Food and Fitness

Activities Guide for Teachers

National Space Biomedical Research Institute
Houston, Texas

The National Space Biomedical Research Institute (NSBRI) is combining the basic research capabilities of some of the nation's leading biomedical research centers with operational and applied research conducted by the National Aeronautics and Space Administration (NASA) to understand and achieve safe and effective long-term human exploration and development of space. The NSBRI's discoveries and research products will help to counter the effects of weightlessness and space radiation and will contribute to the health and well-being of all mankind.

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What Can We Learn in Space

There are many reasons to study life sciences in microgravity, from obvious ones, such as ensuring astronaut health, to less obvious ones, such as improving health care on Earth. The human body is designed to operate in Earth's gravity field. When humans are removed from this environment, as when they travel in space, many complex changes take place: their bones become weaker, fluids shift toward the upper body, body rhythms are disrupted and motion sickness may occur. Life science research allows us to begin planning for long-term stays in space. It also provides important new medical information to improve the health care of people here on Earth, such as care for persons undergoing prolonged bed rest or those with osteoporosis.

BALANCE. During their first days in space, astronauts can become dizzy and nauseous. Eventually they adjust, but once they return to Earth, they have a hard time walking and standing upright. Finding ways to counteract these effects could benefit millions of Americans with balance disorders.

BONES. Astronauts' bones become weak and porous because they are not working against the Earth's gravity. For different reasons, many people on Earth, particularly older women, also develop weak bones that fracture easily with little or no trauma. This condition is known as osteoporosis (porous bone).

CANCER/RADIATION. Outside the Earth's protective atmosphere, astronauts are exposed to many kinds of damaging radiation that can lead to cell damage and increase astronauts' chances of developing tumors. Learning how to keep astronauts safe from space radiation may improve cancer treatments for people on Earth.

About Our Bodies Here on Earth?

HEART & CIRCULATION. The amount of blood in the body is reduced when astronauts are in microgravity. The heart grows smaller and weaker, which makes astronauts feel dizzy and weak when they return to Earth. Heart failure and diabetes, experienced by many people on Earth, lead to similar problems.

IMMUNE SYSTEM. Living and working in space may make it easier for astronauts to become sick or develop diseases. Learning how the body's disease defense systems change in space will help us to understand many illnesses, and their effects on the human immune system, here on Earth.

MUSCLES. When muscles do not have to work against gravity, they weaken and begin to waste away. Special exercises and other strategies to help astronauts' muscles stay strong in space also may help older and bedridden people, who experience similar problems on Earth.

NUTRITION & FITNESS. Research that uncovers ways to reduce space-related health problems through diet, exercise or rehabilitation will contribute to the development of prevention and treatment programs for osteoporosis and other bone disorders, muscle wasting diseases and many other illnesses.

SLEEP & TEAM WORK. It is hard for astronauts in space to get enough sleep because they lose the day/night cycle of Earth and there are many distractions. Strategies to help astronauts perform without errors and deal with stress also will benefit people who work at night or have irregular schedules.

TECHNOLOGY. Special systems and equipment, new remote medical diagnostic tools and intelligent computer software that support life science research—as well as the health of astronauts in space—will improve diagnosis and care for patients on Earth.

Using Cooperative Groups in the Classroom

Cooperative learning is a systematic way for students to work together in groups of two to four. It provides an organized setting for group interaction and enables students to share ideas and to learn from one another. Students in such an environment are more likely to take responsibility for their own learning. Cooperative groups provide support for reluctant learners, model community settings where cooperation is necessary, and enable the teacher to conduct hands-on investigations with fewer materials.

Organization is essential for cooperative learning to occur in a hands-on science classroom. Materials must be managed, investigations conducted, results recorded, and clean-up directed and carried out. When a class is "doing" science, each student must have a specific role, or chaos may result.

The Teaming Up! model* provides an efficient system for cooperative learning. Four "jobs" are delineated: Principal Investigator, Materials Manager, Reporter and Maintenance Director. Each job entails specific responsibilities. Students wear job badges that describe their duties. Tasks are rotated within each group for different activities so that each student has an opportunity to experience all roles. Teachers even may want to make class charts to coordinate job assignments within groups. For groups with fewer than four students, job assignments can be combined.

Once a cooperative model for learning is established in the classroom, students are able to conduct science activities in an organized and effective manner. All students are aware of their responsibilities and are able to contribute to successful group efforts.

Principal Investigator	Maintenance Director	Reporter	Materials Manager
• Reads the directions • Asks the questions • Checks the work	• Follows the safety rules • Directs the clean up • Asks others to help	• Writes down observations and results • Explains the results • Tells the teacher when the group is finished	• Picks up the materials • Uses the equipment • Returns the materials

* Jones, R.M. 1990. Teaming Up! LaPorte, Texas: ITGROUP.

Extension Activities

There are many opportunities for exciting extension activities focusing on space travel and its effects on the human body. The NASA and NSBRI internet sites provide a wealth of educational resources that may be useful in developing such activities. For more information, go to <www.nasa.gov> and <www.nsbri.org>.

CONCEPTS

- All organisms are composed of cells. Cells carry out functions necessary for life.
- Plants and related organisms use energy from the sun to produce food. Animals, fungi and other living things must eat plants or other organisms to obtain energy and building blocks for life.
- Living things give off carbon dioxide and heat, among other byproducts, when they use food.

OVERVIEW

Students will observe and quantify the growth of yeast (a single-celled fungus) when it is given table sugar as a food source.

SCIENCE, HEALTH & MATH SKILLS

- Observing
- Measuring
- Graphing
- Using a low power microscope

1. Energy for Life

Background

All living things on Earth require energy to move, grow and maintain themselves. Some organisms, especially plants and algae, are able to build all of the materials they need from very simple substances. Using energy from light, these organisms, known as **producers**, are able to make food in the form of carbohydrates from water and carbon dioxide. All other organisms, considered **consumers**, rely on producers for food. Food provides energy and other raw materials necessary for life.

When used by organisms, food is broken down and energy is released. Oxygen is consumed during this process, and carbon dioxide is given off as a waste product. Some energy in living things is used to maintain the body and conduct the reactions necessary for life. During these processes, some of the energy also escapes as heat.

This activity is designed to introduce students to the concepts of food and energy. Students will observe what happens when yeast, a single-celled fungus, is fed table sugar.

Time

15 minutes for setup; 45 minutes to conduct activity. (Optional: If students make optimal temperature observations, total time is one hour.)

Materials

Each group will need:

- 100 mL of water at room temperature
- 2 250-mL beakers or plastic cups
- 2 pkgs of rapid rising yeast
- 2 tsp of sugar (or 2 single serve sugar packets)
- 2 craft sticks or plastic spoons
- plastic ruler, metric (mL marked)
- sheet of graph paper
- copy of "Is It Alive?" student sheet

Optional, per group (see Setup):

- microscope
- glass or plastic slides and coverslips
- dropper or plastic pipette
- 12-in. laboratory thermometer or temperature probe

Setup and Management

Students will observe yeast growing in sugar water. Adjust the temperature of the water to room temperature. Place all materials in a central location for each group of students to collect.

Optional. If you have access to 12-in. laboratory thermometers or electronic probes to measure temperature, have students also measure the starting temperature of the yeast mixtures and record the temperatures at 10 minute intervals. OR set up a demonstration with a temperature probe inserted in the yeast, sugar and water mixture. Students will be able to observe that the temperature

They're Alive!

Yeast are tiny members of the Fungus Kingdom, which also includes mushrooms. Fungi (plural of fungus) are important decomposers of waste and dead plant and animal materials. Yeast also is used for baking bread.

Sugars are small molecules made of carbon, hydrogen and oxygen. The energy in sugar is trapped in the chemical bonds between atoms. When sugar molecules are used for energy, carbon dioxide (CO_2) and water (H_2O) are given off. The energy that becomes available can be used immediately or stored in other chemical bonds. Some energy also is transformed and given off as heat.

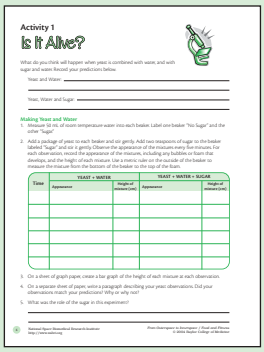
of the water in which the yeast is growing will increase between 0.5–1.5°C during the class period. Have students construct a graph showing the change in temperature over time.

If microscopes are available, have students observe a drop of water containing yeast cells from the beakers containing sugar. Students should place a drop of solution on a slide and cover it with a cover slip.

Procedure

1. Begin a class discussion of energy and living things by asking questions such as, *What are the basic needs of living things? Do all organisms need exactly the same things to live? What do plants need? What about animals? Do animals need the same things as plants?* Mention that plants are able to manufacture everything they need from very basic raw materials (carbon dioxide from air, water, nutrients from soil and energy from sunlight) through the process known as **photosynthesis**. Also mention that plants and other photosynthetic organisms are called producers, and that animals, fungi and others that rely on photosynthetic organisms for food are known as consumers.

