab table or in a central station.

#### Lesson Springboard

Discuss the statement “You are what you eat.” What do students think this statement means? Is it literal, or metaphorical? Tell students that they will learn all about the foods they eat over the next several days.

#### Lesson Development

##### Lab Activity

Divide students into groups of two or four. Pass out Food Fundamentals Lab worksheet and read the introduction as a class. In this lab, students will be testing a variety of common foods for the presence of macromolecules.

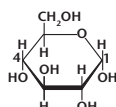


**Class Discussion**

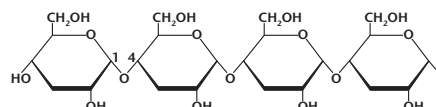
After students complete the lab, pass out the Organic Compounds in Foods worksheet. You may wish to have students complete this worksheet for **homework**. After students have completed the worksheet, discuss the characteristics of the three primary nutrients and their corresponding indicators. You may wish to include some background information on the chemical structure of the nutrients.

**Carbohydrates**

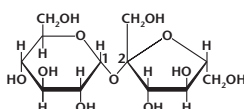
Carbohydrates are molecules made up of carbon (C), hydrogen (H), and oxygen (O) in a ratio of 1:2:1 (for example, the chemical formula for glucose is  $C_6H_{12}O_6$ ). Carbohydrates may be monosaccharides, or simple sugars, such as glucose or fructose; they may be disaccharides, paired monosaccharides, such as sucrose; or they may be polysaccharides, where three or more monosaccharides form chains, such as starch, glycogen, or cellulose.



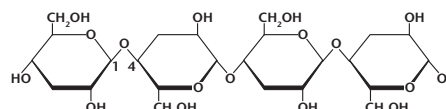
Glucose



Starch: 1 – 4 linkage of alpha glucose monomers



Sucrose



Cellulose: 1 – 4 linkage of beta glucose monomers

When Benedict's reagent is heated with a reactive sugar, such as glucose or maltose, the color of the reagent changes (depending on the amount of sugar present) from blue to green to yellow to reddish orange. Orange and red indicate the highest proportion of these sugars. (Benedict's test will show a positive reaction for starch only if the starch has been broken down into maltose or glucose units by excessive heating.)

Staining by iodine (iodine-potassium iodide,  $I_2KI$ ) distinguishes starch from monosaccharides and disaccharides (as well as other polysaccharides). The basis for this test is that starch is a coiled polymer of glucose and that iodine interacts with these coiled molecules and becomes bluish black. Iodine does not react with carbohydrates that are not coiled and remains yellowish brown. Therefore, a bluish-black color is a positive test for starch, and a yellowish-brown color (i.e., no color change) is a negative test for starch. It should be noted that glycogen, a common polysaccharide in animals, has a slightly different structure than does starch and produces only an intermediate color reaction.

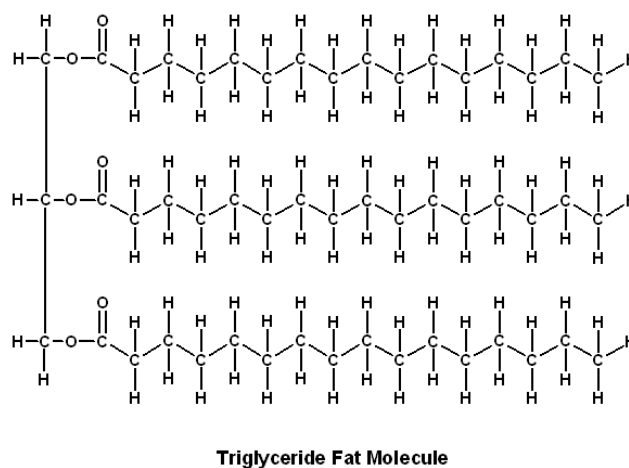
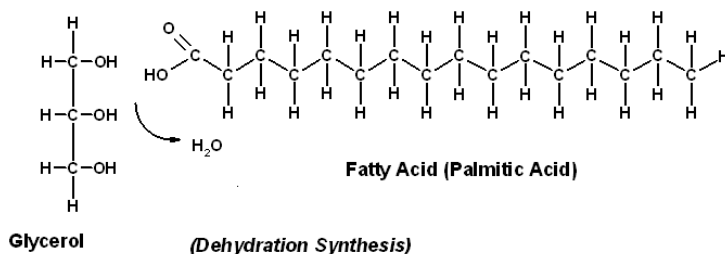
**Lipids**

Lipids are a group of molecules including fats and oils, waxes, phospholipids, steroids (like cholesterol), and some other related compounds. All lipids are hydrophobic (water-hating). Fats and oils are made from two kinds

Subunit 1—Nutrition and You  
**Food Fundamentals**

LESSON 1.1

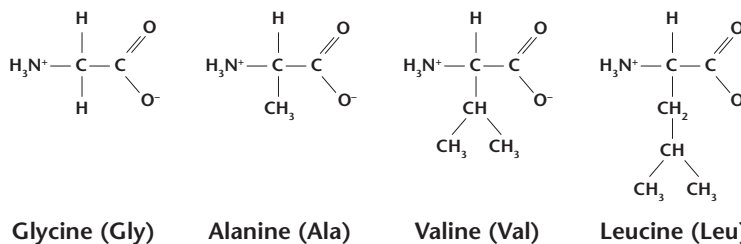
of molecules: *glycerol* (a type of alcohol with a hydroxyl group on each of its three carbons) and *three fatty acids* joined by dehydration synthesis. Since there are three fatty acids attached, these are known as *triglycerides*.



The Sudan IV test is a useful laboratory test for fats. If fats or oils are present, these will appear as floating red droplets or as a floating red layer colored by Sudan IV.

**Proteins**

Proteins are remarkably versatile structural molecules found in all life forms. Proteins are composed of amino acids, each of which has an amino group (NH<sub>3</sub><sup>+</sup>) and a carboxyl group (-COOH).

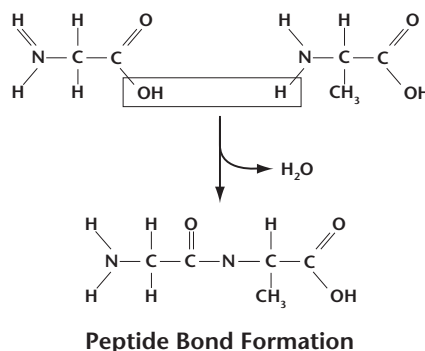


The amino group on one amino acid is linked to the carboxyl group on an adjacent amino acid by a peptide bond. The peptide bond forms through dehydration synthesis. This bond is the site of action for the Biuret test for protein.

Subunit 1—Nutrition and You  
*Food Fundamentals*

LESSON 1.1

The Biuret reagent is light blue, but in the presence of proteins it turns violet; the intensity of color relates to the number of peptide bonds that react. Long-chain polypeptides (proteins) have many peptide bonds and produce the most positive reaction. Free amino acids and very short chains may result in a pinkish color.



**Lesson Closure**

Collect all worksheets for grading. Wrap-up the lesson by asking students to consider how the nutrients they've observed in their food are represented in their bodies. Would they be different in any way if they were eating different foods? Pass out the What's in Food, What's in People? worksheet. Have students analyze the composition of food versus the composition of humans. This worksheet may be completed for **homework**.

**Possible Prior Misconceptions**

Any or all fat is undesirable in a healthy diet—some students may believe that all fat should be eliminated from a healthy diet. In fact, fat serves important functions in a healthy diet.

Foods low in fat are automatically lower in calories or “healthier”—it is true that fat has more calories per gram than carbohydrates or protein, foods can be high in calories regardless of their fat content.

Eliminating fat (or carbohydrates) from the diet is an appropriate way to reduce caloric intake—Some students may believe a diet that eliminates intake of certain nutrients is a healthy way to reduce calories and/or lose weight (e.g., Atkins low-carbohydrate diet). While this may result in a short-term decrease, a diet that includes a healthy decrease in calories should still meet daily nutritional requirements, which include carbohydrates and fats.

**Student Assessment Artifacts**

- Completed Food Fundamentals Lab worksheet
- Completed Organic Compounds in Food worksheet
- Completed What's in Food, What's in People? worksheet

### ***Variations and Extensions***

If time allows, an engaging introduction for this subunit is to show the documentary, *Super Size Me* (Morgan Spurlock 2004), about obesity and fast food in America. There has been subsequent controversy surrounding the methods used by Morgan Spurlock in conducting his experiment, primarily concerning the rigor of his methods, e.g., a careful record of food intake was not made, a systematic rotation through the menu was not done, food selections were biased toward the unhealthiest items for dramatic effect, etc. Discussing the principles of conducting a scientific experiment would be appropriate here. The issue of food choices can be revisited during Subunit 2, Nutrition and Society.

Journal entries: After the lab activity, students may reflect on the foods that they eat—Do they think they have a healthy diet? And if they do not, what might they do to improve their eating habits?

This project can be extended to include more than 3 days. If time allows, you may ask students to collect food intake data while following their Ideal Menus, and then record or reflect on how learning about nutrition may influence their diet.

In addition to considering nutrient information, students might also investigate the Recommended Daily Allowance (RDA) for various vitamins and minerals and compare how their diet aligns with these values.

## **National and State Academic Standards**

### **NATIONAL NRC National Science Education Standards**

#### ***The Cell***

Most cell functions involve chemical reactions. Food molecules taken into cells react to provide the chemical constituents needed to synthesize other molecules. Both breakdown and synthesis are made possible by a large set of protein catalysts, called enzymes. The breakdown of some of the food molecules enables the cell to store energy in specific chemicals that are used to carry out the many functions of the cell.

#### ***Matter, Energy, and Organization in Living Systems***

The chemical bonds of food molecules contain energy. Energy is released when the bonds of food molecules are broken and new compounds with lower energy bonds are formed. Cells usually store this energy temporarily in phosphate bonds of a small high-energy compound called ATP.

### **CALIFORNIA Science Content Standards**

#### ***Biology***

- 1g. Students know most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors.
- 9a. Students know how the complementary activity of major body systems provides cells with oxygen and nutrients and removes toxic waste products such as carbon dioxide.

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## Food Fundamentals Lab

### Introduction

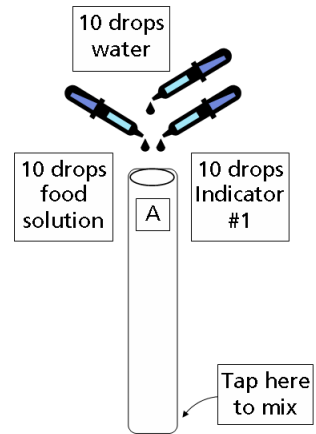
The foods we eat contain important organic compounds that our bodies use as nutrients. Among other things, nutrients provide our bodies with the energy they need to live. Scientists can use a series of chemical tests to determine which compounds are present in different foods. In today’s lab, you will use four indicator solutions to identify the major biological molecules (macromolecules) that are present in food. As the name suggests, indicators are solutions that *indicate* when a specific substance is present by changing color.

### Materials

- 10 small test tubes
  - Test tube rack
  - Test tube brush
  - Masking tape
  - Marker
  - 10 medicine droppers
  - Hot plate
  - 250 ml beaker
  - Indicators #1–4
  - Distilled water
  - Safety goggles
- Food solutions A–I
  - A. Apple juice
  - B. Butter
  - C. Cooking oil
  - D. Diet soda (colorless)
  - E. Egg white
  - F. Flour
  - G. Green beans
  - H. Ham
  - I. Ice cream (vanilla)

### Procedure for Indicator #1 (Sudan IV)

1. Put 10 test tubes in your test-tube rack. Label each test tube by putting masking tape near the top edge of the test tube. Use a marker to write the letter from one of the nine food substances on each label. Mark the tenth label W for water. The water is your control.
2. Use a clean medicine dropper to put 10 drops of each food solution into the appropriate test tube.
3. Add 10 drops of distilled water to each test tube.
4. Add 10 drops of Indicator #1 to each test tube.
5. Mix the solution and indicator together by holding the top of the test tube with one hand and quickly tapping the lower half of the test tube with your other hand.
6. Observe the test tubes using white paper as background. Record the color of each reaction in the data table.
7. Empty and clean the test tubes.



### Observations for Indicator #1

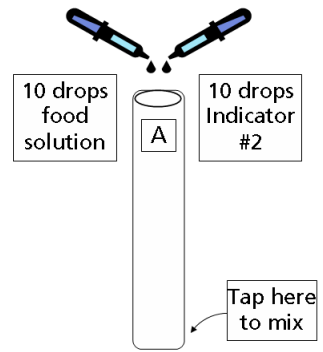
	A	B	C	D	E	F	G	H	I	W
	Apple juice	Butter	Cooking oil	Diet soda	Egg white	Flour	Green beans	Ham	Ice cream	Water
<b>Color of reaction</b>										



Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

**Procedure for Indicator #2 (Biuet)**

8. Use a clean medicine dropper to put 10 drops of each food solution into the appropriate test tube.
9. Add 10 drops of Indicator #2 to each test tube. CAUTION: Indicator #2 can burn your skin. Wash off spills and splashes immediately with plenty of water while calling to your teacher.
10. Mix the solution and indicator together by holding the top of the test tube with one hand and quickly tapping the lower half of the test tube with your other hand.
11. Observe the test tubes using white paper as background. Record the color of each reaction in the data table.
12. Empty and clean the test tubes.

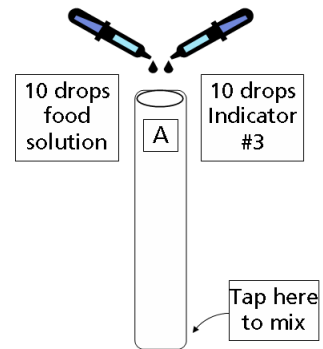


**Observations for Indicator #2**

	A	B	C	D	E	F	G	H	I	W
	Apple juice	Butter	Cooking oil	Diet soda	Egg white	Flour	Green beans	Ham	Ice cream	Water
<b>Color of reaction</b>										

**Procedure for Indicator #3 (Iodine)**

13. Use a clean medicine dropper to put 10 drops of each food solution into the appropriate test tube.
14. Add 10 drops of Indicator #3 to each test tube.
15. Mix the solution and indicator together by holding the top of the test tube with one hand and quickly tapping the lower half of the test tube with your other hand.
16. Observe the test tubes using white paper as background. Record the color of each reaction in the data table.
17. Empty and clean the test tubes.



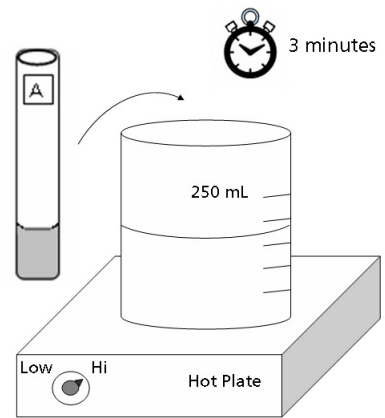
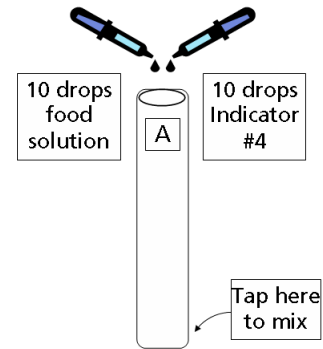
**Observations for Indicator #3**

	A	B	C	D	E	F	G	H	I	W
	Apple juice	Butter	Cooking oil	Diet soda	Egg white	Flour	Green beans	Ham	Ice cream	Water
<b>Color of reaction</b>										

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

**Procedure for Indicator #4 (Benedict)**

18. Fill a 250 ml beaker with 150 ml of water.
19. Place beaker on hot plate and heat water to a low boil.
20. Use a clean medicine dropper to put 10 drops of each food solution into the appropriate test tube.
21. Add 10 drops of Indicator #4 to each test tube. CAUTION: Indicator #4 is poisonous. Do not get any in your mouth!
22. Mix the solution and indicator together by holding the top of the test tube with one hand and quickly tapping the lower half of the test tube with your other hand.
23. Heat the test tubes in the boiling water bath for 3 minutes. You may heat multiple test tubes in the bath at the same time. CAUTION: The test tubes will get very hot. Use a test tube holder or other protective gear when removing the test tubes from the boiling water bath.
24. Observe the test tubes using white paper as background. Record the color of each reaction in the data table.
25. Empty and clean the test tubes.



**Observations for Indicator #4**

	A	B	C	D	E	F	G	H	I	W
	Apple juice	Butter	Cooking oil	Diet soda	Egg white	Flour	Green beans	Ham	Ice cream	Water
<b>Color of reaction</b>										

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

**Results**

The table below shows the original color of each indicator and the color change that indicates a positive result.

Indicator Solution	Original Color	Color Change with Positive Test
1	Dark reddish brown	Red
2	Blue	Pink to purple
3	Yellowish brown	Bluish black
4	Blue	Yellowish orange

Record whether the test was positive (+) or negative (–) for each indicator/food combination.

	A	B	C	D	E	F	G	H	I	W
Indicator	Apple juice	Butter	Cooking oil	Diet soda	Egg white	Flour	Green beans	Ham	Ice cream	Water
1										
2										
3										
4										

Based on your results, what do you think each indicator tests for?

Indicator 1? \_\_\_\_\_

Indicator 2? \_\_\_\_\_

Indicator 3? \_\_\_\_\_

Indicator 4? \_\_\_\_\_

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## Organic Compounds in Food

Different foods react in different ways to different indicators because they consist of different types of molecules. All foods that have a positive reaction with same indicator have something in common chemically. As it turns out, there are three types of biological macromolecules in food: carbohydrates, lipids, and proteins. They are called macromolecules because each macromolecule is made up of smaller organic molecules. Biological macromolecules provide us with the energy and cellular building blocks necessary for life. The chemical tests you conducted in the Food Fundamentals Lab detect these different macromolecules.

Read the information about each of three types of biological macromolecules and identify which foods tested positive for that indicator.

### CARBOHYDRATES

The body uses carbohydrates as “fast fuel.” It is the first macromolecule used to obtain energy for the body because very little energy is required to break down carbohydrates. Carbohydrates found in food come in two varieties: simple and complex. Typical simple carbohydrates you may have heard of are sucrose (table sugar), glucose, and fructose. These sugars can link together, like cars of a train, to form complex carbohydrates. For example, starch is formed from hundreds or thousands of glucose molecules linked together. Together, simple sugars and the larger complex molecules (like starch) constitute the group known as carbohydrates.

#### Benedict’s Reagent (Used as indicator #4)

Sugars are small carbohydrate molecules manufactured in the chloroplasts of plants and used as a source of energy by all organisms. There are many kinds of carbohydrate molecules, all of which are made up of various arrangements of carbon, hydrogen, and oxygen atoms. The simplest carbohydrates are *monosaccharides*, or simple sugars, such as glucose and fructose. *Disaccharides* consist of two bonded monosaccharides. Examples of disaccharides include lactose, the sugar contained in milk; maltose, used in brewing; and sucrose, common table sugar. Benedict’s Reagent binds with monosaccharides and disaccharides and produces a *yellowish-orange color*. Benedict’s Reagent does *not* test for polysaccharides.