2. Have the Materials Manager from each group collect all of the supplies. The Materials Manager should measure 50 mL of water into each of the 250-mL beakers before taking them to his or her work area.


Activity 1
Is It Alive?

3. Tell students that they will be investigating the behavior of a common fungus (baker's yeast) when it is fed. Ask students to share anything they know about yeast. Students will follow the instructions and record their observations on a copy of the student sheet.

4. Before beginning, each group should label the two beakers as "Sugar" and "No Sugar."

5. Have each group predict what will happen when yeast and water are combined. They also should predict what might happen when yeast, water and sugar are combined. Let the groups add yeast to the water in each of the beakers and stir the mixture gently. Groups should observe the appearance of the mixtures and record their observations.

6. Next, have students add approximately two teaspoons of sugar to the beaker labeled "Sugar."

7. Have students observe the appearance of the yeast mixtures at 5-minute intervals and record their observations. They may gently stir the mixtures periodically with separate craft sticks or plastic spoons.

8. Once some of the yeast cultures have accumulated a thin layer of foam, ask students, *What is happening to the yeast?* Help students understand that the yeast cells have begun to grow and multiply in the presence of water and food (sugar). The gas being produced is carbon dioxide, the same waste product that we give off when food is processed inside cells in our body.

9. Next, students will observe the production of carbon dioxide gas by yeast. Have students measure and record the height of the foam in each beaker at 5-minute intervals. (The beaker labeled "No Sugar" may not produce any foam at all.) Students

Energy from the Sun

Almost all energy on Earth comes from the sun. We can see part of this energy as visible light and feel part of it as heat. Heat and light that we can detect are just part of the entire spectrum of radiation given off by the sun.

Radiation travels in waves. Some kinds of radiation are listed below, from longest to shortest wavelengths.

- **long wave radio**
- **short wave radio**
- **radar**
- **microwaves**
- **visible light**
- **ultraviolet light**
- **x-rays**
- **gamma rays**
- **cosmic rays**

Away from Earth's atmosphere, spacecraft are exposed to all types of radiation from the sun.

Did You Know?

Have you ever wondered why a room crowded with people becomes warmer?

At rest, the average person gives off about the same amount of heat as a 60 watt light bulb.

should record their observations on their student sheets.

10. Conclude by leading students in a discussion of yeast growth. Help them understand that they used different kinds of evidence to show that the yeast were using the sugar as food. First, the yeast was breaking down sugar to obtain energy. In the process, the yeast released observable carbon dioxide gas (visible as bubbles). Second, the yeast mixture became warmer. Heat was released as a by-product of the energy conversions happening inside the yeast cells. The yeast in the beaker without sugar did not have food to grow, so these reactions did not occur in this beaker.

Extensions

- Challenge students to come up with other ways to measure yeast growth and development.
- Have students use an acid/base indicator solution (such as bromothymol blue) to detect the presence of carbon dioxide in the air they exhale. Students should blow through a straw into a glass of water and use the indicator to observe whether the water becomes more acidic from the presence of dissolved carbon dioxide (forms a weak acid in water). OR have them make their own indicator by boiling purple cabbage to create a dark blue or purple liquid. This liquid turns pink in the presence of acids and green or blue in the presence of bases.
- Challenge students to compare and contrast the use of sugar by yeast and the burning of a candle. What are the similarities between the two processes? What are the differences?

Plants can manufacture all of the molecules they need. Most animals, on the other hand, have to obtain both energy and nutrients from food. Different animals vary in their abilities to use food sources. For example, cattle have a complex digestive system that allows them to break down and use tough fibers in grasses for food.

Activity 1

Is It Alive?

What do you think will happen when yeast is combined with water, and with sugar and water? Record your predictions below.

Yeast and Water: _____

_____

Yeast, Water and Sugar: _____

_____

Making Yeast and Water

1. Measure 50 mL of room temperature water into each beaker. Label one beaker "No Sugar" and the other "Sugar."

2. Add a package of yeast to each beaker and stir gently. Add two teaspoons of sugar to the beaker labeled "Sugar" and stir it gently. Observe the appearance of the mixtures every five minutes. For each observation, record the appearance of the mixtures, including any bubbles or foam that develop, and the height of each mixture. Use a metric ruler on the outside of the beaker to measure the mixture from the bottom of the beaker to the top of the foam.

Time	YEAST + WATER		YEAST + WATER + SUGAR	
	Appearance	Height of mixture (cm)	Appearance	Height of mixture (cm)

3. On a sheet of graph paper, create a bar graph of the height of each mixture at each observation.

4. On a separate sheet of paper, write a paragraph describing your yeast observations. Did your observations match your predictions? Why or why not?

5. What was the role of the sugar in this experiment?

_____

_____

CONCEPTS

- Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion and the nature of chemicals.
- Food provides energy for living things.
- Different foods provide different amounts of energy.

OVERVIEW

Students will compare the energy released as heat from two different food types.

SCIENCE, HEALTH & MATH SKILLS

- Observing
- Comparing
- Predicting
- Inferring

2. Energy Sources

Background

Living things that cannot harness solar energy through photosynthesis must eat other organisms or the products of other organisms as food. Consumers, which include members of the animal and fungus Kingdoms, frequently use a variety of food sources to meet their energy and nutritional needs.

The amount of energy stored in food usually is measured in **calories**. One calorie is defined as the amount of energy it takes to raise the temperature of one gram of pure water (equivalent to one milliliter of water) one degree Celsius. The calories shown on most food labels are written with an uppercase "C" and represent one kilocalorie or 1,000 calories.

Carbohydrates, fats and proteins are the primary sources of energy in foods. Sugars, starches (such as those in bread, pasta and potatoes) and fiber (such as in bran and many vegetables) are the main forms of carbohydrates. Foods rich in fats include animal and vegetable oils, lard, butter and cream. Proteins, the building blocks of muscles and molecules within cells, are present in meats, as well as in plant materials, such as nuts and beans.

Each of these classes of nutrients provides a different amount of energy as food. Fats and oils provide about nine Calories (Cal) per gram. Carbohydrates and proteins each provide four Cal per gram. The amount of energy provided by each of these kinds of foods is independent of the source and the presence of other nutrients. In other words, olive oil and peanut oil both provide about nine Cal per gram.

This activity introduces students to the concept of "calorie" and allows them to compare the relative amounts of energy in similar-sized portions of a carbohydrate-based food (cereal) and a food rich in oils (pecan).

Time

15 minutes for setup; 45 minutes for activity

Materials

- single-hole punch

Each group will need:

- 1/2 pecan (without shell)
- 2 pieces of round oat cereal, unsweetened ("Cheerios")
- 2 cm piece of clay
- large paper clips
- 6-in.-thermometer (°C)
- graduated cylinder or beaker
- matches or birthday candles
- soda can with top cut off (see Setup)
- pencil (to be used as a holder for can)
- water
- copy of "Calories = Energy!" sheet

Food and Energy Facts

The word "calorie" comes from the Latin word for heat.

Energy also is measured in joules. One calorie is about 4,200 joules.

Carbohydrates provide most people with about 50 percent of their energy needs.

Food must be digested before the body can use it. Digestion changes food into substances like glucose, a simple sugar, that can be carried in the bloodstream to cells throughout the body.

Setup and Management

For each group, cut the top one third off of a soda can using a scissors. Discard top half. Smooth the edges by cutting around again or by covering them with masking tape. Use a single-hole punch to make a pencil sized hole on each side of the open end of the can, so that a pencil may be inserted as a holder (see "Testing Beaker," sidebar). Each class will need a new set of cans.

Students should work in teams to conduct this activity. They should wear goggles and conduct the investigation on a non-flammable, flat surface. Set out all materials for each group of students to collect. OR you may choose to conduct this activity as a demonstration to the class.

Procedure

1. Remind students of the previous activity in which they cultivated yeast in sugar water. Ask, *What happened to the temperature or appearance of the water in which the yeast cells were growing?* Students should be able to report that water became warmer or that the yeast used sugar as food. Follow by asking, *What do you think would happen if we tried to release all of the energy in the sugar as heat?* Use students' answers to guide them into a discussion of energy stored in food. Ask, *Do all kinds of food provide the same amount of energy?*

2. Challenge students to predict which provides more energy: the same portion of a carbohydrate-rich food or an oil-rich food.

3. Have the Materials Managers collect the materials for their groups from a central area in the classroom.

4. Each group will need to make a holder for the food they will be investigating. They should bend a paper clip so that it looks like the image on the right (see "Clay Holder," sidebar) and anchor the base using clay.

5. Have students follow the instructions on their activity sheets to complete the investigation. They will pour 50 mL of water into the soda can and measure the temperature of the water. Next, they will hang two oat cereal pieces on the paper clip and light them from below. They should hold the can by the pencil support with the bottom of the can about one inch above the flame. If necessary, they should relight the cereal pieces until they will no longer burn. They should record the final water temperature.

6. Have students repeat the investigation using a piece of pecan approximately the same size as two pieces of cereal together.

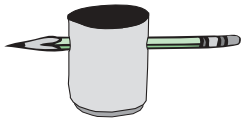
7. Have students follow the instructions on the "Calories = Energy!" page to calculate (approximately) the number of calories released by the similar volume of different foods.

8. Discuss results with students. Ask, *Which food released more heat when burned? Which volume of food had more calories?* Help students understand that fats and oils are more energy-rich than carbohydrates, because of the nature of the chemicals involved.

Extensions

- Have students conduct the investigation again using similar masses of cereal and pecan. Have students weigh the pieces in advance and make adjustments so that similar masses of cereal and pecan are compared.
- The diets of some ethnic groups living in extremely cold climates are very high in fats. Have students investigate why such diets might be necessary.

Testing Beaker



Use a single-hole punch to create openings for the pencil.

Clay Holder

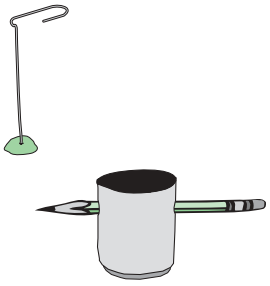
Fats and Energy

Fats are rich sources of energy. Certain kinds of fats and oils are healthier than others. Fats such as shortening, margarine and lard, that are solid at room temperature, should be avoided. Healthier choices include olive, flaxseed, nut or canola oils. Foods that can contain large amounts of unhealthy fats include some red meats, whole milk dairy products and cream, some salad dressings, chocolate, cakes, cookies and crackers.

Activity 2

Calories = Energy!

What has more calories, breakfast cereal or a similar-sized portion of nuts? You will need: piece of pecan, two pieces of cereal, clay, large paper clip, thermometer, 100 mL of water, matches or birthday candle, soda can and a pencil.



1. Straighten the sections of a paper clip so that it looks like the image on the right. Anchor the base in the clay, with the curved part of the paper clip in the air.
2. You also will need a soda can with the top removed. Slide a pencil through the holes in the sides of the can to make a handle.

Cereal

3. Add 50 mL of water to the can. Measure the starting temperature of the water and record your results in the chart on the right.
4. Hook the cereal pieces on the paper clip. Carefully light the cereal from below using a match or candle.

Cereal

Starting water temperature	°C
Final water temperature	°C
Change in temperature	°C

5. Hold the can by the pencil, about one inch above the top of the flame. If the cereal stops burning, light it again until it won't burn any more. Measure the temperature of the water again and record the final water temperature.
6. How many degrees did the temperature of the water change? Record your answer.

Pecan

7. Repeat steps 3 through 6 using the pecan piece. Record the water temperatures in the chart on the right.

Pecan

Starting water temperature	°C
Final water temperature	°C
Change in temperature	°C

Measuring Energy

A calorie is the amount of energy needed to raise the temperature of one mL of water by one degree C. Based on this information and your investigation, answer the following questions. Use a the back of this sheet or a separate sheet of paper to record your answers.

1. How many calories are needed to raise the temperature of 50 mL of water by one degree?
2. Based on your observations, how many calories were given off by the cereal? (Hint: multiply the change in temperature that you observed by 50.)
3. How many calories were given off by the pecan?
4. Would you get more energy from eating a similar size portion of pecans or cereal? Why?

CONCEPTS

- All organisms need energy for their activities.
- Food is the only energy source for people and other animals.
- People's energy needs depend on body composition and level of activity, and correlate directly with fitness.
- Regular exercise is important to maintain and improve health.

OVERVIEW

Students will estimate their average daily energy (Calorie) needs.

SCIENCE, HEALTH & MATH SKILLS

- Calculating
- Predicting
- Converting measurements
- Drawing conclusions
- Inferring

3. Your Energy Needs

Background

Energy fuels growth, movement and all the processes in every cell inside the body. It has many different forms and cannot be created or destroyed, only transformed from one form to another. Light and heat both are examples of energy.

Many students will have difficulty understanding energy and its measurement. One way to approach these concepts is to think of energy as the ability to make either a change or a movement. There are many ways of making a change or creating movement, and energy can have many forms. For example, when a person kicks a ball, the energy from the kick makes the ball move forward. Or in cooking, energy in the form of heat changes a clear liquid egg white into an opaque solid egg white. As noted previously, energy in food commonly is measured as calories.

The easiest way to describe calories is to introduce them as one would introduce any other unit of measure. Weight can be measured in kilograms or pounds; distance can be measured in meters or feet; and energy can be measured in calories. As demonstrated in the previous activity, one calorie is the amount of energy necessary to raise the temperature of one milliliter of water by one degree Celsius. Usually, when we refer to calories in food, we actually are considering kilocalories. One kilocalorie equals one thousand calories and usually is written in the capitalized form, "Calorie."

In this activity, students will figure out how many Calories a typical teenager needs every day. Baseline Calorie needs (also called Basal Metabolic Rate, or BMR), can be estimated based on gender, age, height and weight. Each student may calculate his or her own baseline Calorie needs (see Step 6).

Time

10 minutes for setup; 45–60 minutes to conduct activity

Materials

Each student will need:

- copy of "Baseline Energy Needs" and "Total Energy Needs" student sheets
- calculator

Setup and Management

Have students work individually.

Procedure

1. Begin a class discussion of energy by asking questions such as, *What is energy? Where do we get our energy? What do we do with the energy? Do we all need the same amount of energy? What happens to the food we eat?* Tell students that they will be investigating how many Calories adolescents need every day. Explain that "calorie" is a measure of energy that can be applied to food.

Physical Activity

For most people, physical activity accounts for individual differences in the actual amounts of calories expended during the day. The amount of lean body tissue also affects how much energy the body uses for basic functions.

Fitness Benefits

The benefits of physical fitness include maintaining healthy weight; having energy and strength for routine activities; promoting good muscle tone, bone strength, and strong heart/lung systems; and contributing to improved mental health.

2. Give each student copies of the two activity sheets and have them follow the instructions to calculate the daily Calorie needs of an average teenage boy and girl.

3. Students may need assistance with metric measurements, such as kilograms (kg) and centimeters (cm), necessary for their calculations. If appropriate, talk about conversion factors and different measurement systems. One kg is approximately 2.2 pounds (lb) and one cm is 0.4 inches (in.).

4. Discuss students' calculations. Mention that a person's energy needs are based not only on sex, weight and height, but also on daily activities. Explain that Basal Metabolic Rate (BMR) represents the amount of Calories necessary to maintain life. Ask, *What is the difference between the caloric requirements of different physical activities?*

5. Expand the discussion by introducing the idea that athletes and other persons who are physically fit spend more Calories and as a result require more Calories. Help students understand that to stay fit and healthy, a person must maintain a balance between the intake and expenditure of Calories.

6. As a take-home activity, give students clean copies of both activity sheets and have them calculate their own BMRs and total daily Calorie needs.

Astronaut Edward T. Lu, science officer and flight engineer, exercises on the Treadmill Vibration Isolation System in the Zvezda Service Module on the International Space Station.

(Photo courtesy of NASA)

THE HARRIS-BENEDICT EQUATION

To maintain a constant weight, the amount of Calories used in a day should equal the amount of Calories eaten. To calculate how many Calories are used each day, we first have to determine the baseline rate at which the body uses energy. This baseline rate is called the Basal Metabolic Rate (BMR).

At the beginning of the twentieth century, Francis Benedict directed numerous studies of human basal metabolic rate (BMR). He developed a set of equations that could estimate BMR in humans without complex measurements. The Harris-Benedict equations, shown below, continue to be the most common methods for calculating BMR.

For men, BMR = 66.5 + (13.75 x W) + (5.003 x H) - (6.775 x A)

For women, BMR = 655.1 + (9.5663 x W) + (1.85 x H) - (4.676 x A)

Where: W = actual weight in kilograms (1 kg = 2.2046 pounds)

H = height in centimeters (2.54 cm per inch)

A = age in years

Using Energy

Total energy expenditure includes energy used at rest and during physical activity. Other important variables to consider are age, sex, body size and composition, genetic factors and overall health.

The rate at which the body uses energy (metabolic rate) increases after eating and reaches a maximum about one hour after a meal is consumed. Metabolism refers to all the chemical reactions inside a living organism. Metabolism also releases small amounts of energy as heat (as observed in Activity 1).

People with high Basal Metabolic Rate (BMR) include: athletes, children, pregnant women, and tall, thin people.

Factors that raise BMR include: stress, fever and extreme temperatures (both heat and cold).

Energy expenditures for humans are reduced in space. Astronauts must exercise frequently to counteract some of the effects of living in space.

Activity 3

Baseline Energy Needs

How much energy does a person use in a day? To answer this question, you first need to know how much energy the body uses when it isn't doing anything. This provides a baseline estimate of a person's energy needs. Use the information provided to calculate the amount of energy needed by an average 15 year old boy and girl. Follow the instructions carefully to complete each equation.