Foods that contained sugars:

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#### Iodine (Used as indicator #3)

Organisms store simple sugars in the form of large macromolecules comprised of hundreds or thousands of linked monosaccharides. Some of these *polysaccharides* are broken down as needed for energy. Other polysaccharides serve a structural function (the most abundant organic compound on earth is cellulose, a polysaccharide that is the main component in plant cell walls). Plants store sugars for later energy needs in the form of a polysaccharide called *starch*. In this exercise, you will use the iodine test to detect the presence of starch. Starch interacts with iodine to produce a *bluish-black color* (a yellowish-brown color indicates that no starch is present).

Foods that contained complex carbohydrates:

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Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

**LIPIDS**

The body stores lipids as reserve energy. Lipids are harder to break down for energy than carbohydrates. However, lipids contain more energy per unit weight than carbohydrates. Lipids are good as stored energy. The body will use its carbohydrate source for initial fuel, but if the “fast fuel” runs out, the body will turn to breaking down lipids for a rich energy source. Lipids in foods can be divided into two basic forms that are chemically very similar, fats and oils. The difference between them is that at room temperature fats are solid, and oils are liquid.

**Sudan IV (Used as indicator #1)**

Lipids absorb pigments in fat-soluble dyes such as Sudan IV. A *red color* occurs at the interface of a lipid and Sudan IV dye.

Foods that contained lipids:

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**PROTEINS**

Proteins are the most complex and functionally diverse molecules of living organisms. They consist of linked subunits called *amino acids*, which are in turn composed of carbon, hydrogen, oxygen, and nitrogen. There are 20 different amino acids that can link together in many combinations to make proteins. However, eight of these are not produced in the body, even though they are essential for life. These eight amino acids are called the *essential amino acids*, and they must be consumed in the food you eat.

**Biuret Reagent (Used as indicator #2)**

Biuret reagent detects the presence of a particular type of chemical bond in amino acids, called a peptide bond. A *violet color* results when the copper sulfate (CuSO<sub>4</sub>) in the Biuret reagent reacts with peptide bonds in the presence of sodium hydroxide (NaOH). Only proteins with four to six linked amino acids will react in this way; thus, free amino acids will not be detected. The intensity of the color is related to the number of amino acids linked together.

Foods that contained proteins:

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Some of the foods had a positive reaction to more than one indicator. What does that tell you about those foods?

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Were there any food solutions that did not react with *any* of the indicators? What does that tell you about those foods?

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Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## What’s in Food, What’s in People?

Using the same chemical tests you used in the Food Fundamentals Lab, scientists can determine the chemical composition of all the different foods people eat. In the table below, the composition of a number of common foods is listed.

Food	Water (%)	Carbohydrates (%)	Protein (%)	Lipids (%)	Vitamins & Minerals (%)
Coca-Cola	90	10	0	0	<1
Marshmallow	16	75	9	0	<1
Ground beef	56	0	25	19	<1
Lamb chop	44	0	20	36	<1
Chicken breast	62	0	30	8	<1
Corn	70	26	3	1	<1
Refried beans	74	19	6	1	<1
Brown rice	71	26	3	<1	<1
Banana	75	24	1	<1	<1
Dry roasted peanuts	1	22	25	48	<1
Broccoli	88	8	3	0	<1

Carbohydrates, protein, and lipids make up just about all of the food, excluding water, that we eat. Below is the chemical composition of an average human.

	Water (%)	Carbohydrates (%)	Protein (%)	Lipids (%)	Vitamins & Minerals (%)
<b>Average Human</b>	59	<1	14	22	5

- Based on this information and the Food Fundamentals Lab, compare the composition of the foods we eat to the composition of the average human. What does this suggest about the origins of the building blocks that allow us to grow?

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Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

You can calculate the percentage of nutrients in some of the foods you eat as well. Look at the Nutrition Facts from the labels of packages of food recently purchased. Pick a food that has the serving size listed in grams. The label should have the number of grams of carbohydrates, lipids (or fats), and protein for one serving of the food. Use this information to fill in the table below in the Weight per Serving column.

If you know the weights of carbohydrates, lipids, and proteins, it is easy to calculate the percentage of each of those nutrients in a given food using the following formula:

$$\frac{\text{Weight of Carbohydrates in One Serving} \times 100}{\text{Total weight of serving size}} = \% \text{ Carbohydrates}$$

Calculate the percentage of each nutrient in your food and write the calculated value in the percent column.

Food _____	Weight per Serving	Percent in Serving
Carbohydrate		
Lipid (Fat)		
Protein		

2. Compare the percentage composition of your food item with that of the average human composition. How do they compare? Is this food a good source of nutrients? Explain.

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3. Does knowing the percentage or the grams give you a better idea of the composition of your food? Explain why.

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Subunit 1—Nutrition and You

# Nutrition and Growth

## LESSON 1.2

### BIOLOGY, CHEMISTRY, OR HEALTH SCIENCE

#### Time

120 minutes

#### Materials

- Digestion Simulation worksheet
- Digestion Simulation Time Cards 0–4
- Counting Calories worksheet
- Calorie Calculations worksheet
- Calorie Comparisons worksheet
- My Ideal Menu worksheet

#### Prior Student Learning

Students should be familiar with the three basic nutrients: carbohydrates, proteins, and lipids.

### *Essential Question for This Unit*

Should we care about what we eat? Why?

### *Objectives*

After completing this lesson, students should be able to

- Identify the smaller organic molecules that make up macromolecules.
- Explain the role of biological macromolecules in health and human development.
- Analyze the nutritional content of the foods they eat.
- Create an “ideal” 1-day menu that satisfies daily nutritional requirements for an adolescent.
- Assess the adequacy of their own diet.

### *Lesson Activities*

#### **Teacher Preparation for Digestion Simulation**

Using a color printer, print out the digestion diagrams for Time Points 0–4. You may wish to laminate these sheets for future use.

#### **Lesson Springboard**

Ask students to try to explain how they get physically bigger. Where does that extra “stuff” come from? Does all their additional mass come from the food they consume?

#### **Lesson Development**

##### *Digestion Simulation*

Pass out the Digestion Simulation worksheet and the Time Cards 0–4. Divide students into groups of four and have them follow the instructions on the worksheet. In this activity, students will observe how nutrients from foods are broken down and reconstructed within cells of the body.

After students have finished the activity, discuss their findings as a class. Be sure students recognize that the macromolecules consumed as food are broken down into their component parts and reassembled by the cell as different macromolecules.

##### *Nutrition Project Assignment*

Now that students have explored the chemical components of food, have them investigate food as an energy source. Explain how the calories are a unit of measurement for energy. Food energy is typically measured in kilocalories (kcal). Confusingly, the kilocalorie is also referred

#### **Classroom Management**

This lesson requires students to record data outside of class for several days, so you may wish to begin the lesson on Monday and conclude it on Friday.

Subunit 1—Nutrition and You  
*Nutrition and Growth*

LESSON 1.2

to as a Calorie (with a capital “C”). Pass out the Counting Calories worksheet and have students calculate their daily caloric recommended values for each of the three nutrients as well as learn to calculate how many kilocalories of each nutrient are present in various types of food.

Assign students to record their food intake over 3 to 5 days, creating a diet log. Then, using the Nutri-Facts website (<http://www.nutri-facts.com/search.php>), have students calculate their caloric intake for each day on the Calorie Calculations worksheet.

After students have recorded their diet for several days, pass out the Calorie Comparisons worksheet. Have students calculate and record their average daily totals and compare these to the recommended values for each nutrient they calculated earlier.

Using the data from foods they eat, have students design an “ideal” 1-day menu appropriate for their own calorie needs. Each menu **must** include breakfast, lunch, dinner, and snacks for one (1) day. Use these percentages: 20% Fats, 50% Carbohydrates, 30% Proteins.

**Lesson Closure**

Revisit the statement “You are what you eat.” Have students write a short paragraph explaining a literal interpretation of this statement based on what they have learned about how nutrients are absorbed and utilized by the body.

***Possible Prior Misconceptions***

Any or all fat is undesirable in a healthy diet—some students may believe that all fat should be eliminated from a healthy diet. In fact, fat serves important functions in a healthy diet.

Foods low in fat are automatically lower in calories or “healthier”—although it is true that fat has more calories per gram than do carbohydrates or protein, foods can be high in calories regardless of their fat content.

Eliminating fat (or carbohydrates) from the diet is an appropriate way to reduce caloric intake—some students may believe a diet that eliminates intake of certain nutrients is a healthy way to reduce calories and/or lose weight (e.g., the Atkins low-carbohydrate diet). While certain diets may result in a short-term weight decrease, a diet that includes a healthy decrease in calories should still meet daily nutritional requirements, which include carbohydrates and fats.

***Student Assessment Artifacts***

Completed Digestion Simulation worksheet  
Completed Counting Calories worksheet  
Completed Calorie Comparisons worksheet  
My Ideal Menu (single-day menu)

### **Variations and Extensions**

If time allows, an engaging introduction for this subunit is to show the documentary *Super Size Me*, about obesity and fast food in America. There has been subsequent controversy surrounding the methods used by Morgan Spurlock in conducting his experiment, primarily concerning the rigor of his methods (e.g., a careful record of food intake was not made, a systematic rotation through the menu was not done, and food selections were biased toward the unhealthiest items for dramatic effect). Discussing the principles of conducting a scientific experiment would be appropriate here.

Journal entries: Have students reflect on the foods that they eat. Do they think they have a healthy diet? And, if not, what might they do to improve their eating habits?

This project can be extended to include more than 3 days. If time allows, you may ask students to collect food intake data while following their Ideal Menus and then record or reflect on the potential impact of learning about nutrition on their diet.

In addition to considering nutrient information, students might also investigate the Recommended Daily Allowance (RDA) for various vitamins and minerals and compare how their diet aligns with these values.

## **National and State Academic Standards**

### **NATIONAL NRC National Science Education Standards**

#### *The Cell*

Most cell functions involve chemical reactions. Food molecules taken into cells react to provide the chemical constituents needed to synthesize other molecules. Both breakdown and synthesis are made possible by a large set of protein catalysts, called enzymes. The breakdown of some of the food molecules enables the cell to store energy in specific chemicals that are used to carry out the many functions of the cell.

#### *Matter, Energy, and Organization in Living Systems*

The chemical bonds of food molecules contain energy. Energy is released when the bonds of food molecules are broken and new compounds with lower energy bonds are formed. Cells usually store this energy temporarily in phosphate bonds of a small high-energy compound called ATP.

### **CALIFORNIA Science Content Standards**

#### *Biology*

- 1g. Students know most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors.
- 9a. Students know how the complementary activity of major body systems provides cells with oxygen and nutrients and removes toxic waste products such as carbon dioxide.

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## Digestion Simulation

In the Food Fundamentals Lab, you should have observed that the chemical composition of foods we eat and the chemical composition of our bodies are very similar. In this digestion simulation, you will examine more closely the relationship between the foods we eat and what we are made of.

Line up the Digestion Simulation Time Cards on your desk. Each Time Card is a diagram that represents the food molecules in your body at a certain time. The Time 0 diagram shows the molecules that might be found in a person's mouth after taking a bite of a taco. How would you group these molecules together? In the table below, place the molecules into two to five groups, using whatever criteria seem reasonable to you.

Group	Molecules in Group (list by number)	What did all the molecules in the group have in common?	Differences (if any) between the molecules in the group
A			
B			
C			
D			
E			

Testing the nine molecules with the same indicators you used in the Food Fundamentals Lab produces the following results:


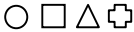


Molecule	Sudan IV	Benedict's Reagent	Iodine	Biuret Reagent
1	—	—	+	—
2	+	—	—	—
3	—	—	—	—
4	+	—	—	—
5	—	—	—	+
6	—	—	+	—
7	+	—	—	—
8	—	—	—	+
9	+	—	—	—

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

Using the results from the indicator tests, group the molecules into carbohydrates, proteins, and lipids in the table below.

Nutrient	Food Molecules by Number
Simple Carbohydrates (Sugars)	
Complex Carbohydrates (Starches)	
Proteins	
Fats	

- How similar were these groups to the ones you made on your own?
- Which molecule(s) tested negative as carbohydrate, protein, and fat?
- If you had to place it into one of the three nutrient groups, where would you place it and why? What do you think that molecule is?
- As food passes through your body and is digested, the food molecules undergo changes. Time Cards 1–4 represent food molecules at four different time points during digestion. What do you observe happening to each type of food molecule at the different time intervals?  
 Time 1:  
  
 Time 2:  
  
 Time 3:  
  
 Time 4:
- Count all the components that make up the larger molecules originally present in the mouth at Time 0, and then count all the components spread around the body at Time 4.

Group	Number of Pieces at Time 0	Number of Pieces at Time 4
		
		
		
		


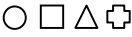


Were you able to account for all the building blocks?



Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

**Digestion and Growth**

As you discovered in the Food Fundamentals Lab, the three major nutrients in food are made up of smaller molecules with different structures and chemical properties. In the Digestion Simulation Time Cards, these molecules are represented by the shapes below.

Group	Name
	Sugar
	Amino Acids
	Fatty Acids
	Glycerol

You observed that these smaller subunits are connected together to make up the three biological macromolecules that make up carbohydrates, proteins, and lipids. As digestion progressed, you observed that the larger macromolecules were broken down into the smaller molecules before being reassembled within the body’s cells.

**Breakdown and Distribution**

Nutrients, like other substances, are transported through the body by the circulatory systems. In order for the food molecules to pass from the digestive system into the blood stream, they need to be broken down into molecules small enough to be absorbed by the cells that line the wall of your intestine. The digestive process in your stomach and small intestine breaks down the food into these small parts.

You should also have observed an unusual molecule that did NOT get broken down, molecule #3. This molecule represents cellulose, the substance that makes up the cell wall in plants. Cellulose is very difficult for most animals to digest. Even though it is part of food, the body cannot use it as a nutrient.

However, scientists have observed that some bacteria can break down (digest) cellulose. If you had bacteria in your intestine that could break down cellulose, what nutrients would cellulose provide for you? How do you know?

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**Reassembly**

Your body uses the molecules from food to help you maintain and grow your body, but the foods you eat do not always provide exactly what your body needs. How did the appearance of the protein molecules in the food on Time Card 0 compare the proteins that were formed by in the cells on Time Card 4?

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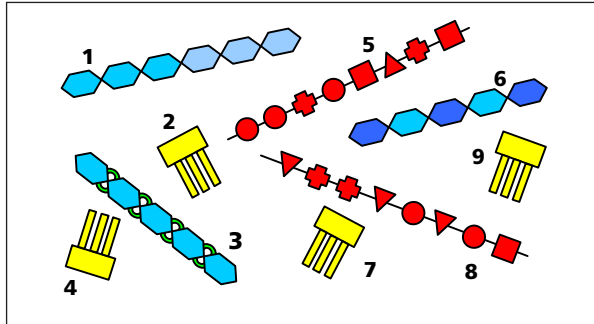
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Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

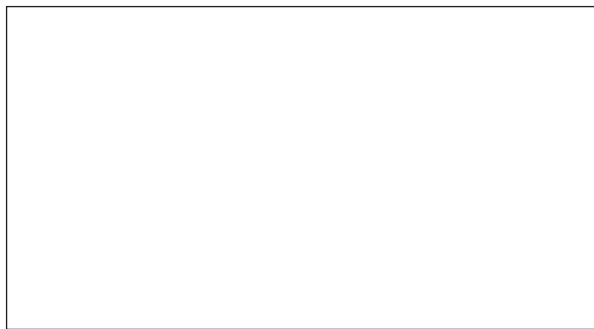
### Digestion Simulation Time 0



Mouth



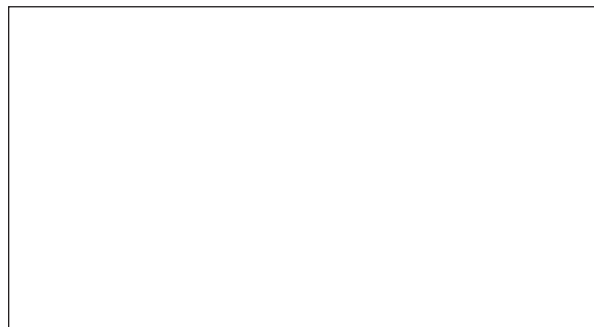
Stomach/Small Intestine



Large Intestine



Blood



Typical Cell



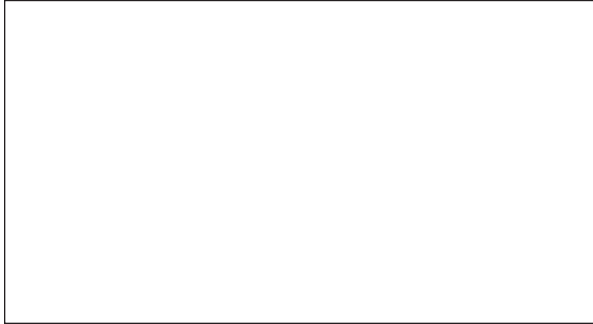
Fat Cell



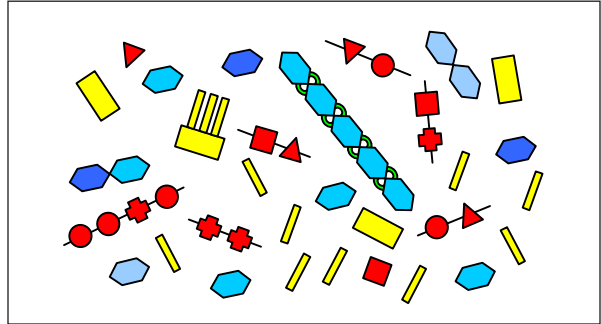
Waste

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## Digestion Simulation Time 1