1. Fill in the values to convert weight from pounds (lb) to kilograms (kg), and height from inches (in.) to centimeters (cm).

BOY (Weight = 136 lb | Height = 67 in.)	GIRL (Weight = 127 lb | Height = 64 in.)
_____ (lb) ÷ 2.2 = _____ (kg)	_____ (lb) ÷ 2.2 = _____ (kg)
_____ (in.) × 2.54 = _____ (cm)	_____ (in.) × 2.54 = _____ (cm)

2. Use the information from Item 1 to complete the equations below and figure out resting energy needs. This is called Basal Metabolic Rate, or BMR. Begin with the equations at the the top and work down.

BOY	GIRL
_____ (kg) × 13.8 = _____ (A)	_____ (kg) × 9.6 = _____ (A)
_____ (cm) × 5 = _____ (B)	_____ (cm) × 1.9 = _____ (B)
_____ (A) + _____ (B) = _____ (C)	_____ (A) + _____ (B) = _____ (C)
_____ (C) + 66.5 = _____ (D)	_____ (C) + 655.1 = _____ (D)
_____ (Age) × 6.8 = _____ (E)	_____ (Age) × 4.7 = _____ (E)
_____ (D) − _____ (E) = ☐ (BMR)	_____ (D) − _____ (E) = ☐ (BMR)

Note. The tables and equation models on this page may be used to calculate your own resting energy needs.

Activity 3

Total Energy Needs

Resting energy needs, also called BMR, account for only part of the Calories used by the body. Physical activities also use energy. The total amount of energy used depends on the kind of activity and time spent working on it. Use the BMRs (from the Baseline Energy Needs sheet) you already calculated for the boy and girl and add their exercise habits (shown below) to the equation to find out how many Calories a typical boy and girl might actually use each day.

Boy: Spends most of his time watching TV or sitting in school.
Girl: Attends daily soccer practice after school for two hours and runs (jogs) for at least one hour each day on the weekend.

1. Select the category that best describes the exercise level for each teenager and solve the corresponding equation below. You also will need the BMR numbers from the "Baseline Energy Needs" page.

LOW ENERGY	MEDIUM ENERGY	HIGH ENERGY
Most strenuous activities in a day include at least an hour of one of the following: reading, sitting or eating.	Most strenuous activities in a day include at least an hour of one of the following: walking, dancing, skating, bowling, golfing or other light exercise.	Most strenuous activities in a day include at least an hour of one of the following: running, bicycling, playing basketball, playing soccer, gymnastics, playing tennis or other moderate to intense exercise.

BOY					GIRL				
Low Energy	1.3	×	_____ BMR	= _____ Cal/Day	**Low Energy**	1.3	×	_____ BMR	= _____ Cal/Day
Medium Energy	1.7	×	_____ BMR	= _____ Cal/Day	**Medium Energy**	1.7	×	_____ BMR	= _____ Cal/Day
High Energy	1.9	×	_____ BMR	= _____ Cal/Day	**High Energy**	1.9	×	_____ BMR	= _____ Cal/Day

2. What were the total energy needs of the boy? _____ Cal/Day

3. What were the total energy needs of the girl? _____ Cal/Day

4. Based on your calculations, did the boy or girl have higher total daily Calorie needs?_____

5. What could a person do if he or she wanted to use more Calories in a day?

_____

_____

CONCEPTS

- Objects have observable properties that can be measured.
- Serving sizes on Nutrition Facts labels can help guide food choices.

OVERVIEW

Students will estimate serving sizes of different foods and compare their estimates to serving size information provided on Nutrition Facts food labels.

SCIENCE, HEALTH & MATH SKILLS

- Estimating dry and liquid measures of volume
- Estimating appropriate portion sizes

4. Serving Sizes

Background

Food labels and other guides often use "serving size" to describe a recommended single portion of a food. Serving sizes are different for various kinds of food (liquid versus solid foods, and cooked versus raw foods). In many cases, the amount specified as a "serving size" for a particular food is smaller than the amount typically eaten.

Frequently, the serving sizes listed on "Nutrition Facts" labels of food packages are larger than the serving sizes listed by other guides to healthy eating, such as the Food Pyramid (shown on p. 22). Serving sizes listed on food labels are designed to make it easier to compare the calorie, carbohydrate and fat content of similar products, and to identify nutrients present in a food. Used appropriately, the information on food labels can help consumers make better food choices.

This activity introduces students to solid and liquid measures and to the concept of "serving size."

Time

15 minutes for setup; 45 minutes to conduct activity

Materials

- 2 packages of each of the following foods: frozen peas, dry breakfast cereal, popped popcorn (remove and save Nutrition Facts labels from packaging)
- 3 large containers for dry sample foods
- 2-liter bottle of soft drink, regular (remove and save Nutrition Facts labels from packaging)

Each group will need:

- 6 paper plates (for dry foods)
- 2 large cups or containers (for liquids)
- permanent marker
- 2 measuring cups (one for solids, one for liquids)
- copy of Nutrition Facts labels removed from food items above (see Setup)
- copy of "What Is A Serving Size?" student sheet
- copy of "Labels & Estimates" student sheet

Setup and Management

Save the Nutrition Facts label from each food item listed under Materials. Paste all of the labels onto a sheet of paper and make a copy for each group. Display the three dry food items and the bottle of soft drink at a food station within the classroom. Place all materials in a central location for Materials Managers to collect. Have students work in groups of four.

Procedure

1. Ask students, *What is a serving size?* Use students' answers to guide them into a discussion of food portions. Explain that food portions frequently are measured in terms of "cups" or other units. Show students the measuring cups that they will be using to measure dry and liquid foods. Point out to students that each of the units commonly used in cooking can be translated to standard international

Nutrition Facts Labels

The Nutrition Facts labels on packaged food can help people make better food choices. Labels list the amounts of nutrients present in the food in grams or as a percentage of the Recommended Dietary Allowance (RDA). The Nutrition Facts label is designed to help consumers select foods that will meet their dietary guidelines.

PORTIONS VERSUS SERVINGS*		
FOOD ITEM	NORMAL PORTION	NUMBER OF SERVINGS REPRESENTED
Bagel	1 whole	4
Muffin	1 large	3
Cinnamon bun	1 large	4
Flour tortilla	1 burrito-sized	2
Tortilla chips	1 individual bag	2
Popcorn	movie theatre medium (16 cups)	8
Baked potato	one large	3
French fries	medium order (4 oz)	4
Fried chicken	3 pieces (7–8 oz)	3
Steak	13 oz	5
Sliced ham or roast beef	amount in typical deli sandwich (5 oz)	2

* Portions of many common foods consist of more than one "serving size."

(metric) units, such as liters or grams.

2. After students have discussed food portions and serving sizes, challenge them to predict serving sizes for liquid and solid foods.

3. Have Materials Mangers pick up the materials for each group. Give each group a copy of the "What Is A Serving Size?" student sheet. Have students follow the instructions on their activity sheets to label the plates and cups, and predict appropriate portion sizes for each of the four foods.

4. Once students have completed their predictions, allow each group to measure and place the corresponding amounts of each of the food into the cup and on the plates labeled "Estimate."

5. After students have measured out the amounts of food representing their predicted serving sizes, give each group a copy of the Nutrition Facts labels from of all four foods.

6. Help students find the manufacturers' suggested serving sizes for each food on the labels. Have students measure and place one serving (as indicated on the label) into the cup and on the plates marked "Food Label." Have students observe and compare the amounts they estimated as one serving size with the amounts actually listed on the food labels.

7. Allow each group to share its findings with the rest of the class.

8. Distribute a copy of the "Labels & Estimates" student sheet to each student. Help students find other relevant information on the label, such as total calories needed and amounts of important nutrients. Point out the Quick Hand Measures of portion sizes on the sheet. Ask, *Do you think food labels can help you make better decisions about what and how much to eat?*

Extensions

- In order to learn about "hidden sugar" in different foods and drinks, have students compare the amounts of sugar listed on the labels of packaged juice, soda, cookies, cereal, commercially baked breads and other foods (4 g of sugar = 1 tsp).

Food Labels and Fats

If an ingredient list on a food label includes the words "shortening," "partially hydrogenated vegetable oil," or "hydrogenated vegetable oil," the food contains trans fats and might not be a healthy choice. (See sidebars on pp. 17 and 25 for more information on fats and trans fats.)

Equivalent Measures

1 tbsp = 3 tsp
4 tbsp = 1/4 cup
8 tbsp = 1/2 cup
12 tbsp = 3/4 cup
16 tbsp = 1 cup

Liquid Measures

1 oz = 2 tbsp
2 oz = 1/4 cup
4 oz = 1/2 cup
6 oz = 3/4 cup
8 oz = 1 cup
16 oz = 2 cups
32 oz = 4 cups

Dry Measures

4 oz = 1/4 lb
8 oz = 1/2 lb
12 oz = 3/4 lb
16 oz = 1 lb

Activity 4

What Is A Serving Size?

Have you ever wondered what are appropriate serving sizes of different foods? You will be investigating serving sizes of the foods displayed in your classroom.

You will need six plates and two cups. Label three of the plates and one cup as "Estimate." Mark the other three plates and cup as "Food Label."

Serving Size: Estimates

1. Write the name of each food under the Food Name column on Table 1.
2. For each food, decide how many cups (or fractions of cups) make up one serving size. Record your estimates on the table.
3. Take the plates and cup labeled "Estimate" to the station where the foods are displayed. Also bring this sheet with your serving size estimates. Measure out what you recorded (estimated) for one serving size of each food on a plate or in the cup. Take a look at the amounts you measured. Are they more or less than you expected?

TABLE 1. Estimates

Food Name	How much do you estimate is one serving of this food? — Use cups as a measure.

Serving Size: Nutrition Facts Labels

1. Look at the copy of the Nutrition Facts labels of the foods. Write the name of each of the foods under the Food Name column on Table 2. Find the serving size recommendations on each Nutrition Facts label. Write the recommended serving size listed on the Nutrition Facts label for each food in the appropriate space.
2. Take the plates and cup marked "Food Label" to the food station. Measure out the appropriate amounts of each food based on the Nutrition Facts labels. Put each portion on a plate or in the cup.

TABLE 2. Nutrition Facts Labels

Food Name	Nutrition Facts food label recommended serving size. — Use cups as a measure.

3. Compare your serving size estimates to the serving sizes recommended by the Nutrition Facts labels. Describe any differences on the back of this sheet.
4. Based on the information you collected, why do you think it might be important to look at the serving sizes listed on food labels? Record your answer on the back of this sheet.

Activity 4

Labels & Estimates

Serving sizes often are smaller than the portions we actually eat.

Look for low levels of saturated, hydrogenated and trans fats. These are unhealthy.

Cholesterol is found in foods of animal origin.

Look for foods that have more carbohydrates as fiber and fewer as sugar. Only foods from plants provide fiber.

Protein is important for muscles and growth. It is found in animal and plant foods.

Vitamins and minerals are essential for health. Calcium is important for bones and teeth.

Use this section as a guide for daily planning. The amount of calories needed by each person depends on many factors, including exercise.

Refried Beans
Fat Free

Nutrition Facts

Serving Size 1/2 cup (125g)
Serving Per Container 3.5

Amount Per Serving	
Calories 130	Calories from Fat 0
	% Daily Value*
Total Fat 0g	**0%**
Saturated Fat 0g	**0%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 490mg	**20%**
Total Carbohydrate 24g	**8%**
Dietary Fiber 7g	**28%**
Sugars 0g	
Protein 9g	**16%**
Vitamin A	**0%**
Vitamin C	**0%**
Calcium	**6%**
Iron	**15%**

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

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

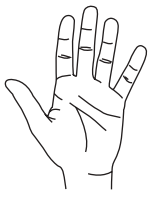
Use the Quick Hand Measures to estimate the size of one serving of different foods.

Quick Hand Measures

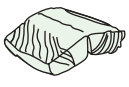
A closed fist
=
Piece of fruit or cup of raw vegetables

Two fingers
=
Ounce of cheese

A cupped hand
=
Cup of dry cereal



An open palm
=
Single serving of meat



Tip of thumb
=
Teaspoon of butter

CONCEPTS

- A person's daily Calorie intake should match his or her daily Calorie needs and Calorie expenditures.
- Nutritional requirements vary with body weight, age, gender, activity level and body functioning.

OVERVIEW

Students will document their individual eating habits and learn whether their eating patterns meet their needs.

SCIENCE, HEALTH & MATH SKILLS

- Calculating
- Comparing
- Modeling
- Drawing conclusions

5. Servings and Choices

Background

Food provides us with the energy we need for our daily activities. However, to maintain an appropriate weight, we must balance the foods we eat with the energy we spend. In other words, Calorie intake must match Calorie expenditure. Many teenagers and children do not realize the importance of this balance. As a result, teenagers' diets often include too many Calories.

When the body takes in too many Calories, part of the excess is stored as fat. Conversely, when more Calories are used than are consumed, stored fat is burned to make up the energy difference.

This activity is designed to make students aware of the Calories they consume each day and to give them opportunities to compare their Calorie intakes and expenditures.

Time

10 minutes for setup; 45–60 minutes for activity

Materials

Each student will need:

- copies of "Serving Savvy" and "Serving Sizes & Calories" student sheets
- writing paper and pen or pencil
- calculation of daily Calorie needs from Activity 3, "Total Energy Needs" student sheet

Setup and Management

Students will need their estimates of daily Calorie needs from Activity 3. They will work individually on this activity.

Procedure

1. Distribute copies of the "Serving Savvy" student sheet. On a separate sheet of paper, have each student list everything he or she would eat in a typical day, using the food items on the chart. OR have students write down everything that they eat in a 24-hour period. This list should designate meals: breakfast, lunch and/or dinner, plus snacks. Students should record both the type and amount of food, based on serving sizes given on the chart.


Activity 5
Serving Savvy

2. Once students have listed their food intake for a day, ask them if they think their consumption will meet daily Calorie requirements for a typical boy or girl, as calculated in Activity 3.

3. Distribute copies of the "Serving Sizes & Calories" student sheet. Tell students they will use the chart to estimate how many Calories are in each

Everyone has unique nutritional and health care needs. The information in this unit is not intended as a replacement for professional medical advice. Before beginning any diet, supplement or exercise program, discuss it with a doctor or qualified health care provider.

Whenever possible, choose the following.

- **Whole wheat over white bread or white flour**
- **Olive, canola or flaxseed seed oils instead of lard, margarine or shortening**
- **Fresh fruits and vegetables over manufactured cookies, cakes, crackers and pies**
- **Low-fat dairy products instead of those made with whole milk or cream**

"SUPER-SIZING" PORTIONS

In many fast food restaurants, options are given to "Super size" portions. Below are the Calorie counts for some common fast foods.

French fries	
Small	210
Large	450
Super	540
Eggrolls	
3 pieces	440
5 pieces	730
Chicken nuggets	
4 pieces	190
6 pieces	290
9 pieces	430

item on their lists. Point out that the Calories listed are for specific amounts of each food item. If students have recorded more than one serving of an item, they should multiply the Calories for that item by the number of servings.

4. Finally, have students add all the Calorie values they calculated for the day. Ask, *Is this value higher or lower than you expected?*

5. Have students compare the daily Calorie needs, obtained from Activity 3, "Total Energy Needs" sheet, to the total number of Calories calculated from their food lists. Ask, *How many of you had the same number of Calories in your food list as the daily Calorie requirement? What food items had the most Calories? Were you surprised at the Calorie contents of any of the foods?*

6. Discuss with students the importance of balancing Calorie intake and expenditure. Ask students to think about how they could achieve this balance. Point out that it is not only what students eat, but also how much they eat, that determines their Calorie intake.

7. Conclude by asking students, *Are there any ways to improve your eating habits?* Discuss changes they could make in either their daily activities or daily food intake. Collect or have students save their lists to use with Activity 6.

Extensions

- Have students search the Internet for Calorie values corresponding to foods not listed in the chart.

Astronauts select their meals from a wide variety of foods. Shown here during off-duty time, astronauts N. Jan Davis, payload commander, and Stephen K. Robinson, mission specialist, try their hands at chopsticks while having a meal of Japanese rice on the Space Shuttle's mid-deck.

(Photo courtesy of NASA)

Guide to Fats

The properties of fats are related to their chemical makeups. Not all fats are "bad." Some fats are important for good health.

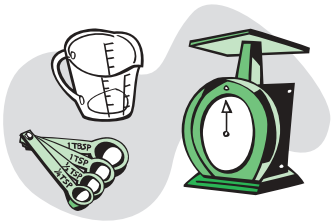
- **Omega-3 fats may help protect against cardiovascular disease. Fish and flaxseed oils are good sources of omega-3s.**
- **Unsaturated fats like olive, peanut, canola, soybean or corn oils are healthier choices.**

Some fats can contribute to an increased risk of coronary heart disease.

- **Saturated fats, which often are solid at room temperature, are less healthy. Animal-based fats (such as lard and butter) are highly saturated.**
- **The process of hydrogenation turns oils into solid fats. (See sidebar, p. 25 for more information.)**

Activity 5

Serving Savvy

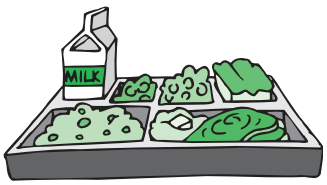


On a separate sheet of paper, use the information below to list or create a "typical" one-day menu for yourself. Include all meals and snacks and the amount you would eat of each food.