Mouth



Stomach/Small Intestine



Large Intestine



Blood



Typical Cell



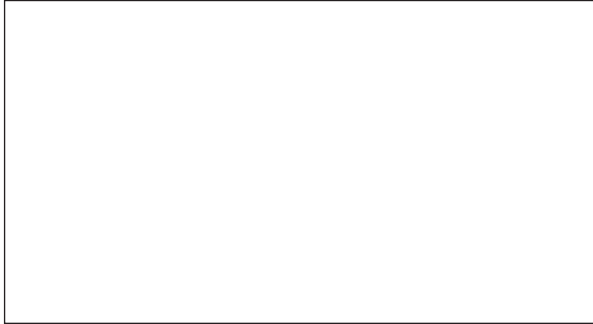
Fat Cell



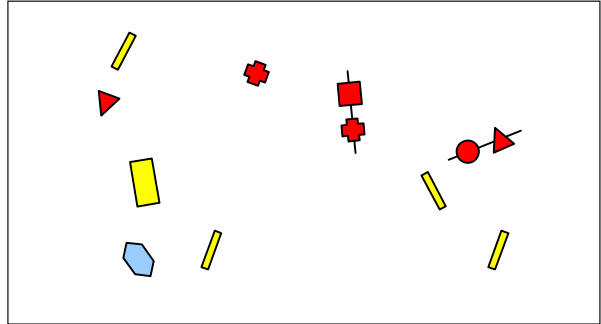
Waste

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

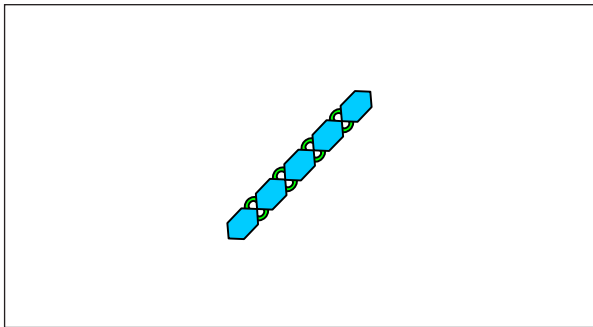
### Digestion Simulation Time 2



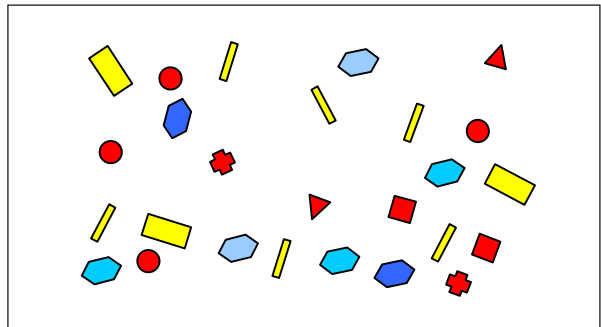
Mouth



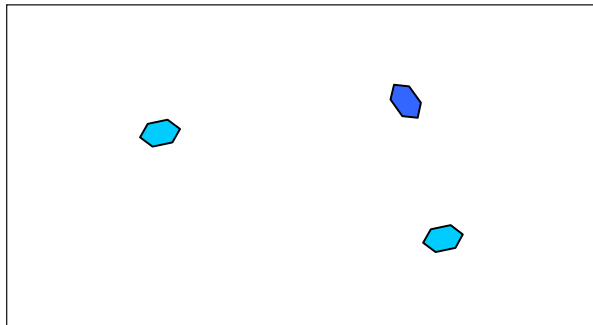
Stomach/Small Intestine



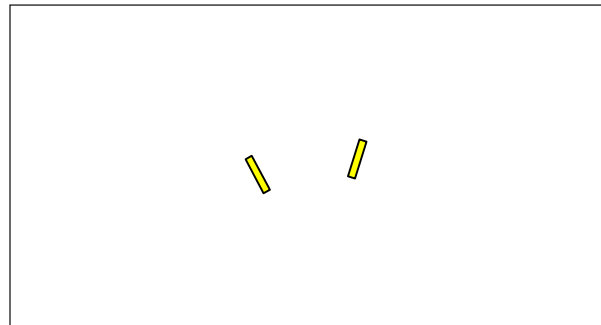
Large Intestine



Blood



Typical Cell



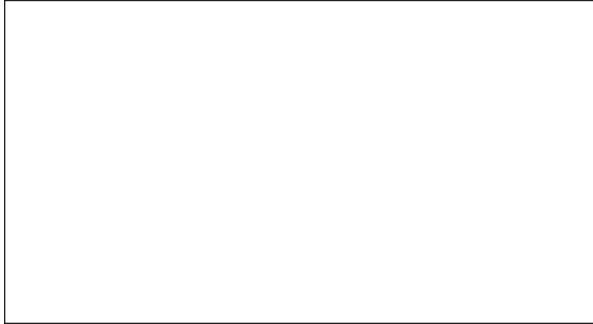
Fat Cell



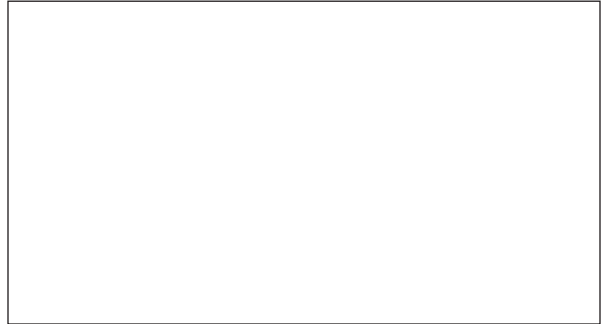
Waste

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

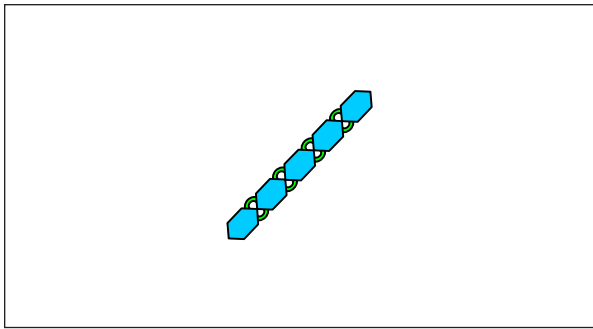
### Digestion Simulation Time 3



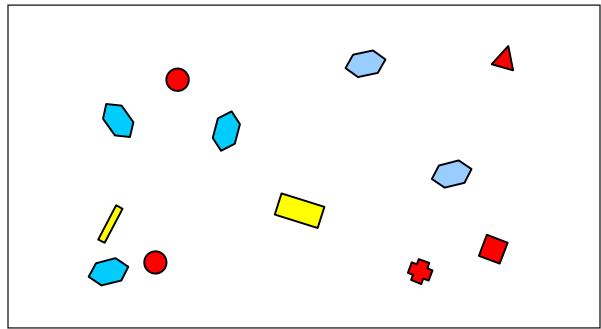
Mouth



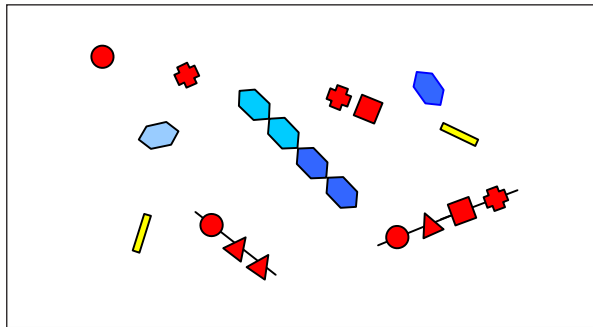
Stomach/Small Intestine



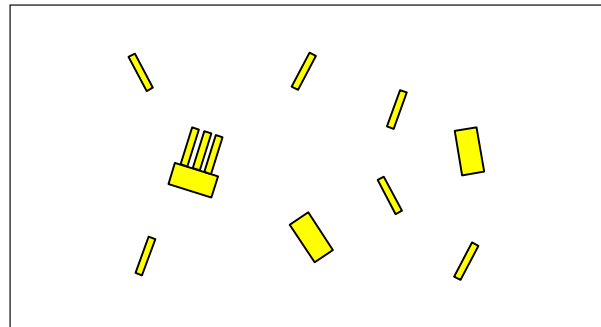
Large Intestine



Blood



Typical Cell



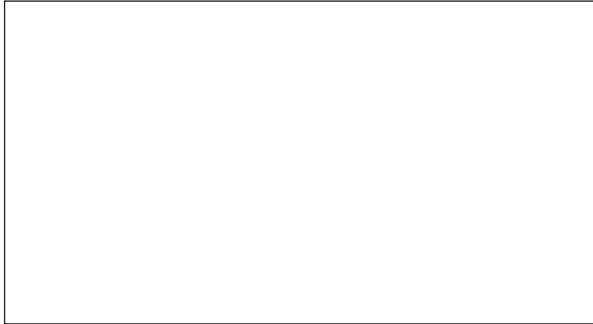
Fat Cell



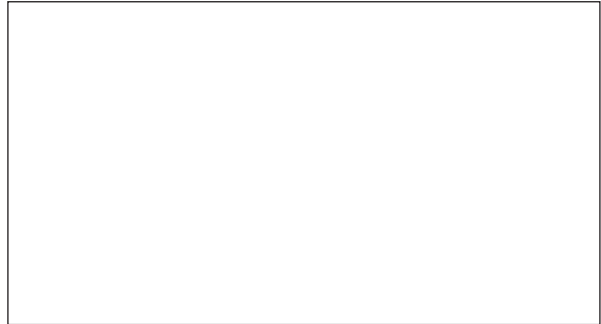
Waste

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## Digestion Simulation Time 4



Mouth



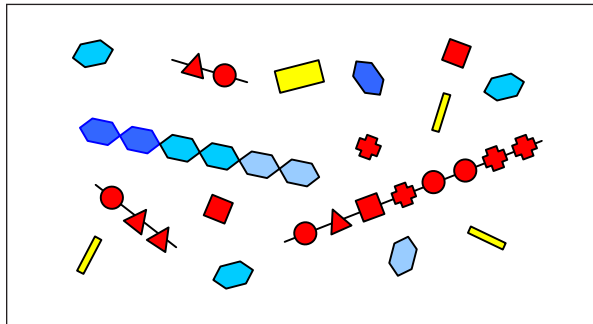
Stomach/Small Intestine



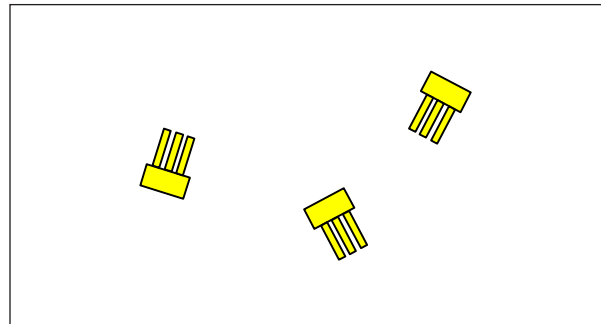
Large Intestine



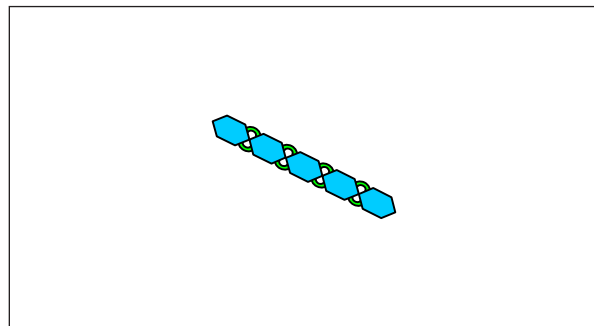
Blood



Typical Cell



Fat Cell



Waste

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## Counting Calories

- The average woman needs to consume 2000 calories/day
- The average man needs to consume 2500 Calories/day
- I need to consume \_\_\_\_\_ total kcals each day

According to the daily recommendations, the suggested distribution of nutrients in a healthy diet is

- Fat = 20%
- Carbohydrate = 50%,
- Protein = 30%

### Calculate how many

- Fat calories per day =  $0.20 \times$  \_\_\_\_\_ total kcals = \* \_\_\_\_\_ kcals of Fat/day
- Carbohydrate calories per day =  $0.50 \times$  \_\_\_\_\_ total kcals = \* \_\_\_\_\_ kcals of Carbohydrate/day
- Protein calories per day =  $0.30 \times$  \_\_\_\_\_ total kcals = \* \_\_\_\_\_ kcals of Protein/day

These are your recommended totals (insert into bottom of Calorie Comparisons table)

### Calorie Calculations Example

For the next few days, you will keep track of all foods you eat and calculate your total caloric intake using the Calorie Calculations worksheets. Below is a sample calculation for a glass of milk.

Fat = **9** kcal/gram  
 Carbohydrate = **4** kcal/gram  
 Protein = **4** kcal/gram

#### 2% Vitamin A Fortified Milk

<b>Nutrition Facts</b>		
Serving Size	1 cup (244g/8.7oz)	
<b>Calories</b> 122 kcal		
% Daily Value		
<b>Total Fat</b>	4.68 g	8%
Saturated Fat	2.916 g	15%
Polyunsaturated Fat	1.354 g	
Monounsaturated Fat	0.173 g	
<b>Cholesterol</b>	20 mg	7%
<b>Sodium</b>	122 mg	6%
<b>Total Carbohydrates</b>	11.71g	4%
Dietary Fiber	0.0 g	0%
Sugars		
<b>Protein</b>	8.13 g	

---

**Food 1: 2% Vitamin A fortified milk** \_\_\_\_\_ **Serving Size = 1 cup** \_\_\_\_\_

Total Fat: 4.68 g/serving × 9 kcal/fat g × 1 servings = 42.12 kcals of fat

Total Carbohydrates: 11.71 g/serving × 4 kcal/carb g × 1 servings = 46.84 kcals of carb

Total Protein: 8.13 g/serving × 4 kcal/protein g × 1 servings = 32.52 kcals of protein

Calculated total calories = \_\_\_\_\_ 121.48 kcal (**42.12 + 46.84 + 32.52**)

Printed total calories (on label) = \_\_\_\_\_ 122 kcal

---

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## Calorie Calculations—Day \_\_\_\_\_

**Food 1:** \_\_\_\_\_ **Serving Size =** \_\_\_\_\_

Total Fat: \_\_\_\_\_ g/serving × 9 kcal/fat g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of fat

Total Carbohydrates: \_\_\_\_\_ g/serving × 4 kcal/carb g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of carb

Total Protein: \_\_\_\_\_ g/serving × 4 kcal/protein g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of protein

Calculated total calories = \_\_\_\_\_ kcal

Printed total calories (on label) = \_\_\_\_\_ kcal

**Food 2:** \_\_\_\_\_ **Serving Size =** \_\_\_\_\_

Total Fat: \_\_\_\_\_ g/serving × 9 kcal/fat g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of fat

Total Carbohydrates: \_\_\_\_\_ g/serving × 4 kcal/carb g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of carb

Total Protein: \_\_\_\_\_ g/serving × 4 kcal/protein g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of protein

Calculated total calories = \_\_\_\_\_ kcal

Printed total calories (on label) = \_\_\_\_\_ kcal

**Food 3:** \_\_\_\_\_ **Serving Size =** \_\_\_\_\_

Total Fat: \_\_\_\_\_ g/serving × 9 kcal/fat g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of fat

Total Carbohydrates: \_\_\_\_\_ g/serving × 4 kcal/carb g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of carb

Total Protein: \_\_\_\_\_ g/serving × 4 kcal/protein g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of protein

Calculated total calories = \_\_\_\_\_ kcal

Printed total calories (on label) = \_\_\_\_\_ kcal

**Food 4:** \_\_\_\_\_ **Serving Size =** \_\_\_\_\_

Total Fat: \_\_\_\_\_ g/serving × 9 kcal/fat g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of fat

Total Carbohydrates: \_\_\_\_\_ g/serving × 4 kcal/carb g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of carb

Total Protein: \_\_\_\_\_ g/serving × 4 kcal/protein g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of protein

Calculated total calories = \_\_\_\_\_ kcal

Printed total calories (on label) = \_\_\_\_\_ kcal

**Food 5:** \_\_\_\_\_ **Serving Size =** \_\_\_\_\_

Total Fat: \_\_\_\_\_ g/serving × 9 kcal/fat g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of fat

Total Carbohydrates: \_\_\_\_\_ g/serving × 4 kcal/carb g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of carb

Total Protein: \_\_\_\_\_ g/serving × 4 kcal/protein g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of protein

Calculated total calories = \_\_\_\_\_ kcal

Printed total calories (on label) = \_\_\_\_\_ kcal



Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## Calorie Calculations—Day \_\_\_\_\_

**Food 6:** \_\_\_\_\_ **Serving Size =** \_\_\_\_\_

Total Fat: \_\_\_\_\_ g/serving × 9 kcal/fat g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of fat

Total Carbohydrates: \_\_\_\_\_ g/serving × 4 kcal/carb g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of carb

Total Protein: \_\_\_\_\_ g/serving × 4 kcal/protein g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of protein

Calculated total calories = \_\_\_\_\_ kcal

Printed total calories (on label) = \_\_\_\_\_ kcal

**Food 7:** \_\_\_\_\_ **Serving Size =** \_\_\_\_\_

Total Fat: \_\_\_\_\_ g/serving × 9 kcal/fat g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of fat

Total Carbohydrates: \_\_\_\_\_ g/serving × 4 kcal/carb g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of carb

Total Protein: \_\_\_\_\_ g/serving × 4 kcal/protein g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of protein

Calculated total calories = \_\_\_\_\_ kcal

Printed total calories (on label) = \_\_\_\_\_ kcal

**Food 8:** \_\_\_\_\_ **Serving Size =** \_\_\_\_\_

Total Fat: \_\_\_\_\_ g/serving × 9 kcal/fat g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of fat

Total Carbohydrates: \_\_\_\_\_ g/serving × 4 kcal/carb g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of carb

Total Protein: \_\_\_\_\_ g/serving × 4 kcal/protein g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of protein

Calculated total calories = \_\_\_\_\_ kcal

Printed total calories (on label) = \_\_\_\_\_ kcal

**Food 9:** \_\_\_\_\_ **Serving Size =** \_\_\_\_\_

Total Fat: \_\_\_\_\_ g/serving × 9 kcal/fat g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of fat

Total Carbohydrates: \_\_\_\_\_ g/serving × 4 kcal/carb g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of carb

Total Protein: \_\_\_\_\_ g/serving × 4 kcal/protein g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of protein

Calculated total calories = \_\_\_\_\_ kcal

Printed total calories (on label) = \_\_\_\_\_ kcal

**Food 10:** \_\_\_\_\_ **Serving Size =** \_\_\_\_\_

Total Fat: \_\_\_\_\_ g/serving × 9 kcal/fat g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of fat

Total Carbohydrates: \_\_\_\_\_ g/serving × 4 kcal/carb g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of carb

Total Protein: \_\_\_\_\_ g/serving × 4 kcal/protein g × \_\_\_\_\_ servings = \_\_\_\_\_ kcals of protein

Calculated total calories = \_\_\_\_\_ kcal

Printed total calories (on label) = \_\_\_\_\_ kcal

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

### Calorie Comparisons

	Food Name	Total Fat kcal	Total Carb kcal	Total Protein Kcal
<b>Day 1</b>	1.			
	2.			
	3.			
	4.			
	5.			
	6.			
	7.			
	8.			
	9.			
	10.			
<b>Day 2</b>	1.			
	2.			
	3.			
	4.			
	5.			
	6.			
	7.			
	8.			
	9.			
	10.			
<b>Day 3</b>	1.			
	2.			
	3.			
	4.			
	5.			
	6.			
	7.			
	8.			
	9.			
	10.			
<b>Day 4</b>	1.			
	2.			
	3.			
	4.			
	5.			
	6.			
	7.			
	8.			
	9.			
	10.			
Total =				
Average (Total/# of days) =				
<b>Recommended Total =</b>		*	*	*

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## My Ideal Menu (list foods here)

Based on knowledge of your own nutritional and caloric needs, create a healthy and delicious menu for a single day.