Item (amount)	Item (amount)	Item (amount)
Apple, fresh (1 medium)	Egg (1 medium)	Pizza, pepperoni (1/8 of 12-in. pie)
Apple juice (1 cup)	Egg roll, fried (1 roll, 3.5 oz)	Pocket sandwich, chicken (1 pocket)
Applesauce, sweetened (1/2 cup)	Enchilada, cheese (1 enchilada, 5.7 oz)	Popcorn, air popped (1 cup)
Asparagus, fresh (1/2 cup)	Fish, catfish, fried (3 oz portion)	Popcorn, microwave butter (3 cups)
Avocado, mashed (1/2 cup)	Fish, flounder, baked (3 oz portion)	Pork, chop (3 oz portion)
Bacon, cooked (1 slice)	Grapes, fresh (1 cup)	Pork, ham (1 cup chopped)
Bagel, plain (3.5 in.)	Grapefruit (1 medium)	Potato, baked, plain (1 large)
Banana, fresh (1 medium)	Gravy (1/4 cup)	Potato, french fried (20 pieces)
Beans, baked (1/2 cup)	Green beans, cooked (1/2 cup)	Potato, mashed (1/2 cup)
Beans, refried (1/2 cup)	Hot dog (1 hot dog)	Potato, tater tot style (9 pieces)
Beef, ground, broiled (3 oz portion)	Ice cream, regular (1/2 cup)	Potato, sweet (1 small)
Beef, pot roast, roasted (3 oz portion)	Ice cream, rich (1/2 cup)	Pretzel snack mix (1/2 cup)
Beef, steak, broiled (3 oz steak)	Jelly or jam (1 tablespoon)	Pudding cup, any flavor (1/2 cup)
Bread, hamburger bun (1 medium)	Ketchup (1 tablespoon)	Raisins (1/4 cup)
Bread, hot dog bun (1 medium)	Lettuce, iceberg, fresh (1 cup)	Ravioli, beef (1 cup)
Bread, pita, wheat or white (1/2 pocket)	Macaroni and cheese (1 cup)	Ravioli, cheese (1 cup)
Bread, sandwich, wheat or white (1 slice)	Margarine (3 teaspoons or 1 tablespoon)	Rice cake (1 cake)
Broccoli, fresh (1 cup)	Mayonnaise (1 tablespoon)	Rice, brown or white, cooked (1/2 cup)
Brownie (1 piece)	Milk, 2% (1 cup)	Rice, fried (3/4 cup)
Burrito, bean and cheese (6 oz burrito)	Milk, whole (1 cup)	Salad dressing, ranch (2 tablespoons)
Butter (3 teaspoons or 1 tablespoon)	Milk drink, chocolate (1 cup)	Salad dressing, fat-free (2 tablespoons)
Cake, chocolate, frosted (1 cupcake-size)	Milk drink, hot chocolate/cocoa (1 cup)	Salsa, con queso (2 tablespoons)
Candy, chocolate bar (2 fun size)	Milk drink, milkshake (1 cup)	Salsa, picante (2 tablespoons)
Candy, hard (1 piece)	Muffin, any flavor (1 medium)	Snacks, cheese puffs, baked (3/4 cup)
Candy, jelly beans (10 small)	Mushrooms, fresh (1 cup)	Snacks, Cheetos-style (26 pieces)
Carrots, cooked (1/2 cup)	Nachos with cheese (8 chips)	Soft drink, cola (12-oz can)
Cauliflower, cooked (1/2 cup)	Noodles, egg, cooked (1 cup)	Soft drink, diet cola (12-oz can)
Celery, fresh (1 stalk)	Noodles, chow mein, cooked (1 cup)	Soup, cream style (1 cup)
Cereal, sweetened, dry (1 cup)	Noodles, rice, cooked (1 cup)	Soup, noodle style (1 cup)
Cereal, unsweetened, dry (1 cup)	Oatmeal, plain, cooked (1/2 cup)	Soup, vegetable (1 cup)
Cheese, American (1 slice)	Oil, cooking (1 tablespoon)	Soup, vegetable with meat (1 cup)
Cheese, Swiss (1 slice)	Olives, green (4 medium)	Sour cream (2 tablespoons)
Chicken, thigh, fried (1 piece)	Onion, fresh (1/2 cup, chopped)	Spaghetti sauce, vegetable (1/2 cup)
Chicken, thigh, roasted (1 piece)	Onion rings, fried (9 rings)	Spaghetti sauce, meat flavored (1/2 cup)
Chicken, breast, fried (1 piece)	Orange, fresh (1 medium)	Spinach, canned (1/2 cup)
Chicken, breast, roasted (1 piece)	Orange juice (1 cup)	Squash, canned (1/2 cup)
Chicken, nuggets (6 pieces)	Pancake, plain (1 4-in. pancake)	Strawberries, fresh (1/2 cup)
Chicken, deli sandwich (2 slices)	Pasta, cooked (1 cup)	Sugar, white (1 tablespoon
Chili, with or without beans (1 cup)	Pastry, toaster-type, no icing (1 pastry)	Sunflower seeds (1/4 cup)
Cookie, chocolate chip (1 cookie)	Peach, fresh (1 medium)	Sushi, California or tuna roll (1 piece)
Cookie, chocolate sandwich (3 cookies)	Peaches, canned (1/2 cup)	Syrup, pancake (1/4 cup)
Cookie, oatmeal (2 cookies)	Pear, fresh (1 medium)	Syrup, pancake, lite (1/4 cup)
Cookie, vanilla wafer (8 cookies)	Peanuts (1/4 cup)	Tofu (1-in. slice or 3 oz)
Corn, cooked (1/2 cup)	Peanut butter (2 tablespoons)	Tortilla, corn or flour (1 tortilla)
Chips, any style (1 oz or about 15 chips)	Peas, canned (1/2 cup)	Taco, beef, prepared (1 small)
Corn dog, cooked (1 corn dog)	Peas, black-eyed with bacon (1/2 cup)	Taco salad (1 1/2 cups)
Cottage cheese (1/2 cup)	Peppers, banana or jalapeno (3 peppers)	Tamales, beef (3 small)
Cracker, graham (8 small squares)	Pickles, dill hamburger chips (5 pieces)	Tomato, fresh (1 medium)
Cracker, peanut butter wheat (1 pkg)	Pickles, sweet (3 small)	Tuna, canned in water (2 oz)
Cracker, saltine (1 cracker)	Pie, apple (1 slice or 1/6-slice of pie)	Turkey, without skin (1 cup)
Cream cheese (2 tablespoons)	Pineapple, canned (1/2 cup)	Yogurt, plain (1 cup)
Doughnut, plain (1 medium)	Pizza, cheese (1/8 of 12-in. pie)	Yogurt, with fruit (1 cup)

Activity 5

Serving Sizes & Calories



Use the values below to figure out how many Calories are in each of the items on your menu.

Item (amount)	Cal
Apple, fresh (1 medium)	91
Apple juice (1 cup)	90
Applesauce, sweetened (1/2 cup)	97
Asparagus, fresh (1/2 cup)	20
Avocado, mashed (1/2 cup)	175
Bacon, cooked (1 slice)	35
Bagel, plain (3.5 in.)	195
Banana, fresh (1 medium)	120
Beans, baked (1/2 cup)	150
Beans, refried (1/2 cup)	110
Beef, ground, broiled (3 oz portion)	238
Beef, pot roast, roasted (3 oz portion)	284
Beef, steak, broiled (3 oz steak)	185
Bread, hamburger bun (1 medium)	180
Bread, hot dog bun (1 medium)	116
Bread, pita, wheat or white (1/2 pocket)	71
Bread, sandwich, wheat or white (1 slice)	70
Broccoli, fresh (1 cup)	25
Brownie (1 piece)	160
Burrito, bean and cheese (6 oz burrito)	300
Butter (3 teaspoons or 1 tablespoon)	300
Cake, chocolate, frosted (1 cupcake-size)	188
Candy, chocolate bar (2 fun size)	190
Candy, hard (1 piece)	24
Candy, jelly beans (10 small)	40
Carrots, cooked (1/2 cup)	35
Cauliflower, cooked (1/2 cup)	14
Celery, fresh (1 stalk)	10
Cereal, sweetened, dry (1 cup)	220
Cereal, unsweetened, dry (1 cup)	110
Cheese, American (1 slice)	110
Cheese, Swiss (1 slice)	90
Chicken, thigh, fried (1 piece)	162
Chicken, thigh, roasted (1 piece)	153
Chicken, breast, fried (1 piece)	218
Chicken, breast, roasted (1 piece)	193
Chicken, nuggets (6 pieces)	290
Chicken, deli sandwich (2 slices)	45
Chili, with or without beans (1 cup)	300
Cookie, chocolate chip (1 cookie)	78
Cookie, chocolate sandwich (3 cookies)	170
Cookie, oatmeal (2 cookies)	110
Cookie, vanilla wafer (8 cookies)	140
Corn, cooked (1/2 cup)	67
Chips, any style (1 oz or about 15 chips)	150
Corn dog, cooked (1 corn dog)	330
Cottage cheese (1/2 cup)	120
Cracker, graham (8 small squares)	120
Cracker, peanut butter wheat (1 pkg)	190
Cracker, saltine (1 cracker)	13
Cream cheese (2 tablespoons)	100
Doughnut, plain (1 medium)	110

Item (amount)	Cal
Egg (1 medium)	77
Egg roll, fried (1 roll, 3.5 oz)	202
Enchilada, cheese (1 enchilada, 5.7 oz)	320
Fish, catfish, fried (3 oz portion)	194
Fish, flounder, baked (3 oz portion)	99
Grapes, fresh (1 cup)	58
Grapefruit (1 medium)	80
Gravy (1/4 cup)	164
Green beans, cooked (1/2 cup)	22
Hot dog (1 hot dog)	145
Ice cream, regular (1/2 cup)	130
Ice cream, rich (1/2 cup)	290
Jelly or jam (1 tablespoon)	40
Ketchup (1 tablespoon)	16
Lettuce, iceberg, fresh (1 cup)	10
Macaroni and cheese (1 cup)	320
Margarine (3 teaspoons or 1 tablespoon)	102
Mayonnaise (1 tablespoon)	100
Milk, 2% (1 cup)	120
Milk, whole (1 cup)	150
Milk drink, chocolate (1 cup)	238
Milk drink, hot chocolate/cocoa (1 cup)	147
Milk drink, milkshake (1 cup)	288
Muffin, any flavor (1 medium)	180
Mushrooms, fresh (1 cup)	20
Nachos with cheese (8 chips)	345
Noodles, egg, cooked (1 cup)	213
Noodles, chow mein, cooked (1 cup)	237
Noodles, rice, cooked (1 cup)	192
Oatmeal, plain, cooked (1/2 cup)	72
Oil, cooking (1 tablespoon)	120
Olives, green (4 medium)	15
Onion, fresh (1/2 cup, chopped)	21
Onion rings, fried (9 rings)	275
Orange, fresh (1 medium)	60
Orange juice (1 cup)	105
Pancake, plain (1 4-in. pancake)	83
Pasta, cooked (1 cup)	200
Pastry, toaster-type, no icing (1 pastry)	200
Peach, fresh (1 medium)	37
Peaches, canned (1/2 cup)	100
Pear, fresh (1 medium)	98
Peanuts (1/4 cup)	214
Peanut butter (2 tablespoons)	190
Peas, canned (1/2 cup)	60
Peas, black-eyed with bacon (1/2 cup)	90
Peppers, banana or jalapeno (3 peppers)	11
Pickles, dill hamburger chips (5 pieces)	5
Pickles, sweet (3 small)	40
Pie, apple (1 slice or 1/6-slice of pie)	270
Pineapple, canned (1/2 cup)	100
Pizza, cheese (1/8 of 12-in. pie)	140

Item (amount)	Cal
Pizza, pepperoni (1/8 of 12-in. pie)	180
Pocket sandwich, chicken (1 pocket)	300
Popcorn, air popped (1 cup)	30
Popcorn, microwave butter (3 cups)	100
Pork, chop (3 oz portion)	213
Pork, ham (1 cup chopped)	369
Potato, baked, plain (1 large)	280
Potato, french fried (20 pieces)	235
Potato, mashed (1/2 cup)	160
Potato, tater tot style (9 pieces)	160
Potato, sweet (1 small)	118
Pretzel snack mix (1/2 cup)	140
Pudding cup, any flavor (1/2 cup)	180
Raisins (1/4 cup)	112
Ravioli, beef (1 cup)	260
Ravioli, cheese (1 cup)	220
Rice cake (1 cake)	40
Rice, brown or white, cooked (1/2 cup)	120
Rice, fried (3/4 cup)	190
Salad dressing, ranch (2 tablespoons)	150
Salad dressing, fat-free (2 tablespoons)	50
Salsa, con queso (2 tablespoons)	90
Salsa, picante (2 tablespoons)	10
Snacks, cheese puffs, baked (3/4 cup)	140
Snacks, Cheetos-style (26 pieces)	150
Soft drink, cola (12-oz can)	150
Soft drink, diet cola (12-oz can)	2
Soup, cream style (1 cup)	130
Soup, noodle style (1 cup)	70
Soup, vegetable (1 cup)	90
Soup, vegetable with meat (1 cup)	134
Sour cream (2 tablespoons)	60
Spaghetti sauce, vegetable (1/2 cup)	100
Spaghetti sauce, meat flavored (1/2 cup)	140
Spinach, canned (1/2 cup)	25
Squash, canned (1/2 cup)	25
Strawberries, fresh (1/2 cup)	50
Sugar, white (1 tablespoon)	45
Sunflower seeds (1/4 cup)	186
Sushi, California or tuna roll (1 piece)	25
Syrup, pancake (1/4 cup)	210
Syrup, pancake, lite (1/4 cup)	100
Tofu (1-in. slice or 3 oz)	50
Tortilla, corn or flour (1 tortilla)	140
Taco, beef, prepared (1 small)	370
Taco salad (1 1/2 cups)	279
Tamales, beef (3 small)	280
Tomato, fresh (1 medium)	30
Tuna, canned in water (2 oz)	70
Turkey, without skin (1 cup)	238
Yogurt, plain (1 cup)	144
Yogurt, with fruit (1 cup)	240

Note. Calorie counts on prepared foods may be higher or lower depending on how the food is prepared and the different ingredients that may be added. Check package labels for specific information on prepared foods.

CONCEPTS

- Nutrition is essential to health.
- Good nutrition includes eating a variety of foods, and eating less sugar and unhealthy fat.

OVERVIEW

Students will compare their own eating habits to standard recommendations for a healthy diet.

SCIENCE, HEALTH & MATH SKILLS

- Comparing
- Interpreting information in charts and tables
- Modeling

6. Your Nutritional Needs

Background

Food provides more than just energy. It also supplies nutrients important for growth, repair and the maintenance of good health. There are five major types of nutrients: **carbohydrates, proteins, fats, vitamins** and **minerals**. Three of these—carbohydrates, proteins and fats—are known as **macronutrients**, because they provide energy and are consumed in much larger quantities. Vitamins and minerals are needed in much smaller amounts. To operate at its best, the body needs appropriate amounts of each nutrient.

- **Carbohydrates** are a major source of energy found in fruits, vegetables, grains and flours. Fiber, starches and sugars are carbohydrates. The best kinds of carbohydrates are digested slowly and provide an even supply of energy. Breads, cereals and pastas, when made from whole grains, are good carbohydrate choices.
- **Fats** are rich sources of energy. Certain kinds of fats and oils are healthier than others. Fats that are solid at room temperature, such as shortening, margarine and lard, should be avoided. Healthier choices include olive, flaxseed or canola oil. Foods that contain large amounts of unhealthy fats include some red meats, whole milk dairy products and cream, chocolate, cakes, cookies and crackers.
- **Proteins** are building blocks for the body. Muscles, hair, skin and nails are mostly protein, as is the flexible collagen network within bones. Proteins help carry out essential reactions within each cell. The body also can use protein as an energy source. Meats, fish, poultry, eggs, low-fat dairy products, beans and nuts are good sources of protein.
- **Vitamins**, needed by the body in small amounts, are molecules essential for the functioning of cells, but they cannot be manufactured by our bodies.
- **Minerals** have a number of roles. Calcium, the most abundant mineral in the body, makes bones hard and is essential for the nervous system and muscles.

The US Department of Agriculture (USDA) created the Food Pyramid as a visual guide for healthy eating. To get all of the nutrients needed for good health, choose the recommended number of daily servings from each of the five major food groups.

This activity allows students to learn about food selections and to compare their own diets to the USDA recommendations for a healthier diet.

Time

10 minutes for setup; 45–60 minutes to conduct the activity

Materials

Each student will need:

- copy of "Serving Sizes & Calories" and

Water for Life

Water makes up three-fourths of the brain and muscles. Every cell in the body is packed with water. Water transports nutrients and wastes, helps control temperature, and makes many chemical reactions possible. The body loses almost three liters of water every day. Some of it is replaced with food, but drinking six to eight glasses of liquid each day to maintain the body's water supply is recommended.

During space flight, there is no light source to provide vitamin D, which is necessary for calcium absorption. Therefore, astronauts' dietary vitamin D must come from fish oil or supplements.

completed food list from Activity 5
- copy of "Healthy Choices" and "What's On Your Menu" student sheets

Setup and Management

Conduct an initial discussion with the entire class. Students should work individually on their food selections. Students will need the daily food list they prepared for the previous activity.

Procedure

1. Ask students, *Are calories the only important part of someone's diet? Could you live on chocolate alone? How about lettuce? Or hamburgers? Why do you think it is important to eat different kinds of foods?* Discuss the five classes of nutrients and their importance with the class.

2. Distribute the student sheets. If necessary, explain the Food Pyramid diagram to students. *The Food Pyramid helps us make better choices about foods we should eat. Each section represents a nutrient group and tells us how many servings we should have each day from that group.* Mention that one "serving size" on the Food Pyramid is probably smaller than the amount we are used to eating or the amount served in restaurants, and may be different from the amount mentioned on the Nutrition Facts label.