---

**Breakfast:**

---

**Lunch:**

---

**Dinner:**

---

**Snacks:**

---

# Obesity: An Expanding Problem

## LESSON 1.3

### HEALTH SCIENCE

#### Time

120 minutes

#### Materials

##### Equipment

- TV/VCR
- Access to computer lab

#### Resources

- A&E Investigative Reports  
Video: *Supersize Generation, Kids and Obesity*
- Video worksheet
- Obesity Web Research worksheet

#### Prior Student Learning

No specific content is necessary prior to this lesson. However, students should be familiar with classroom norms concerning thoughtful, respectful, and constructive dialogue.

### Essential Question for This Unit

Should we care about what we eat? Why?

### Objectives

After completing this lesson, students should be able to

- Define obesity.
- Identify diseases/disorders that are caused or complicated by obesity.
- Describe specifically how being overweight is a risk factor for each disease/disorder.
- Explain how obesity can affect an individual's overall health and wellness.

### Lesson Activities

#### Lesson Springboard

The subject of weight is sensitive for some. Before you begin this lesson, reinforce classroom standards of respect for others.

Provide students with the following data:

Percent of Overweight Youth

Year	Ages 6–11	Ages 12–19
1976–1980	6.5%	5.0%
1988–1994	11.3%	10.5%
1999–2002	15.8%	16.1%
2003–2004	18.8%	17.4%

Ask students to discuss their ideas about why there has been such an increase in overweight youth in the last 20 years.

### Lesson Development

#### Class Discussion

Ask students to define what it means to be overweight. Suggest students consider whether weight itself is the only factor (e.g., a taller person, or a person with more muscle mass, can weigh a great deal but still not be overweight).

Take a few moments to discuss body mass index (BMI), the ratio of weight to height squared. Calculating BMI is the most common method used to assess whether a person is overweight or obese. Though the correlation between BMI and body fat is strong, it is not without variation. For example, athletes may have a high BMI due to their greater muscle mass rather than body fat. Also note that the average amount of body

# Obesity: An Expanding Problem

## LESSON 1.3

fat differs with age and gender. For this reason, BMI is interpreted differently for children and teens than it is for adults. For further information, go to the website of the Centers for Disease Control and Prevention (CDC) (<http://www.cdc.gov/nccdphp/dnpa/bmi/index.htm>).

### **Video**

Show the Investigative Reports video from the A&E Channel, *Supersize Generation, Kids and Obesity*. Distribute the associated worksheet and have students fill in answers as they watch. Discuss the worksheet results after the video.

### **Computer Lab Research**

Obesity can contribute to other serious health problems. Hand out the Obesity Web Research worksheet and have students investigate some of the major diseases and health risks exacerbated by being overweight or obese, including

- Hypertension
- Dyslipidemia (e.g., high total cholesterol or high levels of triglycerides)
- Type 2 diabetes
- Coronary heart disease
- Stroke
- Gallbladder disease
- Osteoarthritis
- Sleep apnea and respiratory problems
- Some cancers (endometrial, breast, and colon)

### **Lesson Closure**

Collect student worksheets. Go around the room and ask each student to share one new fact about obesity and its associated health risks that she or he learned in the lesson.

### **Student Assessment Artifacts**

Completed Video worksheet

Completed Obesity Web Research worksheet

### **Variations and Extensions**

Have students research obesity rates for subpopulations, such as ethnic groups, age groups, regional populations, and gender. Assign a paper in which students identify the factors that contribute to inter-group variations and recommend strategies appropriate for one or more subgroups to reduce their higher rates of obesity.

# Obesity: An Expanding Problem

## LESSON 1.3

### National and State Career Technical Education Standards

#### **NATIONAL**

##### **NCHSTE National Healthcare Skill Standards**

###### *Foundation Standard 9: Health Maintenance Practices*

Healthcare workers will understand the fundamentals of wellness and the prevention of disease processes. They will practice preventive health behaviors among the clients.

#### **CALIFORNIA**

##### **Health Science and Medical Technology Standards**

- B1.0 Students know how to use appropriate methods and technology in a multidisciplinary healthcare industry to communicate information.
- B2.0 Students know the process for assessing and reporting the health status of patients and clients.



Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## Obesity Web Research

### Is Weight Affecting Your Health?

Answer the following questions BEFORE searching any websites:

1. How do you think society *defines* obesity?
  
  
  
  
  
  
  
2. What is your *personal* definition of obesity?
  
  
  
  
  
  
  
3. What do you think is the *medical* definition of obesity?
  
  
  
  
  
  
  
4. Make an intelligent guess: how many diseases and disorders are caused by or complicated by obesity?

Search the Internet to complete the chart on the back of this page. Also, give a brief description of how the diseases/disorders are linked to being overweight.



Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

What Is the Disease/Disorder?	How Is It Linked to Obesity?
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

After completing your research, answer these questions again. Did any of your answers change?

1. How does society define obesity?
  
2. What is your personal definition of obesity?
  
3. What is the medical definition of obesity?
  
4. How many diseases and disorders are caused by or complicated by obesity?

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

5. Take a minute to reflect on what you have just learned about the health risks of obesity. Write three paragraphs about your thoughts.

6. Reflect on the various ways that we have learned about obesity—watching a video, doing research on the Internet, discussing the issue in class, and writing short papers. Which method (or methods) was most useful in helping you assemble information and draw conclusions? Why? Which method was least useful, and why?



Subunit 1—Nutrition and You

# Biometrics Lab

## LESSON 1.4

### ALGEBRA I OR STATISTICS

#### Time

100 minutes

#### Materials

##### Equipment

- 2 or more bathroom scales
- Measuring tapes (1 per group)

#### Resources

- Biometrics Lab worksheet
- Clinical charts for percentage of Ideal Body Weight, BMI, WHR, and caloric needs (e.g., Rush University Medical Center [www.rush.edu/rumc/page-1108048103230.html](http://www.rush.edu/rumc/page-1108048103230.html))

#### Prior Student Learning

Students should be familiar with measurement techniques and graphing data.

Students should be aware of their own daily caloric needs (Lesson 1.2).

### **Essential Question for This Unit**

Should we care about what we eat? Why?

### **Objectives**

After completing this lesson, students should be able to

- Calculate Ideal Body Weight and Body Mass Index using formulas.
- Graph class distribution.
- Calculate mean, median, mode, and standard deviation of class data.
- Evaluate their own fitness and fitness of the class based on statistical data.

### **Lesson Activities**

#### **Lesson Springboard**

Begin with a discussion about what it means to be considered physically fit. Students may share their own plans for physical fitness or the plans of family members to improve or maintain physical fitness. What factors play important roles? Ask students how they think physical fitness can be measured.

#### **Lesson Development**

##### **Lab Activity**

Introduce the various biometric measures as one approach to measuring physical fitness, including

- Ideal Body Weight
- Body Mass Index (BMI)—measure of body fat based on height and weight
- Waist/Hip Ratio (WHR)

Have students work in small groups to collect data and calculate their biometric measures using the Biometrics Lab procedures and data tables.

##### **Class Discussion**

Collate and display the class data on the board or on an overhead. You may use this opportunity to spot-check students' calculations. Discuss the patterns in the data set. Introduce the concepts of *distribution graphs* and *descriptive statistics*.

Graph class distribution—Have each student create distribution graphs of the class's various biometric measures.

#### **Classroom Management**

Students will need to work in groups of two to four to collect data.

Weight can be a sensitive issue, so it may be best to allow students to choose their own groups.

Prepare a class data chart for collating data that will be visible to the entire class.

#### **Support Strategy**

Some or all calculations can be done as a class, depending on students' familiarity with descriptive statistics.

Calculate descriptive statistics—Have each student calculate the mean, median, and mode (add standard deviation for advanced students) of each set of data.

**Lesson Closure**

As a class, or as a written assignment, have students reflect on their overall fitness and the fitness of the class as a whole. Have students make suggestions on what they might do to maintain or improve their own health status.

**Possible Prior Misconceptions**

There cannot be a single equation to calculate the target BMI for everyone, because ideal body weight varies by race/ethnicity and culture.

**Student Assessment Artifacts**

Completed Biometrics Lab with distribution graphs and descriptive statistics  
Student reflection essays

**Variations and Extensions**

Additional statistics may be calculated using the class data, such as variance.

Introduce other distribution representations (e.g., stem-and-leaf displays and box-and-whisker plots).

Compare class data with the local, state, or national averages.

Have students calculate the biometric measures of family and friends and complete an analysis of their fitness.

**National and State Academic Standards**

**NATIONAL  
NCTM Standards for School Mathematics**

*Algebra*

Represent and analyze mathematical situations and structures using algebraic symbols.

*Data Analysis and Probability*

Select and use appropriate statistical methods to analyze data.

**CALIFORNIA  
Mathematics Content Standards**

*Algebra*

Students solve simple linear equations.

*Probability and Statistics*

Students know the definitions of the mean, median, and mode of a distribution of data and can compute each in particular situations. Students compute the variance and the standard deviation of a distribution of data. Students organize and describe distributions of data by using a number of different methods, including frequency tables, histograms, standard line and bar graphs, stem-and-leaf displays, scatter plots, and box-and-whisker plots.

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## Biometrics Lab

**Day 1:** Students should have groups of three or four already chosen or assigned.

Equipment: Scales, tape measure.

Procedure: Use the tape measure to measure the height, waist, and hip of each person. Record these data on the worksheet below. Use the scales to measure the weight of each person. Record the weight on the worksheet below.

	Student 1	Student 2	Student 3	Student 4
Height in inches (h)				
Waist in inches (w)				
Hip in inches (p)				
Weight in pounds (g)				

Use the data above and the following formulas to calculate the percent of ideal body weight.

**Step 1:**

Calculate Ideal Body Weight.

I = Ideal Body Weight

n = number of inches above 5 feet

For females:  $I = 100 + 5n$

For males:  $I = 106 + 6n$

**Step 2:**

Calculate Percent of Ideal Body Weight.

P = Percent of Ideal Body Weight

$$P = g \div I \times 100$$

Calculate the Waist to Hip Ratio. Calculate the Body Mass Index (BMI).

R = Waist to Hip Ratio

$$BMI = g \div h^2 \times 703$$

$$R = w \div p$$

Complete the table.

	Student 1	Student 2	Student 3	Student 4
Percent of Ideal Body Weight				
Waist to Hip Ratio				
Body Mass Index				
Daily Caloric Needs				

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

What are the desired statistics?

**Waist to Hip Ratio:**

Men should have a waist to hip ratio less than 0.95.  
 Women should have a waist to hip ratio less than 0.8.

**Body Mass Index:**

Less than 20: Underweight  
 Between 20 and 25: Normal  
 Between 25 and 30: Overweight  
 Greater than 30: Obese

**Additional practice**

Use the following data to calculate each person’s vital statistics.

	Student 1 (male)	Student 2 (male)	Student 3 (female)
Height in inches (h)	70	68	65
Waist in inches (w)	33	42	27
Hip in inches (p)	35	38	33
Weight in pounds (g)	155	212	132

	Student 1 (male)	Student 2 (male)	Student 3 (female)
Percent of Ideal Body Weight			
Waist to Hip Ratio			
Body Mass Index			
Daily Caloric Needs			

# Effects of Diet on Rat Weight and Activity Lab

## LESSON 1.5

### BIOLOGY AND STATISTICS

#### Time

Observations over 4 weeks

#### Materials

##### Equipment

- 2 rats, littermates, same sex
- 2 cages with bedding material
- 2 food dishes
- 2 water bottles
- Water
- A variety of foods
- Metric rulers
- Scales
- Access to the Internet

#### Resources

Effects of Diet Lab Report template

#### Prior Student Learning

Students should have a basic understanding of the scientific method and lab procedures.

Students should be familiar with the three basic types of nutrients (carbohydrates, proteins, and lipids).

Students should understand that different organisms have different metabolic needs.

### **Essential Question for This Unit**

Should we care about what we eat? Why?

### **Objectives**

After completing this lesson, students should be able to

- Design a scientific experiment with controlled variables.
- Take quantitative and qualitative measurements of rat appearance and growth.
- Draw logical conclusions about nutrition from data collected.
- Write a lab report documenting the experiment.

### **Lesson Activities**

#### **Lesson Springboard**

Tell the class that now that they have learned about nutrients and their functions, they will be directly observing the effects of different diets. Explain that they will be conducting some simple experiments on lab rats that the class will care for and observe over the next month. Introduce students to the experimental animals and their handling.

#### **Lesson Development**

##### **Lab Introduction**

Explain that the purpose of this lab is to study the effects of diet in rats. Begin by discussing what the nutritional requirements of rats might be. For example, what types of nutrients do rats require? What is a rat's required daily caloric intake?

As a class, determine what kinds of foods would be considered “healthy foods” in a rat diet and what kinds of foods would be “junk foods.” Be sure to evaluate the nutritional content of various typical rat foods. Consider what the serving size for a rat is and how many calories are in each serving. For comparison, you may wish to have students find out the relative percentage of carbohydrates, proteins, and fats in commercial rat food versus foods that rats might scavenge in the wild.

Review the concept of *experimental design* and discuss the procedures the class will be using for this experiment. You may wish to have the class decide on the experimental design together. Discuss the experimental variables. Have students identify the independent (diet) and dependent (weight, appearance) variables. Discuss what other variables should be controlled and whether this will be possible.

Review the difference between quantitative and qualitative data. Introduce care of laboratory animals (assign and record feeding schedules for the next month).



# Effects of Diet on Rat Weight and Activity Lab

## LESSON 1.5

Pass out the the Effects of Diet Lab Report template and have the students complete the introductory portion of a lab report, including the Introduction/Background Information, Hypothesis, Materials, Procedures, and Nutritional Data on Various Rat Foods. Students should also take some initial measurements of each rat and record that information on their Lab template.

### **Observations**

Over the next several weeks, set aside time in class for observations and measurements to be made on the rats. Have students record the data in the appropriate tables of their Lab template. Take a few minutes each week to compare the changes in rat appearance as the month progresses.

### **Lesson Closure**

After data collection is complete, examine the data as a class. Discuss the changes in appearance and behavior between the experimental rat and the control rat over time. Were students surprised by the level of change observed? What can they conclude about food choices based on their experiment? Have student reflect on how the experiment reflects on their own food choices.

After the class has discussed the lab results, encourage students to discuss how the experimental design could be revised to improve the accuracy of data collection, and to examine different experimental questions.

### **Possible Prior Misconceptions**

Students may believe that size is an indication of health. Some students may believe that relative size is an indication of a “better” organism, i.e., a large rat is healthier than a smaller rat. However, all organisms display variability in physical characteristics, like size. Larger size is not always correlated with increased health. Large size can sometimes be attributed to unhealthy factors, like obesity.

Students may believe that a rapid growth rate is an indication of health. As with their possible view of size, some students may believe that quick growth is a sign of a healthy rat. While slow weight gain and growth can sometimes be associated with poor nutrition, rapid weight gain and growth is not always associated with an appropriate and healthy diet.

### **Student Assessment Artifacts**

Effects of Diet on Rat Weight and Behavior lab report (submitted to the Biology and English teachers)—the report should include appropriate title, introduction, methods, results, and discussion sections. An abstract may or may not be required.

### **Variations and Extensions**

Extend or alter the experimental conditions. Possible variations include

- Allowing additional weeks to increase data collection and improve reliability.

# Effects of Diet on Rat Weight and Activity Lab

## LESSON 1.5

- Conducting multiple trials.
- Running multiple experiments with different independent variables.
- Providing rat diets with varying percentages of carbohydrates, proteins, and fats.
- Providing rat diets with varying vitamins and minerals.

Additional observations can be made on rats—students can devise methods to check for rats’ strength and/or stamina.

Students can run a subsequent experiment to determine an appropriate diet for weight reduction in rats.

If multiple experiments or trails are run, conduct a “research symposium” where students present their individual findings to the class.

A science writer can participate in a class session as a guest speaker or in the optional research symposium. He or she can discuss subjects such as the role of technical journals in communicating research findings to scientists, how technical research findings are communicated to nontechnical audiences, and careers for communications professionals in the health and biomedical sciences.

### National and State Academic Standards

#### **NATIONAL** NRC National Science Education Standards

##### *Science as Inquiry*

Design and conduct scientific investigations

- Formulate and revise scientific explanations and models using logic and evidence

##### *Matter, Energy, and Organization in Living Systems*

- The chemical bonds of food molecules contain energy. Energy is released when the bonds of food molecules are broken and new compounds with lower energy bonds are formed. Cells usually store this energy temporarily in phosphate bonds of a small high-energy compound called ATP.

#### **CALIFORNIA** Science Content Standards

##### *Investigation and Experimentation*

- 1a. Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.
- 1b. Identify and communicate sources of unavoidable experimental error.
- 1c. Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.
- 1d. Formulate explanations by using logic and evidence.
- 1e. Solve scientific problems by using quadratic equations and simple trigonometric, exponential, and logarithmic functions.
- 1j. Recognize the issues of statistical variability and the need for controlled tests.

##### *Biology*

- 9a. Students know how the complementary activity of major body systems provides cells with oxygen and nutrients and removes toxic waste products such as carbon dioxide.

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## Effects of Diet Lab Report

### Introduction

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### Materials

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### Methods

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Food	Calories/ Serving Size	Carbohydrates	Protein	Lipids



Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

**Results—Experimental Rat**

**Quantitative Data**

	Beginning of Project	End of Week 1	End of Week 2	End of Week 3	End of Week 4
Weight of Rat					
Subtract Last Week's Weight		—	—	—	—
<b>Weight Gain</b>					
Length of Tail					
Subtract Last Week's Tail Length		—	—	—	—
<b>Tail Length Gain</b>					
Feed					


**Qualitative Data**

Day of Week	Date	Appearance of Coat	Activity Level and Description



Subunit 1—Nutrition and You

# Writing a Lab Report

## LESSON 1.6

### ENGLISH LANGUAGE ARTS

#### Time

50 minutes

#### Materials

#### Equipment

Access to computer lab (optional)

#### Resources

- IMRaD online handout
- <http://www.wisc.edu/writing/Handbook/ScienceReport.html>
- LabWrite website (optional) (<http://www.ncsu.edu/labwrite>)

#### Prior Student Learning

Students should know the difference between active and passive voice.

#### Classroom Management

If doing peer editing and review, try to match students with complementary writing strengths and weaknesses.

#### Support Strategy

You may direct students to websites designed to scaffold the writing of lab reports, such as LabWrite. Have students do several peer reviews of each other's reports.

### Essential Question for This Unit

Should we care about what we eat? Why?

### Objectives

After completing this lesson, students should be able to

- Write a research report using the standard scientific structure (IMRaD).
- Use evidence to construct an argument.
- Evaluate adherence of writing samples to a particular standard.

### Lesson Activities

#### Lesson Springboard

Remind students of the Rat Weight and Activity Lab (Lesson 1.5). Compare the purpose and audience for writing lab reports to those for other types of writing.

#### Lesson Development

##### Direct Instruction

Review the IMRaD format—the standard structure for scientific research reports. Students may do this online at a variety of sites that describe the format.

- Title—The title should describe the significance of the experiment so that readers can decide if this report is relevant to their interests.
- Abstract (optional)—This section briefly outlines what you did and what your results were, without specific details.
- Introduction—This section needs to capture the reader's attention while addressing (1) the problem, (2) its importance, and (3) the solution.
- Methods—This section describes the materials and procedures you used in the experiment. This section should provide enough detail for experimental replication.
- Results—This section reports exactly what occurred; typically, it contains prose descriptions as well as data tables, figures, or charts. No interpretation of observations should be included here.
- Discussion—This section discusses the meaning of your results. Here you should describe what you expected and what conclusions you can draw from what you actually observed.

#### Classroom Management

If using the computer lab, there should be a maximum of two students per computer.

If available, review lab reports of varying quality and compare them to the lab report rubric, obtained from the Biology teacher.



Subunit 1—Nutrition and You  
*Writing a Lab Report*

LESSON 1.6

**Lesson Closure**

Have students write an outline of their lab report in class. Check for any obvious errors while circulating around the room.

**Possible Prior Misconceptions**

Some students may believe that methods and results can/should be in the same section.

Some students may believe that results and interpretation can/should be discussed in the same section.

Some students may believe that passive voice is used in scientific writing because it sounds more “intellectual.”

**Student Assessment Artifacts**

Effects of Diet on Rat Weight and Behavior lab report (submitted to Biology and English teachers)—this report should include an appropriate title and introduction, methods, results, and discussion sections. An abstract may or may not be required.

**Variations and Extensions**

Have students complete formal critiques of sample research reports.

Have students read one or two research articles published prior to the mid-1900s. Students should compare the structure of those articles with the current standard. Were the older articles more or less compelling? Were they harder or easier to understand? Ask students to discuss what prompted the shift in scientific writing style.

**National and State Academic Standards**

**NATIONAL  
NCTE Standards for the English Language Arts**

4. Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
6. Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language, and genre to create, critique, and discuss print and non-print texts.
12. Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).

**CALIFORNIA  
English Language Arts Content Standards**

**Writing**

- 2.3 Write expository compositions, including analytical essays and research reports:
  - a. Marshal evidence in support of a thesis and related claims, including information on all relevant perspectives.
  - b. Convey information and ideas from primary and secondary sources accurately and coherently.
  - c. Make distinctions between the relative value and significance of specific data, facts, and ideas.
  - d. Include visual aids by employing appropriate technology to organize and record information on charts, maps, and graphs.
  - e. Anticipate and address readers’ potential misunderstandings, biases, and expectations.
  - f. Use technical terms and notations accurately.

Subunit 1—Nutrition and You

# Am I Gaining or Losing Weight?

## LESSON 1.7

### ALGEBRA I

#### Time

115 minutes

#### Materials

##### Equipment

- Graph paper
- Rulers
- Colored pencils (optional)

#### Resources

- Daily Activity Record worksheet
- Calorie Intake Record worksheet
- Chart of Average Calories Burned per Hour of Activity from <http://www.nutristrategy.com/activitylist4.htm>, or [http://www.coolnurse.com/calories\\_burned.htm](http://www.coolnurse.com/calories_burned.htm)

#### Prior Student Learning

Students should already have completed Lesson 1.2 and recorded their daily food intake.

### **Essential Question for This Unit**

Should we care about what we eat? Why?

### **Objectives**

After completing this lesson, students should be able to

- Create line graphs of data using appropriate scale and axes, including data with negative values.
- Interpret and analyze data through graphical representation.
- Combine two graphs and make sense of the result.

### **Lesson Activities**

#### **Lesson Springboard**

In Lesson 1.2, students recorded their food consumption for several days and analyzed the nutritional composition of their diets. Although this analysis supports reflection about healthy or unhealthy diets, it does not tell individuals if they are losing or gaining weight. This is determined primarily by caloric input and output (how many calories you eat—how many you burn). This lesson will use graphical analysis to determine whether or not altering eating and activity habits will result in any change in weight.

#### **Lesson Development**

##### **Direct Instruction/Individual Work**

Introduce the lesson to the class and state that each individual will be analyzing his or her own calorie intake and activity level. Hand out the Daily Activity Record worksheet and have students fill it out for a 24-hour period, starting with the current class session. The worksheet will be due in class the next day. Students should also bring their Diet Log (from Lesson 1.2) and Daily Activity Record to class tomorrow.

Remind students that every activity they do during the day burns calories, including sleeping and sitting. Therefore, there should be no gaps of time in their record.

Tell the class to leave the “Calories Burned/Hour,” “Total Calories Burned by Activity,” and “Total Calories Burned So Far” columns on their worksheet blank for now. They will be filling them out in class.

##### **Individual Work**

When students return with their data, give them a table of common activities and the rate at which calories are burned for each one. Some examples can be found at <http://www.nutristrategy.com/activitylist4.htm> and [http://www.coolnurse.com/calories\\_burned.htm](http://www.coolnurse.com/calories_burned.htm). Have students fill in their “Calories Burned/Hour” column and then calculate and record

# Am I Gaining or Losing Weight?

## LESSON 1.7

the two “Total Calories Burned” columns for each activity. Students may have trouble calculating fractions of an hour and making sense of (*Rate of calories burned*)  $\times$  (*Time in hours*) = *Total calories burned*. This may require direct instruction. It is also a good time to emphasize the need to keep track of units when multiplying fractions.

Hand out the Calorie Intake Record worksheet. Have students refer to their Diet Log to fill in the entire chart. Again, this may require direct instruction for the class to understand and apply the equation:

$$\text{Calories consumed} / \text{Time in hours} = \text{average rate of calorie consumption}$$

### **Direct Instruction/Discussion**

Introduce the concept of *graphing* as a way to visually represent the data that each student has just calculated. Define the terms *axis*, *scale*, and *coordinates*. Although a discussion of *slope* will occur in this lesson, a formal definition of the term is not necessary. Model how to set up a graph with Time (hours) as the *x* axis and Total Calories in the Body as the *y* axis. Decide as a class what an appropriate scale for the graphs would be—everyone in the class should use the same scale to make subsequent comparisons easier.

### **Individual Work**

Have students graph the calorie intake data they have collected. To simplify the problem, ask students to assume that when they are eating, their calorie intake rate is constant. In other words, if a meal consisted of salad, a hamburger, and a soft drink, have them assume that they were eating all of the foods at an even pace during the entire meal. (Imagine putting everything in a blender and drinking it at a constant speed for the duration of the meal.)

The following questions can be asked while circulating among the students to check for their understanding:

- What does the graph look like when you are not eating anything?
- Show me a place where you ate something with a lot of calories quickly. What happens to the graph at that time? Why?
- How can you tell on the graph when you are eating and when you are not? How can you tell if you are eating quickly or slowly?
- Can you point to the place on the graph where you ate for the second time during the day? What time was that meal? How many calories have you put in your body at that point? How do you know from the graph?
- At what time of day did you already put 1,000 calories in your body? How can you tell?

### **Class Discussion**

After all students have completed their first graph, discuss how they might graph the calories they burned during the 24-hour period using

# Am I Gaining or Losing Weight?

## LESSON 1.7

the same axes (Calories in body vs. Time). Students should understand that burning calories will remove them from the body, which corresponds to a negative number. To graph the data, then, students will need a negative region in the  $y$  direction. Show the class how to set up a graph with negative values on the  $x$  and  $y$  axes and how to name the four quadrants of the coordinate plane. Clarify that all of the data for this graph have negative  $y$  values, and thus the entire graph will lie below the  $x$  axis. There is no need for the 1st or 2nd quadrants. Further, time does not go in the negative direction, so there is no need for the 3rd quadrant either.

### **Individual Work**

Students now create their second graph and complete it for homework if necessary. Make sure that they are using the same axes and scale as in their graph of Calorie intake vs. Time.

### **Class Discussion**

After completing the graphs of calorie intake and calorie usage, ask students how they might more easily tell if they are losing or gaining weight at any given time. Remind students that it is really the net result of eating and activity that results in weight change, so the two graphs will have to be combined somehow. This process might be more useful if data were collected over a period longer than 24 hours, but students should understand that the method of graphical representation is valuable in many situations and that this is a simplified example.

Ask students to look at their two graphs and figure out if they had a net gain or loss of calories that day at 1:00 p.m. Have students explain how they came up with their answer. They will probably respond that they took the  $y$  coordinates of the caloric intake and caloric usage at 1:00 p.m. and added them together. Ask the class if this makes sense, and why. Then allow students to create their third graph, Net calories in the body vs. Time, by finding the sum of the  $y$  coordinates at each point in time on the graphs.

### **Lesson Closure**

Ask students to determine from their final graph whether they would be losing or gaining weight if they did exactly the same things every day as they did in those 24 hours. Make sure students understand that negative slope in this case does not necessarily mean you are losing weight. Weight is lost if the graph falls into the negative  $y$  region, which signifies an overall net loss in calories. Inversely, if at the end of the day your overall calorie intake is positive, you are gaining weight.

Tell the class that 1 pound of body fat is equivalent to 3,500 calories. Ask students to calculate the rate at which they would be losing or gaining weight based on the activity they just completed. Then have the class reflect on whether their analysis changed the way they thought about their individual fitness plans.

# Am I Gaining or Losing Weight?

## LESSON 1.7

### **Possible Prior Misconceptions**

Many students misinterpret graphs, especially the concept that slope represents a rate of change. Horizontal and vertical lines often cause trouble when talking about slope, as students tend to assume that horizontal lines signify moving at a positive constant pace rather than having a rate of 0.

Students may not be aware that in some contexts, graphs can be added together, as in this lesson.

Often students will not remember that when scaling a graph, each length interval should represent the same quantity to avoid distortion.

### **Student Assessment Artifacts**

Daily Activity Record worksheet

Calorie Intake Record worksheet

Graph of Caloric Usage During 24 Hours

Graph of Caloric Intake During 24 Hours

Graph of Net Caloric Intake

### **Variations and Extensions**

To avoid possible confusion, teachers may choose to graph caloric usage as a positive value and have students subtract that number from caloric intake at any given point in time.

Students may want to return to the  $x$  axis every time they graph the calories used during a new activity. Explain that the graph represents total calories burned at a given time during the day, and thus the results are cumulative. In other words, each coordinate point on their graph corresponds with Time Elapsed and Total Calories Burned So Far from their data table.

This lesson can be expanded to a formal discussion on slope and  $x$ - and  $y$ - intercepts.

Students can use the equations relating total calories burned to length of activity to solve for the time it takes to burn off certain foods. Ask students how long it would take to burn off the soda they just consumed in terms of hours of sleeping, walking, or swimming.

To determine how quickly weight is gained or lost, have students create a graph using the average rate of daily caloric loss/gain per day or week.

# Am I Gaining or Losing Weight?

## LESSON 1.7

### National and State Academic Standards

#### **NATIONAL NCTM Standards for School Mathematics**

##### *Algebra*

- Use mathematical models to represent and understand quantitative relationships.
- Analyze change in various contexts.

#### **CALIFORNIA Mathematics Content Standards**

##### *Algebra I*

- 5.0 Students solve multistep problems, including word problems, involving linear equations and linear inequalities in one variable and provide justification for each step.
- 6.0 Students graph a linear equation and compute the x- and y- intercepts (e.g., graph  $2x + 6y = 4$ ). They are also able to sketch the region defined by linear inequality (e.g., they sketch the region defined by  $2x + 6y < 4$ ).
- 15.0 Students apply algebraic techniques to solve rate problems, work problems, and percent mixture problems.

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

### Daily Activity Record

In the chart below, record all of your activity for a 24-hour period. Be sure to include anything that you do for longer than a few minutes, including sleeping, sitting, and standing. Attach another sheet if needed.

**Example:**

Activity	Time Started–Ended	Time Elapsed	Calories Burned/Hour	Total Calories Burned by Activity	Total Calories Burned So Far
Sleeping	10:00 p.m.–6:30 a.m.	8.5 hours	60	510	510
Getting ready for school (standing)	6:30 a.m.–7:00 a.m.	0.5 hours	120	60	570
Walking to school	7:00 a.m.–7:45 a.m.	0.75 hours	264	198	768

Activity	Time Started–Ended	Time Elapsed	Calories Burned/Hour	Total Calories Burned by Activity	Total Calories Burned So Far

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

### Calorie Intake Record

Fill out the Calorie Intake Record for a 24-hour period. Use your Diet Log from lesson 1.2 for your data. Attach another sheet if needed.

Food (type/quantity)	Time Started–Ended	Elapsed Time	Calories Consumed	Rate of Calorie Consumption	Total Calories Consumed So Far





# Nutrition and Society

## SUBUNIT 2 OVERVIEW

### Essential Question for This Unit

Should we care about what we eat? Why?

### Subunit Goals

In Subunit 2, students engage in a series of lessons that explore how society and their local culture shape attitudes about nutrition and health. They also have opportunities to contribute information and positive messages about nutrition and health back to their community. Students learn how the media shapes their views of physical attractiveness in ways that may or may not be consistent with actual physical health and how the prevalence of marketing and distribution of fast food products influences the average American diet. Students also produce informational materials in English and Spanish on healthy eating habits for youth in their communities.

### Subunit Key Questions

- How does the media influence our cultural norms regarding beauty? Are these norms aligned with physical health and wellness? (Health Science and Interpersonal Relations)
- How has the fast food industry shaped American diet and culture? (English Language Arts)
- How does legislation support and/or hinder healthy eating in Americans? (U.S. Government)
- What is the responsibility of the U.S. government in regulating food and diet? (U.S. Government)
- How healthy are foods from other cultures? How can we educate immigrants to the United States about healthy eating habits? (Spanish I)
- How can we encourage kids to make thoughtful decisions about eating? (English Language Arts)

### Lesson Summaries

Lesson	Subject	Description
2.1	Health Science, Interpersonal Relations, or English Language Arts	<b>Developing a Healthy Body Image</b> Students examine images from the media and discuss how beauty and health are portrayed and perceived by the American public.
2.2	Spanish I	<b>Alphabet of Healthy Foods</b> Students learn Spanish vocabulary associated with healthy eating and examine the nutritional content of popular Hispanic foods. Students also create and distribute Spanish language resources to promote healthy eating.
2.3	English Language Arts and U.S. Government	<b>Fast Food Nation</b> Students examine the role of fast food in American culture and discuss how the prevalence of convenience foods has influenced society. Students will read and discuss <i>Fast Food Nation</i> by Eric Schlosser and examine the perspectives of the various special interest groups associated with the food industry.
2.4	English Language Arts	<b>You Are What You Eat Speech Assignment</b> Students synthesize what they have learned about nutrition and health into an informative and engaging presentation for a middle school audience.



Subunit 2—Nutrition and Society

# Developing a Healthy Body Image

## LESSON 2.1

HEALTH SCIENCE,  
INTERPERSONAL RELATIONS,  
OR ENGLISH LANGUAGE  
ARTS

### Time

100 minutes

### Materials

#### Equipment

- Popular magazines
- Scissors
- Poster paper or newsprint
- Glue or tape
- Markers

### Resources

The following websites provide valuable information, worksheets, and further lesson suggestions:

- <http://www.advocatesforyouth.org>
- <http://www.mediaawareness.ca>
- <http://www.inthemix.org>
- <http://www.dairyCouncilofca.org>

### *Essential Question for This Unit*

Should we care about what we eat? Why?

### *Objectives*

After completing this lesson, students should be able to

- Recognize the effect the media has on attitudes about body image.
- Demonstrate increased awareness of their physical self and of media influences on their own self-image and behavior.
- Recognize that the physical changes occurring during puberty are healthy and normal.
- Explain the need to take good care of oneself by eating right, getting enough sleep, and being active as well as how these activities contribute to developing a positive body image.

### *Lesson Activities*

#### **Lesson Springboard**

Ask students to do a private and quick write-up (5 minutes) on how they feel about their own bodies. How would they describe their body? How would someone else describe their body? How do they feel about the words they used to describe themselves? No one will read the quick write-up; it is simply an exercise to think about their own body image before beginning the lesson. If any students feel comfortable sharing, ask them to discuss the things they thought about when considering their body image.

Ask the class to think about the factors that influenced their body image. Where did their ideas of “beautiful,” “healthy,” “ugly,” etc., come from? This lesson will examine the role popular media might have in determining body image.

#### **Lesson Development**

##### *Class Activity*

Prepare in advance several pieces of poster paper titled with adjectives that describe positive attributes regarding the body. Make two posters for each adjective: one for females, and one for males. Examples of titles could be Beautiful/Handsome, Healthy, Attractive, Unattractive, Stylish, Overweight.

Split the class into same-sex groups and assign each group to one of the posters. Hand each group several magazines and instruct them to cut out images that fit the title of the poster and to use them to create a collage. If they cannot find an image of an attribute they would like to add to

# Developing a Healthy Body Image

## LESSON 2.1

the poster, they can draw it or write the words using the markers provided. Allow 15–20 minutes for this activity.

When the groups have finished, post their collages around the room. Ask for complete silence. Then ask students to each take a pen or pencil and slowly circulate around the posters and look at them. If they have something constructive to add to the poster, they may **silently** add a word or image. No one is allowed to cross out another person's contribution, but everyone is allowed to contribute to any poster.

### ***Class Discussion***

Bring the class together and ask students to share their impressions of the activity. What did they notice? What do they think about the media's role in the creation of personal body image? You may also suggest that students answer these questions:

- Do you feel that your ethnic or racial group was represented in the magazines available? Does this signify anything about how society influences your body image? If so, how?
- Do you feel that the opposite sex feels more or less pressure to look a certain way, either in terms of physique or clothing?
- What attributes other than physical ones do we consider when we judge people?
- Look at the words and images on a poster with a positive adjective title. Think about the following questions: In order for you to become that adjective, what would you have to change? How can you make those changes? Are there any changes that would be impossible because of your beliefs, genetic make-up, and/or values and priorities?
- Do you think people judge you by the attributes displayed on the posters? Do you judge people that way? Do you want to be judged that way?
- Are these images of “normal” people/teens? What does normal mean in terms of a teenager's body?
- What are the influences that affect your body image other than the media?
- Were there any attributes that you wanted to add but could not find in the magazines? Where do you think those ideas (attributes) came from in your personal history?
- What do the people who create these images value? What, if anything, does it say about your values when you read these magazines?

### ***Lesson Closure***

Ask students to think of how this activity relates to their personal health and nutrition choices as well as the choices society makes. Have students write a journal entry about factors influencing their own body image and the body image of American teens in general. Students can reflect on whether these influences are appropriate, healthy, and balanced.

# Developing a Healthy Body Image

## LESSON 2.1

They can also reflect on what, if anything, they would like to change about their bodies and why those changes are important to them.

If time permits, students can return to their reflections the next day and compose a concrete plan to make the changes in their bodies that they would like to see. Or, the class can write a persuasive letter to advertisers addressing any changes they would like to see concerning the media's role in creating societal norms of physical appearance.

### ***Possible Prior Misconceptions***

Students may believe that body image is not affected by the media. They may not have realized the extent to which they feel pressure to look a certain way until asked to reflect upon it.

### ***Student Assessment Artifacts***

Quick write-up about body image

Group collages about body image

Journal entry about the media's influence on body image and goals for change

Organized plan to change body image

Persuasive letter/essay on how the media could change the message they are sending to teens about their body

### ***Variations and Extensions***

The lesson can be paired with a Health or Biology class that covers the natural changes adolescents can expect in their bodies and what can and cannot be done about each change.

Students can write a personal narrative on the past and present influences on their body image.

A health professional can be a guest speaker on the healthy and unhealthy ways to deal with a negative body image. She or he can also address how to support friends and peers to develop a more healthy body image.

# Developing a Healthy Body Image

## LESSON 2.1

### National and State Academic Standards

#### NATIONAL

##### NCTE Standards for the English Language Arts

1. Students read a wide range of print and non-print texts to build an understanding of texts, of themselves, and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment. Among these texts are fiction and nonfiction, classic and contemporary works.
4. Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
5. Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.
12. Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).

#### CALIFORNIA

##### English Language Arts Content Standards

###### *Writing*

- 2.1 Write biographical or autobiographical narratives or short stories.
- 2.4 Write persuasive compositions.
- 2.5 Write business letters.

###### *Listening and Speaking*

- 1.1 Formulate judgments about the ideas under discussion and support those judgments with convincing evidence.
- 1.2 Compare and contrast the ways in which media genres (e.g., televised news, news magazines, documentaries, online information) cover the same event.

# Alphabet of Healthy Foods

## LESSON 2.2

### SPANISH I

#### Time

50 minutes

#### Materials

##### Equipment

- White paper
- Colored pencils
- Overhead projector

#### Resources

- Create a Food Pyramid transparency from the United States Department of Agriculture website (<http://www.mypyramid.gov/index.html>)
- Food Pyramid worksheet
- Takeout menus from Mexican or Central or South American restaurants in your community

#### Prior Student Learning

Students should already have been introduced to the USDA Food Pyramid in their Health Science class.

### Essential Question for This Unit

Should we care about what we eat? Why?

### Objectives

After completing this lesson, students should be able to

- Use basic Spanish vocabulary related to food in writing and conversation.
- Describe how to create a healthy diet of Hispanic foods.

### Lesson Activities

#### Lesson Springboard

Cluster students into groups and distribute several takeout menus from local Mexican or Central or South American restaurants. Have each group identify what they believe is the healthiest item from the menu and report the conclusion, with justifications, to the rest of the class.

#### Lesson Development

##### Vocabulary

Pass out the Food Pyramid worksheet. Introduce the Spanish vocabulary associated with the Pyramid.

Grain	<i>Granos</i>
Vegetables	<i>Verduras</i>
Fruits	<i>Frutas</i>
Oils	<i>Aceites</i>
Dairy Products	<i>Productos Lácteos</i>
Meat and Beans	<i>Carnes y Frijoles</i>
Steps to a Healthier You	<i>Pasos Hacia Una Mejor Salud</i>

Have students fill in the vocabulary word for each of the six food groups on the worksheet chart. Each segment of the Food Pyramid corresponds to one of the six food groups and represents the relative amount of each food present in a healthy diet. Starting from left, the Pyramid segments are: grains, vegetables, fruits, oils, milk/dairy, and meat/beans. The chart also provides the color which corresponds with each food group. Have students color their Pyramids and then translate and answer questions at the bottom of the worksheet.

#### Poster Project

Assign students to groups of four and ask them to create a large poster of the Food Pyramid. All labels should be in Spanish, and the Food Pyramid should include names and illustrations of Hispanic foods that fall



# Alphabet of Healthy Foods

## LESSON 2.2

into each category. Students may wish to use their poster as a model for the Food Pyramid they will be including in the Book Project activity (discussed below).

After students become familiar with the vocabulary and the Pyramid, divide the groups into pairs. Have the pairs write a short skit that includes conversation about healthy eating using the new vocabulary. Allow some time for students to practice their skits.

### **Book Project**

Ask each student to create a resource about healthy eating for elementary-age students, called the “Alphabet Book of Healthy Foods.” Have students complete this assignment at home. The book should include

- A cover page
- An original drawing of the Food Pyramid labeled in Spanish, including drawings of common Hispanic foods for each category.
- For each letter of the alphabet, a picture of a healthy food beginning with that letter, the Spanish name, the English name, and (optional) a description of the nutritional benefits.

### **Lesson Closure**

Have students perform their skits for the class. Assess students on the extent to which they include new Spanish vocabulary and pronounce the words correctly.

### **Student Assessment Artifacts**

Completed Food Pyramid worksheet  
Food Pyramid poster  
Healthy Foods skit  
Alphabet Book of Healthy Foods

### **Variations and Extensions**

Take your class to a local elementary school to spend an afternoon teaching the younger students about both healthy eating and some basic Spanish vocabulary from their Alphabet Book of Healthy Foods.

Print out the “Anatomy of MyPyramid” handout from the U.S. Department of Agriculture website (<http://www.mypyramid.gov/index.html>) in either English or Spanish and have students translate it.

# Alphabet of Healthy Foods

## LESSON 2.2

### National and State Academic Standards

#### **NATIONAL**

#### **ACTFL Standards for Foreign Language Learning**

##### *Communication*

Standard 1.1: Students engage in conversations, provide and obtain information, express feelings and emotions, and exchange opinions.

Standard 1.2: Students understand and interpret written and spoken language on a variety of topics.

Standard 1.3: Students present information, concepts, and ideas to an audience of listeners or readers on a variety of topics.

##### *Connections*

Standard 3.1: Students reinforce and further their knowledge of other disciplines through the foreign language.

#### **CALIFORNIA**

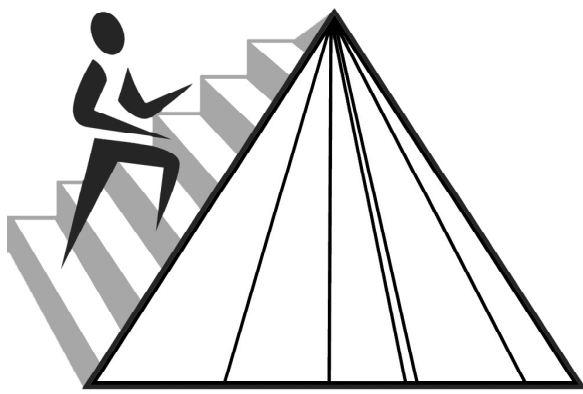
California has no curriculum standards for foreign language at this time.

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## Food Pyramid

Fill in the chart with the Spanish vocabulary for each food group. Color in the Pyramid with the colors shown on the chart, starting with orange for the left-most segment.

Grains	Vegetables	Fruits	Oils	Dairy Products	Meat & Beans
<i>Anaranjado</i>	<i>Verde</i>	<i>Rojo</i>	<i>Amarillo</i>	<i>Azul</i>	<i>Púrpura</i>



**MyPyramid.gov**  
STEPS TO A HEALTHIER YOU

Translate each of the following questions into Spanish, and answer them in Spanish; also place two of your answers—as examples—in the boxes above:

1. What foods are in the grain group?

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---

2. What foods are in the vegetable group?

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3. What foods are in the fruits group?

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---

4. What foods are in the oils group?

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Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

5. What foods are in the dairy products group?

---

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6. What foods are in the meat and beans group?

---

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# Fast Food Nation

## LESSON 2.3

### ENGLISH LANGUAGE ARTS AND U.S. GOVERNMENT

#### Time

1 week

#### Materials

- *Fast Food Nation* by Eric Schlosser (2001)
- Video: *Super Size Me* by Morgan Spurlock (2004)
- Questions from Congress handout

#### Prior Student Learning

Assign students to read *Fast Food Nation* before beginning this lesson.

Students should know how a Congressional bill is written and transformed into law. They should have a grasp of the U.S. Constitution, federal versus state authority, and limits on the power of government.

### **Essential Question for This Unit**

Should we care about what we eat? Why?

### **Objectives**

After completing this lesson, students should be able to

- Critically evaluate nonfiction text.
- Deliver oral presentations based on research.
- Discuss possible roles for localities, states, and the federal government to reduce obesity within the context of creating public policy at various levels of government.

### **Lesson Activities**

#### **Lesson Springboard**

Read the following excerpt from a review of the book *Fast Food Nation* by Eric Schlosser:

“It’s hardly news that fast food has become a way of life in America. But the facts and figures are startling nonetheless: On any given day, Schlosser writes, about a quarter of the adult population visits a fast food restaurant. Every month about 90 percent of American children between the ages of 3 and 9 visit a McDonald’s. We spend \$110 billion a year on fast food. The typical American now consumes approximately three hamburgers and four orders of French fries every week ... An estimated one out of eight U.S. workers has at some point toiled in a McDonald’s. The roughly 3.5 million fast food workers are by far the largest group of minimum wage earners in the United States.” (Marjorie Williams, *Any Given Hamburger*, 2001, <http://www.slate.com/id/2000232/entry/1007010/>)

Ask students what is their opinion of McDonald’s and its enormous impact on the world. What are its positive effects? What are its negative effects?

#### **Lesson Development**

##### **Reading Assignment and Discussion**

Have students read *Fast Food Nation*, or excerpts from the book. Have students consider the following questions:

- What does the author of *Fast Food Nation* say about the origins of fast food?
- Why did the American diet change in the early 20th century?
- Compare the changes described in *Fast Food Nation* to the ones found in the historical readings you have examined.

Subunit 2—Nutrition and Society  
*Fast Food Nation*

LESSON 2.3

Fast food reaches out toward the consumer, in a thousand kinds of advertising, and then back toward the producer, shaping entire industries such as cattle raising and the farming of corn. Discuss its impact on American institutions such as

- Mass media
- Children’s culture (TV, tie-ins with movies, toys, etc.)
- Agribusiness and the family farm
- Employment (the job market, teen employees, etc.)
- Local communities

**Video and Discussion**

Show the video *Super Size Me* in class, or have students rent and watch it at home. Compare the book *Fast Food Nation* with *Super Size Me*. What points do they make about fast-food’s effects on health? How are they consistent and how do they differ? How might the fast-food industry reply to each?

Extend the discussion to the role of federal and state government in contributing to the nation’s health and management of obesity. What does *Fast Food Nation* recommend we do to reform our eating habits? Or reform the food industry? What are the obstacles to reform? And what specific role can the government play?

Ask students to brainstorm about the government’s role in several areas. These might include making reforms in

- Media and marketing
- Standards for diets in schools and other public institutions
- Production and distribution of food
- Lifestyle choices for Americans

**Teacher Preparation**  
You will serve as the Congressional committee. If possible, recruit additional teachers for your committee.

**Mock Congressional Hearing—Research**

Divide students into six groups. Tell the groups they will be presenting testimony, and answering questions, before a Congressional committee on nutrition. Their job is to (1) provide information for the committee as it drafts a Food Reform Act (meant to improve the nation’s health and, specifically, to reduce obesity) and (2) influence the outcome of this legislation. Each group will testify for about 15 minutes. Four groups will represent “reformers”: citizen activists who specialize in (1) the media, (2) the food industry, (3) schools and prisons, and (4) fast-food regulation. The fifth and sixth groups will represent the food industry and the media. What would their positions be? Why? Would they want to change or support the status quo? Would they support or oppose government regulation?

Pass out the Questions from Congress handout, a brief guide to the questions that the committee will pose to each group. Explain to students that they will be proposing ideas, using their knowledge from reading

Subunit 2—Nutrition and Society  
*Fast Food Nation*

LESSON 2.3

*Fast Food Nation*, for reforming various aspects of the food industry. Each group will likely need to conduct some additional research. Some possible websites they might visit include the following:

- <http://www.foodmuseum.com/issuesschoollunch.html>
- <http://www.bestfoodnation.com/>
- <http://www.slate.com/id/2000232/entry/1007010/>
- <http://www.corpwatch.org/article.php?id=11984>
- [http://www.loc.gov/today/cyberlc/feature\\_wdesc.php?rec=4047](http://www.loc.gov/today/cyberlc/feature_wdesc.php?rec=4047)

In addition to proposing reforms in its field, each group will need to give reasons for these reforms and, if possible, outline implementation procedures and costs. Each group should present no more than three reform proposals based on their research about their special interest. Each group's task is to construct answers to the Questions from Congress that express their special interest perspective.

They may divide the labor any way they choose; however, each group must (1) appoint a secretary to take notes (three pages minimum) and make one copy to be turned in at the end of Class 2 and (2) submit a three-page paper summarizing their testimony.

***Mock Congressional Hearing—Testimonies***

Allow each group 15 minutes to present their reform proposals. The format may vary, but it is recommended that half the time be reserved for a presentation and the other half for answering questions from the Congressional committee (teacher). A few suggestions:

- Groups may address points made by other groups but not pose questions to them.
- Any member of a group may answer a question, and several groups may combine to answer a question.

**Lesson Closure**

After the testimonies are complete, conduct a debriefing of the hearing with the entire class. What did they learn about the American diet and the industries and services that contribute to it? Which areas are most important to reform? Within each area, which reforms seem most important? Which seem least important? Which seem most practical or cost-effective?

***Possible Prior Misconceptions***

Students may not know that both the federal and state governments have the authority to regulate foods.

Students may not realize that the food industry is aggressively involved in politics, through lobbying and financial contributions to campaigns.



### ***Student Assessment Artifacts***

Group testimonies

Paper summarizing each group's presentation

### ***Variations and Extensions***

Have students play the role of the Congressional committee and design their own questions.

Groups may develop their three-page papers into letters they send to their school board, local or state officials, food-advocacy groups, and to their Congressional representative.

Students may research the history of Congressional testimony on food-related issues over the past 10 years and add this research to the information that future students will use for this lesson.

## **National and State Academic Standards**

### **NATIONAL NCTE Standards for the English Language Arts**

1. Students read a wide range of print and non-print texts to build an understanding of texts, of themselves, and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment. Among these texts are fiction and nonfiction, classic and contemporary works.
5. Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.
6. Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language, and genre to create, critique, and discuss print and non-print texts.
7. Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources (e.g., print and non-print texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.
8. Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.

### **CALIFORNIA English Language Arts Content Standards**

#### ***Reading***

- 2.0 Students read and understand grade-level-appropriate material. They analyze the organizational patterns, arguments, and positions advanced.

#### ***Writing***

- 1.0 Students write coherent and focused essays that convey a well-defined perspective and tightly reasoned argument. The writing demonstrates students' awareness of the audience and purpose.

#### ***Listening and Speaking***

- 1.0 Students formulate adroit judgments about oral communication. They deliver focused and coherent presentations of their own that convey clear and distinct perspectives and solid reasoning. They use gestures, tone, and vocabulary tailored to the audience and purpose.

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## Questions from Congress

You've arrived, I'm sure, with many ideas for reform. But the Food Reform Act we are considering must take account of priorities. How do you determine which of your proposals are most important? And which are most practical or cost-effective?

Do your ideas for reform fall within the authority of the federal government to carry out? If so, can you cite a precedent or two for what you're trying to achieve? If not, can your ideas be implemented by state government? Can they be implemented through voluntary action by individuals?

Will your reforms raise taxes? Reduce employment?

How do we know that your ideas will actually improve our people's health and, specifically, reduce obesity? Are there studies that show this?

Members of the committee are free to ask additional questions, of course, especially if they pertain to the topic on which the group is testifying.



# You Are What You Eat Speech Assignment

## LESSON 2.4

### ENGLISH LANGUAGE ARTS

#### Time

100 minutes

#### Materials

- Informational Speech handout
- Informational Speech Rubric

#### Prior Student Learning

Students should have completed the majority of lessons from Subunits 1 and 2 before this lesson.

### *Essential Question for This Unit*

Should we care about what we eat? Why?

### *Objectives*

After completing this lesson, students should be able to

- Synthesize what they have learned during their study of nutrition and health.
- Prepare and deliver an informational speech about what they have learned.
- Use visual aids to illustrate their information and enrich their delivery for both verbal and visual learners.
- Work collaboratively in small groups to reach a mutual goal.

### *Lesson Activities*

#### **Lesson Springboard**

Ask students to think about the most boring class they have had and what could have been done to make it more interesting. Tell them their assignment will be to create a speech or presentation about what they have learned about nutrition and health that will be both informative and interesting to an audience like themselves.

#### **Lesson Development**

Pass out the Informational Speech handout. Students will be synthesizing the information they've learned so far into an information speech on nutrition designed for middle school students.

In creating a speech or presentation, it is important that students keep in mind the following academic elements of persuasion:

- **Body language**—Students need to have a proper posture. If their shoulders are sagging and their legs are crossed, they will not appear as sincere and people will not accept their message
- **Articulation**—Articulation refers to the total vocal process. There are several steps to this process that students must understand. First, they need to get air from their lungs, their vocal cords in their larynx must be working, their mouth and tongue must be in sync, and they need enough saliva in their mouths to keep things oiled.
- **Pronunciation**—Students need to pronounce each word. They must avoid slang, except to make a point, and not slur their words. They must avoid saying filler words such as “you know,” “like,” and “um.”

# You Are What You Eat Speech Assignment

## LESSON 2.4

- **Pitch**—Pitch refers to the highs and lows of the voice. Whatever they do, they must avoid a monotone!
- **Speed**—The speed, or pace, of the voice is an important variable to control. Between 140–160 words per minute is the normal pace for a persuasive speech—any faster may appear to be glib; any slower sounds like lecturing. If students are not sure about the speed of their voice, tape them for 1 minute and then replay it and count the number of words they used. The human ear and brain can compile and decode over 400 spoken words per minute, so if they are speaking too slowly, their listeners’ minds will wander as they find other ways to keep themselves occupied.
- **Pauses**—The pause, or *caesura*, is a critical persuasive tool. When students want to emphasize a certain word, have them pause for one second before; this highlights the word. If they really want to punch it, tell them to pause before and after the word.
- **Volume**—Volume is another good tool for a persuasive speech, but students should use it with caution. If they scream all the way through their speech, people will become accustomed to it, and the speech will lose its effectiveness. On the other hand, a few well-timed shouts can liven up the speech. They must try to “project,” or throw, their voice out over the entire class, or speak to the last row.
- **Quality**—Quality of voice is gauged by the overall impact a voice has on listeners. It is the net caliber of the voice, its character and attributes. A student must try to keep the vocal quality high; it is what separates their voice from everyone else’s.
- **Variance**—Variance of vocal elements is the most important consideration of all. Have students try to vary their pitch, volume, and speed at least once every 30 seconds. Never let them go more than one paragraph without a vocal variance. This keeps the class locked into the speech, if for no other reason than it sounds interesting. Let the students’ words speak for themselves—reflect their nature through their voices. If they use the word “strangle,” have them say it with a hint of menace in their voices. If they say the word “heave,” let the class feel the onomatopoeic force behind it. If they say the word “bulldozer,” make it sound like a titan earthmover, not like a baby with a shovel.

### Lesson Closure

Allow students to start working on their speeches and their delivery in class.

### Student Assessment Artifacts

Speech

### Variations and Extensions

Arrange for students to deliver their speeches to local middle school students in addition to their own class.

# You Are What You Eat Speech Assignment

## LESSON 2.4

### National and State Academic Standards

#### **NATIONAL**

##### **NCTE Standards for the English Language Arts**

4. Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
5. Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.
6. Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language, and genre to create, critique, and discuss print and non-print texts.

#### **CALIFORNIA**

##### **English Language Arts Content Standards**

##### *Listening and Speaking*

- 1.0 Students formulate adroit judgments about oral communication. They deliver focused and coherent presentations of their own that convey clear and distinct perspectives and solid reasoning. They use gestures, tone, and vocabulary tailored to the audience and purpose.
- 2.0 Students deliver polished formal and extemporaneous presentations that combine the traditional rhetorical strategies of narration, exposition, persuasion, and description. Student speaking demonstrates a command of standard American English and the organizational and delivery strategies outlined in Listening and Speaking Standard 1.0.

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## Informational Speech

### Why Teens Should Care About What They Eat

Based on what you have studied in the Nutrition and Health Unit, give a speech on the topic. You have examined some key questions in your various classes, especially Biology and Interpersonal Relations classes, and thought about why good nutrition is important to you.

Since good physical health is a big topic of public discussion and there has been a good deal of attention given to it locally, you are assigned to teach upper elementary and middle school students what you have learned. Specifically, explain whether or not it is important for teenagers to be concerned about what they eat and why.

**Synthesize everything you have learned about good nutrition. Explain—through a speech—what upper elementary or middle school students should know about good nutrition.**

Be sure to think about

- What the physical, behavioral, and psychological effects of a “junk food” diet are.
- What role family traditions play in choosing foods to eat.
- What role a person’s self-image plays in choosing foods to eat.
- Whether good nutrition is solely a personal responsibility or society’s responsibility as well.

### “Yes List”

To receive a grade on this assignment, you must be able to answer “yes” to the following questions:

- Do you have a presentation plan that includes the Essential Question, at least three subtopics, the roles of each member in the group, and a timeline for completing the presentation?
- Have you used graphic organizers to synthesize the information learned in all of your classes?
- Do you have an outline or note cards to use during your speech?
- Does your speech have an introduction, body, and conclusion?
- Do you explain where you learned the information used in your speech?
- Do you have visual aids to illustrate what you say in your speech?
- Is your group’s presentation 10–15 minutes long and is your part of the speech at least 3–5 minutes long?

### Grading

Your speech will be scored using the Informational Speech Rubric below (75 points) and the “Yes List” (25 points) above.

### Due Date

You must be ready to present by \_\_\_\_\_. The decision about who begins making presentations will be made that day.

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## Informational Speech Rubric

Comments:

Rubric _____ /75
Yes List _____ /25
<b>Total</b> _____ /100

75—Proficient	56—Adequate	37—Beginning
<input type="checkbox"/> The speaker states a clearly focused and original thesis about the issue or problem.	<input type="checkbox"/> The speaker states a general thesis about the issue or problem.	<input type="checkbox"/> The speaker states a vague thesis, if any, about the issue or problem.
<input type="checkbox"/> The speaker synthesizes and uses ample specific, accurate, and relevant information from biology, algebra, and Interpersonal Relations to support the thesis and his/her claims.	<input type="checkbox"/> The speaker synthesizes and uses some specific, accurate, and relevant information from biology, algebra, and IPR to support the thesis and his/her claims.	<input type="checkbox"/> The speaker uses some information from biology, algebra, and IPR to support his/her main points, but leaves questions unanswered.
<input type="checkbox"/> The speaker clearly indicates where information comes from.	<input type="checkbox"/> The speaker usually indicates where information comes from.	<input type="checkbox"/> The speaker fails to indicate where information comes from.
<input type="checkbox"/> The speaker vividly and fully explains the effects of a junk-food diet.	<input type="checkbox"/> The speaker generally explains the effects of a junk-food diet.	<input type="checkbox"/> The speaker basically fails to explain the effects of a junk-food diet.
<input type="checkbox"/> The speaker vividly and fully explains the roles self-image and family traditions play in deciding what people eat.	<input type="checkbox"/> The speaker generally explains the roles self-image and family traditions play in deciding what people eat.	<input type="checkbox"/> The speaker basically fails to explain the roles self-image and family traditions play in deciding what people eat.
<input type="checkbox"/> The speaker specifically and convincingly explains whether good nutrition is only a personal responsibility or also society's responsibility.	<input type="checkbox"/> The speaker generally explains whether good nutrition is only a personal responsibility or also society's responsibility.	<input type="checkbox"/> The speaker basically fails to explain whether good nutrition is only a personal responsibility or also society's responsibility.
<input type="checkbox"/> The speaker includes visual aids that clearly illustrate his/her main points and enhances the understanding of his/her message by being organized, complete, and visually pleasing.	<input type="checkbox"/> The speaker includes visual aids that generally relate to his/her main points or that may be somewhat disorganized, incomplete, or visually distracting.	<input type="checkbox"/> The speaker may or may not include visual aids that relate to his/her main points and generally is somewhat disorganized, incomplete, or visually distracting.
<input type="checkbox"/> The speaker has a voice that is clear and audible, makes eye contact, and generally expresses deep interest in—maybe some passion for—his/her subject.	<input type="checkbox"/> The speaker audibly articulates, attempts to make eye contact, and generally expresses interest in his/her subject.	<input type="checkbox"/> The speaker is hard to hear and understand, makes virtually no eye contact, and generally expresses indifference or dislike for his/her subject.





# Nutrition in the World

## SUBUNIT 3 OVERVIEW

### Essential Question for This Unit

Should we care about what we eat? Why?

### Subunit Goals

In Subunit 3, students explore food production and availability around the world. They explore the incidence and geographic distribution of hunger and famine, including the various political and economic factors that contribute to the problem. Students write their personal reactions to the disparity of food availability and discuss the responsibility of the international community to ensure the nutrition and health status of the world's population.

Students also study how food production has been affected by advances in genetic science and debate the potential advantages and disadvantages of genetically modified foods in the market.

### Subunit Key Questions

- How are issues of nutrition and health viewed in other countries around the world? (World History or World Geography)
- What is the experience of people without enough to eat on a regular basis? How can those experiences be shared in a meaningful way? (English Language Arts)
- Whose responsibility is the problem of world hunger? What role should the international community play in monitoring and feeding the population of other countries? (World History or World Geography, English Language Arts)
- How can plants and animals be purposefully altered to improve their capacity as agricultural products? Should organisms be altered to serve the needs of the human race? What are the potential consequences of doing so? (Biology)
- How can seemingly small economic actions result in large change? (Algebra I)

### Lesson Summaries

Lesson	Subject	Description
3.1	English Language Arts	<b>Arithmetic of Hunger</b> Students are introduced to the experiences and implications of hunger around the world, and they write their personal reactions to the effects of hunger.
3.2	World History or World Geography	<b>World Hunger</b> Students study several well-known famines in history and their underlying causes, exploring the complex interactions among politics, economics, and food production and distribution.
3.3	Biology	<b>Genetically Modified Foods</b> Students apply their knowledge of genetics to the field of genetic engineering in agriculture. They explore several examples of genetically engineered foods and consider the potential advantages of and concerns about such modifications in the food source.
3.4	Algebra I	<b>The Power of Two</b> Students learn about and graph exponential functions. They project the potential success of a micro-credit bank—with a mission to alleviate hunger—by demonstrating the growth in capital that would result from an exponential increase in investments.



Subunit 3—Nutrition in the World

# Arithmetic of Hunger

## LESSON 3.1

### ENGLISH LANGUAGE ARTS

#### Time

45 minutes

#### Materials

- Arithmetic of Hunger worksheet and answers
- “Arithmetic of Poverty” poem
- Country/Food Cards
- World Hunger Country Reports

#### Prior Student Learning

Students should be able to identify major countries on a map.

Students should know a few key features of “underdeveloped countries.”

### *Essential Question for This Unit*

Should we care about what we eat? Why?

### *Objectives*

After completing this lesson, students should be able to

- Understand the experience and implications of hunger in poor countries.
- Convey their response to the issue of world hunger in a poem or essay.

### *Lesson Activities*

#### **Lesson Springboard**

Hand out the Arithmetic of Hunger worksheet and ask students to fill it in based on the knowledge they bring to class. Students will not know many of the answers, which is fine. Before presenting the actual facts on world hunger, ask students to share their answers and record them on the board. Note and discuss the discrepancies between the students’ beliefs and the facts.

#### **Lesson Development**

##### *Poem and Class Discussion*

Ask students to remember a time when they were very hungry. Go around the room and have a few students share their memories.

Pass out and have students read the poem “The Arithmetic of Poverty.” What message is the poem attempting to convey? Is this a realistic situation? Who or what might the mother hate? Invite students to put themselves in the place of a poor person confronting hunger in the United States or the underdeveloped world. What feelings and thoughts does this evoke?

##### *Small Group Discussion*

Divide the students into 10 groups. Ask a representative from each group to draw a card from a hat. On each card is the name of a country and the foods that make up a typical evening meal there. For example:

- United States: chicken with mashed potatoes and gravy, asparagus, Caesar salad, and dessert
- Ethiopia: corn meal porridge, vegetable every other day
- Italy: spaghetti marinara, green vegetable, fruit, cheese, wine
- Japan: sushi cake w/tuna and vinegar rice, radishes and carrots, miso soup, spinach in soy broth, tea
- Egypt: okra, 3 ounces of mutton, bulgar wheat, tomato

Subunit 3—Nutrition in the World  
*Arithmetic of Hunger*

LESSON 3.1

- Ecuador: potato soup with cabbage, homegrown turnips, tamales without meat
- Mongolia: mutton dumplings, onion, cucumber, yogurt, bread
- Mali: 1 cup rice, tomato every other day
- Turkey: zucchini, shredded wheat soup with tomatoes, eggplant with onion, flatbread
- Bangladesh: 1 cup lentil soup, one-half potato with curry

Have students share their thoughts about their dinners, first within their groups and then with the entire class. Explain that 10% of the world dines as well as the average American (ask 10% of students in class to stand up) and that 40% dines no better than the average citizen of Bangladesh (ask 40% of students to stand up). Discuss the implications of these statistics in terms of cross-national differences in nutrition and health.

- What effect does poor nutrition have on brain development and learning?
- Can children concentrate in class when they come to school hungry nearly every day?
- Can adults devote themselves to productive work if getting enough food is their full-time preoccupation?

**Lesson Closure**

Have students write a 200-word essay on their “hunger thoughts” inspired by the poem and the lesson.

***Possible Prior Misconceptions***

Students may think of hunger as merely a signal to eat, not as a debilitating condition.

Students may believe that a single factor (e.g., bad weather) causes widespread hunger and famine, rather than multiple factors, including political mismanagement or oppression.

***Student Assessment Artifacts***

200-word response to the poem “The Arithmetic of Poverty”

***Variations and Extensions***

Students’ “hunger thoughts” may be developed into a poem.

In groups, students could generate ideas about how to alleviate world hunger. These may include reforms on the individual or local level or larger political solutions.

Class presentations on the World Hunger Country Reports.

## National and State Academic Standards

### **NATIONAL**

#### **NCTE Standards for the English Language Arts**

1. Students read a wide range of print and non-print texts to build an understanding of texts, of themselves, and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment. Among these texts are fiction and nonfiction, classic and contemporary works.
2. Students read a wide range of literature from many periods in many genres to build an understanding of the many dimensions (e.g., philosophical, ethical, aesthetic) of human experience.
3. Students apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts. They draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies, and their understanding of textual features (e.g., sound-letter correspondence, sentence structure, context, graphics).

### **CALIFORNIA**

#### **English Language Arts Content Standards**

##### *Reading*

- 3.0 Students read and respond to historically or culturally significant works of literature that reflect and enhance their studies of history and social science. They conduct in-depth analyses of recurrent patterns and themes.

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## Arithmetic of Hunger

1. Americans make up \_\_\_\_\_% of the world's population and consume \_\_\_\_\_% of the world's resources.
2. Among the world's 6.3 billion people, \_\_\_\_\_ suffer from malnutrition.
3. Each day about \_\_\_\_\_ people die as a result of malnutrition.
4. In India \_\_\_\_\_% of people are malnourished, whereas in the United States \_\_\_\_\_% are dieting or planning to diet.
5. In the less developed countries, average life expectancy is \_\_\_\_\_ years, while in the developed countries it is \_\_\_\_\_ years.
6. When typical Americans say that they're hungry, what do they usually mean? When people living in extreme poverty say this, what do *they* mean? What is your own definition of hunger?
7. What are the major causes of world hunger?
8. What are three possibilities for reducing world hunger?

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## Arithmetic of Hunger: Answers

1. Americans make up 6% of the world's population and consume 40% of the world's resources.
2. Among the world's 6.3 billion people, 750 million suffer from malnutrition.
3. Each day about 50,000 people die as a result of malnutrition.
4. In India, 50% of people are malnourished, whereas in the United States about 75% are either dieting or planning to diet.
5. In the less developed countries, average life expectancy is 40–50 years, while in the developed countries it is 70–80 years.
6. When typical Americans say that they're hungry, they usually mean that they feel symptoms of vague discomfort, such as rumblings in the stomach, which are signaling them to eat. When people in extreme poverty say this, they are usually severely weak, in ceaseless pain, and sick with parasites, diarrhea, or infectious disease. They think about food all the time and often dream about it.
7. Among the causes of world hunger are drought; lack of clean water or arable land; low rates of education and literacy, especially among women; disease; and overpopulation. These may, in turn, be the results of social and political inequality. Political oppression is often a direct or indirect cause of hunger, as well. Also contributing to poverty and, therefore, to hunger are misallocation of resources, especially land; export production at the expense of domestic production; and low-wage labor in industry and agriculture.
8. World hunger may be reduced through many approaches. These include raising the level of health and education, especially in rural areas; providing low-interest loans for businesses and farms; investing in appropriate technology, from irrigation, farm equipment, and seeds to the infrastructure of communications and transport; and addressing the problems of foreign debt and tariffs that prevent poor nations from selling their food abroad. Political corruption must also be reduced, as must tax evasion by the rich and the "brain drain" that sends educated professionals from their native countries to the affluent nations of the West. These reforms can be made through the efforts of national governments, non-governmental organizations, charities, and international agencies like the United Nations.



Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## The Arithmetic of Poverty

*Decide, mother  
who goes without.  
Is it Rama, the strongest?  
or Baca, the weakest  
who may not need it much longer  
or perhaps Sita?  
who may be expendable.  
Decide, mother  
kill a part  
of yourself  
as you resolve the dilemma.  
Decide, mother  
decide ...  
and hate.*

by Appadura  
(India)

Source: *Overcoming World Hunger—The Challenge Ahead*, Presidential Commission on World Hunger, 1980.

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## Country/Food Cards

The cards that students will draw for their discussion of typical dinners around the world should include these, but others may be added depending on the teacher's own interests.

<p><b>UNITED STATES</b></p> <p>Chicken with mashed potatoes and gravy, asparagus, Caesar salad, and dessert</p>	<p><b>ETHIOPIA</b></p> <p>Corn meal porridge, vegetable every other day</p>
<p><b>ITALY</b></p> <p>Spaghetti with marinara sauce, green vegetable, fruit, cheese, wine</p>	<p><b>JAPAN</b></p> <p>Sushi cake with tuna and rice vinegar, radishes and carrots, miso soup with spinach, tea</p>
<p><b>EGYPT</b></p> <p>Okra, 3 ounces of mutton, bulgar wheat, tomato</p>	<p><b>ECUADOR</b></p> <p>Potato soup with cabbage, turnips, meatless tamales</p>
<p><b>MONGOLIA</b></p> <p>Mutton dumplings, onion, cucumber, yogurt, bread</p>	<p><b>MALI</b></p> <p>1 cup of rice, tomato every other day</p>
<p><b>TURKEY</b></p> <p>Zucchini, shredded wheat soup with tomatoes, eggplant with onion, flatbread</p>	<p><b>BANGLADESH</b></p> <p>1 cup lentil soup, one-half potato with curry</p>

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## World Hunger Country Reports

Each student or group member will report on an assigned country. If working in a group, each group member will have 1 to 2 minutes for reporting on his/her portion of the assignment. The following items should be included in the report:

**COUNTRY:** Identify your country. Give an overview about the population, economics, agriculture, terrain, exports, and imports. Familiarize the class with the country.

**MAP:** Display a map of the country big enough for the class to see.

**HUNGER:** Explain the reasons for hunger in the country (national catastrophe, drought, over-population, lack of education, political repression, etc.). Include photos, where appropriate.

**FOOD:** Describe the diet of the people. Give three to five of the main foods that are eaten daily. Describe a typical diet, foods used to celebrate, and other traditional food information.

Subunit 3—Nutrition in the World

# World Hunger

## LESSON 3.2

### WORLD HISTORY OR WORLD GEOGRAPHY

#### Time

120 minutes

#### Materials

Computer lab with Internet access

#### Prior Student Learning

Students should be familiar with the basic nutritional needs for the average person.

Students should be familiar with conducting research on the Internet.

### *Essential Question for This Unit*

Should we care about what we eat? Why?

### *Objectives*

After completing this lesson, students should be able to

- Describe major famines, including their geographic locations, and accurately identify their causes.
- Apply knowledge about the complexity of hunger and famine to propose preventative measures and possible solutions.

### *Lesson Activities*

#### **Lesson Springboard**

Famines occur for many reasons. Often there are factors involved besides food shortage or drought. For example, during the Great Irish Famine (1845–1849), it is estimated that millions of Irish died after the blight (destructive infection) of the potato (their main food source) dramatically reduced the food supply. At the same time, absentee English landlords exported food from Irish farms to England where it commanded higher prices.

During China’s “Great Leap Forward” (1959–1961), the ruler of China attempted to industrialize the Chinese economy. Industrial machinery required steel. The people of China melted down many metal products, including some farming tools and tractors, to increase steel production. China’s attempt to industrialize failed, and the resulting decrease in grain production led to a disastrous famine in which an estimated 10 to 40 million people died.

In 1984, Ethiopia suffered famine in which an estimated 1 million people died. This famine was spurred by drought and crop failure and was exacerbated by the government’s inability to provide aid. International media exposure prompted extensive world aid.

#### **Lesson Development**

##### *Class Discussion*

Ask students what they think about when they hear the word “famine.” What geographic regions of the world do they associate with it? What do they feel is the most likely cause of any large famine? Common answers may relate to food shortage or weather. Ask students whether it is possible for a country to plant, grow, farm, and export food to another country for profit while millions of its citizens starve to death? Discuss the various causes of famine, including political instability, poverty, and inadequate food distribution. Food shortage is only one cause.

# World Hunger

## LESSON 3.2

### **Group Work**

Students should work in groups of five or six. Each group should be assigned one of the famines listed below:

- The Great Irish Famine 1845–1849
- Ukraine Famine (Stalin) 1932–1933
- Bengal Famine of 1943
- The Great Leap Forward 1959–1961
- Ethiopian Famine 1984
- North Korean Famine 1996–1999

Instruct students to research these famines as a team. Students can delegate to each group member one facet of their assigned famine (i.e., the people affected, the economy, the government's role, the causes, the consequences, the solution, and images of life during the period). Students should compile their research into a report that addresses the following questions:

- Where is the country (on the map), and why were its people vulnerable to famine?
- What caused the famine: man, nature, or both?
- Was it preventable? How?
- What happened to the economy (exports, imports, or foreign aid) during the famine?
- What were the consequences (death, emigration, etc.)?
- How did the famine end?
- What is the status of that country now?
- Is the country susceptible to future famines? Why or why not?

### **Presentations**

Working in the same groups, students can present their information to the class using PowerPoint presentations (or maps created on construction paper) to show locations of countries and any relevant images found on the Internet. The questions listed above should be answered and students should present any other interesting information that they have collected. Students should also present images (retrieved and printed from the Internet) that accurately depict their assigned famine.

### **Lesson Closure**

Ask the class if their views about famine and its causes have changed. If so, why and how? Do they feel that the governments of these countries did all that they could to prevent famine? Where they did not, what are possible explanations? What is the responsibility of the international community regarding these issues? Explain that there is a less obvious problem called hunger and that many people, including Americans, suffer from this. Who is responsible for addressing this problem in the United States?

# World Hunger

## LESSON 3.2

### ***Possible Prior Misconceptions***

Many students may believe that famine and hunger are caused by food shortages. Often famine is a complex problem arising from a combination of factors, including the misallocation of food, ill-advised economic policies, poverty, and political incompetence or corruption.

### ***Student Assessment Artifacts***

Famine presentation

### ***Variations and Extensions***

Students can research current events related to famine and also explore the history of public policies designed to alleviate hunger in the United States and other developed countries. Or, they can explore the complex relationships involving poverty, hunger, and obesity. How can some people be “too fat” when they don’t have enough money to purchase nourishing food?

## National and State Academic Standards

### NATIONAL NCSS Curriculum Standards for Social Studies

#### I. Culture

Social studies programs should include experiences that provide for the study of culture and cultural diversity, so that the learner can:

- a. analyze and explain the ways groups, societies, and cultures address human needs and concerns;

#### III. People, Places, and Environments

Social studies programs should include experiences that provide for the study of people, places and environments, so that the learner can:

- a. refine mental maps of locales, regions, and the world that demonstrates understanding of relative location, direction, size, and shape;
- b. create, interpret, use, and synthesize information from various representations of the earth, such as maps, globes, and photographs;
- j. analyze and evaluate social and economic effects of environmental changes and crises resulting from phenomena such as floods, storms, and drought;
- k. propose, compare, and evaluate alternative policies for the use of land and other resources in communities, regions, nations, and the world.

#### VI. Power, Authority, and Governance

Social studies programs should include experiences that provide for the study of how people create and change structures of power, authority, and governance, so that the learner can:

- a. examine persistent issues involving the rights, roles, and status of the individual in relation to the general welfare;
- f. analyze and evaluate conditions, actions, and motivations that contribute to conflict and cooperation within and among nations;

### CALIFORNIA History–Social Science Content Standards

#### Chronological and Spatial Thinking

1. Students compare the present with the past, evaluating the consequences of past events and decisions and determining the lessons that were learned.
2. Students analyze how change happens at different rates at different times; understand that some aspects can change while others remain the same; and understand that change is complicated and affects not only technology and politics but also values and beliefs.

#### Historical Interpretation

1. Students show the connections, causal and otherwise, between particular historical events and larger social, economic, and political trends and developments.
2. Students recognize the complexity of historical causes and effects, including the limitations on determining cause and effect.
3. Students interpret past events and issues within the context in which an event unfolded rather than solely in terms of present-day norms and values.
4. Students understand the meaning, implication, and impact of historical events and recognize that events could have taken other directions.
5. Students analyze human modifications of landscapes and examine the resulting environmental policy issues.

#### World History

- 10.7 Students analyze the rise of totalitarian governments after World War I.
  - 10.7.2 Trace Stalin’s rise to power in the Soviet Union and the connection between economic policies, political policies, the absence of a free press, and systematic violations of human rights (e.g., the Terror Famine in Ukraine).
- 10.9 Students analyze the international developments in the post-World War II world.
  - 10.9.4. Analyze the Chinese Civil War, the rise of Mao Tse-tung, and the subsequent political and economic upheavals in China (e.g., the Great Leap Forward, the Cultural Revolution, and the Tiananmen Square uprising).

# Genetically Modified Foods

## LESSON 3.3

### BIOLOGY

#### Time

50 minutes

#### Materials

Food samples with and without genetically engineered ingredients. A list of examples can be found at [http://www.truefoodnow.org/shoppersguide/guide\\_printable.html](http://www.truefoodnow.org/shoppersguide/guide_printable.html)

#### Resources

- *The Botany of Desire*, by Michael Pollan (2001)
- The following websites address various issues related to the production and use of genetically modified foods.  
From the U.S. Department of Energy:  
[http://www.ornl.gov/sci/techresources/Human\\_Genome/elsi/gmfood.shtml](http://www.ornl.gov/sci/techresources/Human_Genome/elsi/gmfood.shtml)  
From the United Nations:  
<http://www.fao.org/news/2001/010405-e.htm>

#### Prior Student Learning

This should be one of the later lessons in the Biology unit on Genetics. Students should be familiar with the basics of genes: how they are identified and passed to the next generation. They should also know the basic techniques of genetic manipulation, including the insertion of genes through the use of restriction enzymes.

### Essential Question for This Unit

Should we care about what we eat? Why?

### Objectives

After completing this lesson, students should be able to

- Relate their knowledge of genetics to the engineering of genetically modified foods.
- Describe the general history of genetic modification.
- Explain the role of genetically modified crops in food production.

### Lesson Activities

#### Lesson Springboard

Ask students if they have ever eaten genetically modified foods. How would they know if they had? Do they think genetically modified foods taste different from nonmodified foods? Place some food and plant samples at the front of the room and ask students to try to identify which items have been genetically modified and which have not.

#### Lesson Development

##### Class Discussion

Define *genetically modified foods* as crop plants that are altered in the laboratory using the latest molecular biology techniques. This modification typically occurs to enhance desirable traits. Ask students if this is a new goal. Hopefully, they will remember from lessons on genetic crosses and breeding that humans have been attempting to modify plants and animals for hundreds of years. However, genetic engineering allows for the creation of very specific traits with great speed and accuracy.

Ask students to apply what they know about genetics to explain how desirable genes can be isolated and then inserted into a new organism.

##### Direct Instruction

Review with students the primary advantages and potential hazards of genetically modified foods:

- Pest resistance—Many tons of chemical pesticides are needed to keep crops from being eaten or damaged by pests. Even when farmers can afford to use pesticides, consumers may not wish to eat foods that have been treated with them because of potential health hazards. Run-off of agricultural wastes from excessive use of pesticides and fertilizers can also poison the water supply and cause harm to the environment. Growing genetically modified foods, such as Bt corn, can help eliminate the application of chemical pesticides and reduce the cost of bringing a crop to market.



# Genetically Modified Foods

## LESSON 3.3

- **Herbicide tolerance**—Crop plants that are genetically engineered to be resistant to one very powerful herbicide could help prevent environmental damage by reducing the amount of herbicides needed.
- **Disease resistance**—There are many viruses, fungi, and bacteria that cause plant diseases. Plant biologists are working to create plants with genetically engineered resistance to these diseases.
- **Cold tolerance**—Unexpected frost can destroy sensitive seedlings. An antifreeze gene from coldwater fish has been introduced into plants such as tobacco and potatoes. With this antifreeze gene, these plants are able to tolerate cold temperatures that normally would kill unmodified seedlings.
- **Drought tolerance/salinity tolerance**—As the world’s population grows and more land is utilized for housing instead of food production, farmers will need to grow crops in locations previously unsuited for plant cultivation.
- **Nutrition**—Malnutrition is common in Third World countries where impoverished peoples rely on a single crop such as rice for the main staple of their diet. However, rice does not contain adequate amounts of all necessary nutrients to prevent malnutrition. If rice could be genetically engineered to contain additional vitamins and minerals, nutrient deficiencies could be alleviated.
- **Loss of diversity**—When crops are engineered to have desirable traits, other varieties are often abandoned for cultivation. As a result, there is a loss of biodiversity, which can put a crop at risk if new pests or diseases emerge.
- **Harm to other organisms**—Genetic modification can have unintended and unanticipated side effects on other organisms. For example, the pollen from pest-resistant Bt corn may cause mortality in nondestructive organisms like the monarch butterfly. It is difficult to anticipate the potential risk to nontarget organisms.
- **Reduced effectiveness of pesticides**—Much as bacteria can become resistant to antibiotics, there is concern that insects will become increasingly resistant to a wider range of pesticides.
- **Gene transfer to nontarget species**—Genetically engineered traits may pass to nontarget organisms through crossbreeding. It is difficult to control and predict the effect of cross-pollination in plants. It could be that the genes for pest or herbicide resistance are transferred to undesirable organisms, creating a “superweed” that cannot be controlled.

Ask students to come up with other possible advantages or concerns. Additional information can be found at the website of the Department of Energy: ([http://www.ornl.gov/sci/techresources/Human\\_Genome/elsi/gmfood.shtml](http://www.ornl.gov/sci/techresources/Human_Genome/elsi/gmfood.shtml)).

### **Poster Project**

Have students work in groups of two or three to create a poster that illustrates the steps in creating genetically modified organisms. Have each

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# Genetically Modified Foods

## LESSON 3.3

group select a concrete example (e.g., Bt corn, Flavr Savr tomato, Round-up-Ready soybeans, and so on) for their illustration.

### **Lesson Closure**

Ask students to display their posters around the class; then have a poster session. Each group takes 3 minutes to explain how they created their genetically modified food. Strictly enforce the time limit students are allowed to speak, forcing them to cover the important highlights of the process.

### **Possible Prior Misconceptions**

Many students many not realize the extent to which genetically modified foods are present in the American market.

Students may believe that genetic modification is against the natural order and is morally wrong. This is a belief, rather than a misconception, but it can still influence how receptive students are to the scientific content associated with genetic engineering.

### **Student Assessment Artifacts**

Genetic Engineering poster

### **Variations and Extensions**

Have a class debate or symposium on genetically modified foods. Divide the class into four special interest groups in order to examine all sides of the issue:

- Environmentalists—Concerned that crops developed from genetic engineering may overcome or destroy the balance of nature and that the need to feed the world's population may divert attention from protecting the environment.
- Scientists—Believe that genetic modification can be used in a responsible manner to solve world food issues.
- Consumer advocates—Wish consumers to be informed of all the potential benefits and hazards of genetically modified foods.
- Legislators—Concerned about enacting safety regulations and/or labeling requirements for genetically modified foods.

Have students read and discuss section four of the book *The Botany of Desire* by Michael Pollan. Section four discusses the history and genetic modification of the potato plant.

# Genetically Modified Foods

## LESSON 3.3

### National and State Academic Standards

#### NATIONAL

##### NRC National Science Education Standards

###### *Science and Technology*

Science often advances with the introduction of new technologies. Solving technological problems often results in new scientific knowledge. New technologies often extend the current levels of scientific understanding and introduce new areas of research.

###### *Science in Personal and Social Perspectives*

Science and technology are essential social enterprises, but alone they can only indicate what can happen, not what should happen. The latter involves human decisions about the use of knowledge.

Understanding basic concepts and principles of science and technology should precede active debate about the economics, policies, politics, and ethics of various science- and technology-related challenges. However, understanding science alone will not resolve local, national, or global challenges.

Progress in science and technology can be affected by social issues and challenges. Funding priorities for specific health problems serve as examples of ways that social issues influence science and technology.

#### CALIFORNIA

##### Science Content Standards

###### *Biology/Life Science*

5. The genetic composition of cells can be altered by incorporation of exogenous DNA into the cells.
  - c. *Students know* how genetic engineering (biotechnology) is used to produce novel biomedical and agricultural products.
  - d. \* *Students know* how basic DNA technology (restriction digestion by endonucleases, gel electrophoresis, ligation, and transformation) is used to construct recombinant DNA molecules.
  - e. \* *Students know* how exogenous DNA can be inserted into bacterial cells to alter their genetic makeup and support expression of new protein products.

Subunit 3—Nutrition in the World

# The Power of Two

## LESSON 3.4

### ALGEBRA I

#### Time

65 minutes

#### Materials

##### Equipment

- Graph paper
- Rulers
- Scientific calculators

#### Resources

Sample Solution—  
Power of Two table

#### Prior Student Learning

Students should already be familiar with graphing on a coordinate plane from a table of values.

Students should have completed Lesson 3.2 before beginning this lesson.

### Essential Question for This Unit

Should we care about what we eat? Why?

### Objectives

After completing this lesson, students should be able to

- Recognize base and exponent in algebraic expressions.
- Understand the concept of raising a number to a certain power and calculate the value of the exponent.
- Graph exponential functions with different bases and identify differences between those graphs.

### Lesson Activities

#### Lesson Springboard

Remind students what they have learned about the causes of world hunger in Lesson 3.2. Research suggests that world hunger is not primarily caused by a lack of food production. One of the reasons that people go hungry is because they do not have enough money to pay for food. Many people would like to start businesses that would allow them to earn this money, but they lack the initial capital to get these businesses started.

Muhammad Yunus discovered that if he loaned very small amounts of money (as little as \$20 USD) to the poorest people in a developing country, they were able to start successful small businesses and soon made enough money to feed their families adequately. Not only that, but Yunus was paid back all of his money—with interest—at a default rate lower than that experienced by commercial banks. Yunus opened the first “micro-bank,” Grameen Bank in Bangladesh, and has helped thousands of people feed their families through their own entrepreneurial efforts. He won the Nobel Peace Prize in 2006 for his work with the Grameen Bank. (For more information on microfinance, see <http://www.grameenfoundation.org/what-we-do/microfinance-in-action>.)

You would like to start a micro-credit system to help end world hunger, but you do not have the money to give loans to enough people. You decide to get two people you know to donate \$1 to your project. If each person who donates convinces two more people to donate \$1 every day for a month, how much money will you have to start your micro-bank? (For examples of real efforts to collect money for microfinance situations, see <http://www.kiva.org>.)

#### Lesson Development

##### Small Group Work

Form groups of three or four students and ask them to come up with strategies for diagramming how many new people have donated money

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*The Power of Two*

LESSON 3.4

each day. Also, have the groups calculate the total amount collected by the end of each day. Students might make tree diagrams, with each donor branching off into two more donors, or they may make a table/list.

Refer to the completed Sample Solution–Power of Two table for a solution to this problem.

**Class Discussion**

Ask class volunteers to share their problem-solving methods and discuss any surprises students experienced when calculating the answer. For example, students often think their answer is incorrect because it is so large. Have students say the entire number out loud and give examples for the class to get a sense of the magnitude of \$4 billion. Questions to the class might be

- If your average loan was \$500, how many people could you give loans to?
- The current world population is approximately 6.6 billion. What percentage of the world population will have donated at the end of the month? Just on the 30th day?
- If you earned an annual salary of \$50,000, how many years would it take you to earn the amount donated by the end of the month?

Discuss the tedious nature of doubling a number 30 times and suggest that there is a faster way to come up with the final tally. Introduce *exponent notation* and the terms *base* and *exponent*. Students should see that in this situation, when the base is 2 and the exponent is the number of days, the result is the number of people who donate on the given day. Have the class practice using their calculators to find the value of various exponential expressions.

**Group Work**

Have each group create a different graph representing data from the situation described above. Graphs can depict either of the following:

- \$ received vs. day of the month
- Total \$ received vs. # of days

Graph one of the above but with each person asking three more people instead of two, or graph one of the above but with each person donating \$5 instead of \$1.

**Class Discussion**

Have students present their posters and ask the class to compare and contrast them in terms of their slope and  $y$  intercept. Ask students to analyze why these differences occur in the graphs as related to the situation and the exponential equations they are graphing. Have the class consider if there is an  $x$  intercept and, if so, where it might be and what it would represent in the situation.

### **Lesson Closure**

Ask students to think of other situations that could be described by exponential functions and if there could be any situations where a negative base or exponent would be appropriate. Have the class reflect on their power as individuals to create change and on how they might use the concept of exponential growth to design ways to spread knowledge, ideas, or resources.

### **Possible Prior Misconceptions**

Although in the given situation it might be appropriate to think of an  $x$  intercept as the banker having no donations on day zero, students will discover on their calculators that any number to the zero power is equal to 1. A discussion of this concept is necessary at some point.

### **Student Assessment Artifacts**

Completed diagram or table with solution to the donation problem  
Graph of exponential functions

### **Variations and Extensions**

Students can be challenged to imagine situations that involve bases and/or exponents that are negative or fractions. The class can also move to a discussion of logarithms as a way to further analyze the banker's situation.

## **National and State Academic Standards**

### **NATIONAL NCTM Standards for School Mathematics**

#### *Algebra*

- Understand patterns, relations, and functions;
- Represent and analyze mathematical situations and structures using algebraic symbols;
- Use mathematical models to represent and understand quantitative relationships;
- Analyze change in various contexts.

### **CALIFORNIA Mathematics Content Standards**

#### *Algebra I*

- 2.0 Students understand and use such operations as taking the opposite, finding the reciprocal, taking a root, and raising to a fractional power. They understand and use the rules of exponents.
- 16.0 Students understand the concepts of a relation and a function, determine whether a given relation defines a function, and give pertinent information about given relations and functions.

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

**Sample Solution—Power of Two**

Day	# People Looking for Donors	# New Donors Asked	\$ Collected That Day	Total \$ Collected
0	1 (yourself)	0	\$0	\$0
1	1	2	\$2	\$2
2	2	4	\$4	\$6
3	4	8	\$8	\$14
4	8	16	\$16	\$30
5	16	32	\$32	\$62
6	32	64	\$64	\$126
7	64	128	\$128	\$254
8	128	256	\$256	\$510
9	256	512	\$512	\$1,022
10	512	1,024	\$1,024	\$2,046
11	1,024	2,048	\$2,048	\$4,094
12	2,048	4,096	\$4,096	\$8,190
13	4,096	8,192	\$8,192	\$16,382
14	8,192	16,384	\$16,384	\$32,766
15	16,834	32,768	\$32,768	\$65,534
16	32,768	65,536	\$65,536	\$131,070
17	65,536	131,072	\$131,072	\$262,142
18	131,072	262,144	\$262,144	\$524,286
19	262,144	524,288	\$524,288	\$1,048,574
20	524,288	1,048,576	\$1,048,576	\$2,097,150
21	1,048,576	2,097,152	\$2,097,152	\$4,194,302
22	2,097,152	4,194,304	\$4,194,304	\$8,388,606
23	4,194,304	8,388,608	\$8,388,608	\$16,777,214
24	8,388,608	16,777,216	\$16,777,216	\$33,554,430
25	16,777,216	33,554,432	\$33,554,432	\$67,108,862
26	33,554,432	67,108,864	\$67,108,864	\$134,217,726
27	67,108,864	134,217,728	\$134,217,728	\$268,435,454
28	134,217,728	268,435,456	\$268,435,456	\$536,870,910
29	268,435,456	536,870,912	\$536,870,912	\$1,073,741,822
30	536,870,912	1,073,741,824	\$1,073,741,824	\$2,147,483,646
31	1,073,741,824	2,147,483,648	\$2,147,483,648	\$4,294,967,294