3. Have each student review the list of daily food choices he/she recorded in the previous activity and compare it with the Food Pyramid. Point out the basic food groups and have students identify the food group in which each item on their lists belongs. Some items may fall into more than one food category. For example, a large portion of lasagna might count as one serving from the bread/pasta group, one serving from the dairy group (cheese), one-half serving from the vegetable group (tomato sauce) and one serving from the meat group (beef or sausage).

SAMPLE OF ONE GROUP/DAY

Meal	Breads & Grains Group portions		Pyramid Servings
Breakfast	1/2 cup of oatmeal	=	1
Lunch	1 hamburger bun	=	2
Dinner	1 slice of garlic bread	=	1
Dinner	1 cup of spaghetti	=	2
TOTAL	**4 portions**	**=**	**6**

4. Have students place the foods and Calories from their food lists into the appropriate categories of the My Selections column of the "What's On Your Menu?" student sheet.

5. When students have recorded their original food list, ask, *How many of you had the recommended amounts of fruits, vegetables, meats and dairy products in your plans? Did anyone exceed the recommendations for fats and sweets, or breads and pastas?*

6. Have students consider how they can improve their eating habits and then record these changes in the healthier plan column. Point out that balancing Calories, nutrition needs and serving sizes is an important individual activity.

Extensions

- Have students read "Nutrition Research" and discuss the article in class. Have students make a list of other kinds of nutritional supplements (multi vitamins, calcium tablets, etc.) about which they have questions. Have students use information provided by the US National Library of Medicine web site (http://www.nlm.nih.gov/medlineplus/) or at the National Institutes of Health web site (http://health.nih.gov/) to answer their questions.

Eating Disorders

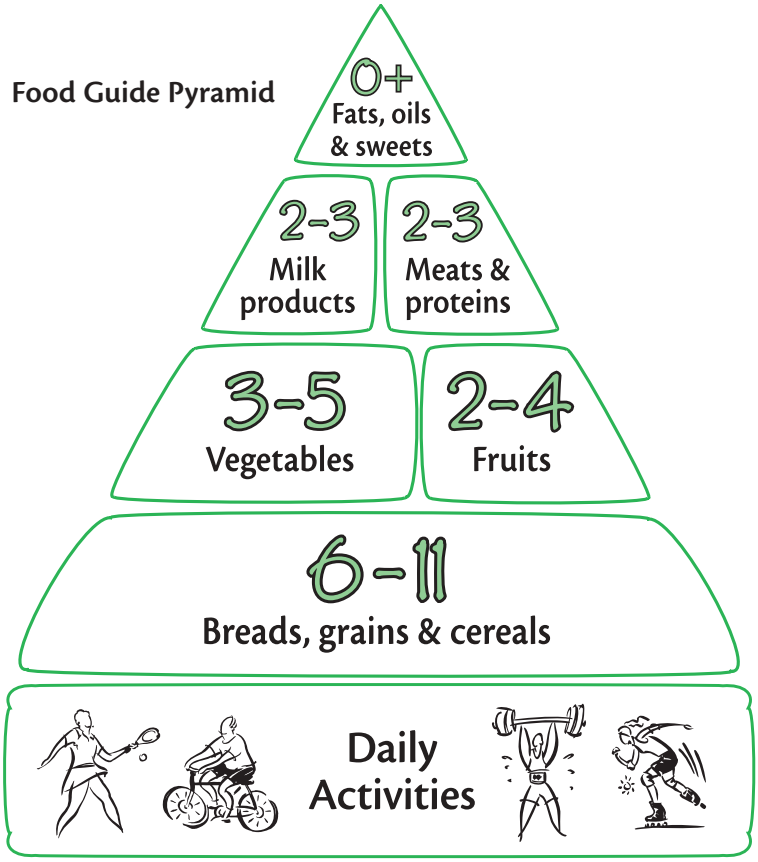
Sometimes girls, women and, increasingly, men become worried about the amount of food they eat and what they weigh. This worry can lead to eating disorders that can cause serious physical and emotional health problems. In a recent study, 70% of 6th grade girls said they began worrying about their weight when they were between 9 and 11 years old! Eating disorders include anorexia nervosa, bulimia nervosa and binge eating.

Anorexia nervosa is an excessive concern with being thin. Bulimia nervosa involves binging and then purging what is eaten (by throwing up, using laxatives or over-exercising). Binge eating is overeating that cannot be controlled. Researchers say that almost 5% of young women in the US have an eating disorder and that as many as 15% have unhealthy attitudes toward themselves and food. Eating disorders are treatable. The sooner the treatment starts, the better.

Activity 6

Healthy Choices

Food Guide Pyramid



1. The Food Guide Pyramid helps you choose a healthy diet.
2. The Food Pyramid recommends the number of servings you should have from each food group each day. These serving sizes may be different from the ones on Nutrition Facts labels.
3. The key to healthy eating is to eat a wide variety of foods. The Pyramid is designed to help you eat a variety of foods to get the nutrients you need and the right amount of calories to maintain healthy body weight.

Safety Note. Everyone has unique nutritional and health care needs. This material is not intended as a replacement for professional medical advice. Before beginning any diet, supplement or exercise program, discuss it with your doctor or qualified health care provider.

RECOMMENDED DAILY SERVINGS

(Start at the Base of the Pyramid)

Breads, grains & cereals | 6–11 Servings
The bread group includes grains, rice, potatoes, cereals, tortillas or pasta. One serving equals 1 slice of bread, 1 tortilla, 1 cup of ready-to-eat cereal, 1/2 cup of cooked cereal, rice or macaroni, or 5–6 small crackers. Cakes, cookies, pies, french fries and chips also count as carbohydrates. Whenever possible, choose whole grains.

Vegetables | 3–5 Servings
One serving of vegetables equals 1 cup of raw, leafy vegetables or 1/2 cup of cooked vegetables (or 1/2 cup chopped raw), or 3/4 cup of vegetable juice.

Fruits | 2–4 Servings
One serving of fruit equals 1 medium apple, banana or orange, 1/2 cup of cooked or canned fruit or 3/4 cup of fruit juice.

Meats & other proteins | 2–3 Servings
The protein group includes meat, chicken, fish, nuts and beans. Pick 2–3 servings from this group. One serving equals 2–3 ounces of cooked meat, poultry or fish, 1 cup of cooked dried beans, 2 eggs, 4 tablespoons of peanut butter or 2/3 cup of nuts.

Milk products | 2–3 Servings
Milk products include milk, yogurt, cheese, cottage cheese and pudding. One serving equals 1 cup of milk or yogurt, 1/2 cup of pudding or 2 slices of cheese. Low-fat milk products are good sources of protein and calcium.

Fats, oils & sweets | Eat sparingly
Fats, oils or sweets are found in candy, nuts, fried foods, cakes, pies, cream, butter, cheese and combination foods. One serving equals 1/8 avocado, 1 tablespoon of cream cheese or salad dressing, 1 teaspoon of butter, margarine, oil or mayonnaise, or 10 peanuts. Healthy fats are liquid at room temperature.

Activity 6

What's On Your Menu?

1. Look at the food list for one day that you completed for Activity 5.
2. Compare the foods you selected to the recommendations of the Food Pyramid. Remember, many foods, like lasagna or pizza, combine items from two or more food groups. The number of servings shown on the Food Pyramid is what you should eat each day.
3. In the "My Selections" column, record the foods on your list corresponding to each food group on the left. Use a separate sheet of paper if necessary.
4. Compare the number of servings that you ate to the recommended number of servings. Count every serving of a specific food as a single item.
5. Now, based on your results, change your servings to meet the Food Pyramid recommendations. Write your selections in the "My Healthier Plan" column. For example, if you originally had 11 or 12 foods in the "breads" category and only two in the "vegetables" category, you may wish to eliminate a bread and add a vegetable.

	My Selections	My Healthier Plan
Fats, oils & sweets		
Milk products		
Meats & proteins		
Vegetables		
Fruits		
Breads, grains & cereals		

Activity 6

Nutrition Research

Scientists and researchers work constantly to find ways to improve people's health. Scientists associated with the National Space Biomedical Research Institute (NSBRI) are conducting studies to help astronauts stay healthy in space. Findings of these studies can benefit people on Earth.

One such study is being conducted by NSBRI scientist, Dr. Robert Wolfe, at The University of Texas Medical Branch at Galveston. Dr. Wolfe and his team are looking for ways to counteract some of the changes that occur in the bodies of astronauts after they have been in space for a while.

Photo by John Glowczwski for the NSBRI.

In space, astronauts' muscles don't have to work as hard as they do on Earth, because there is almost no gravity. Also, astronauts are confined in a small space, so it is difficult for them to get enough exercise. After a while, their bodies adjust to the space environment and astronauts begin to lose muscle, especially in their legs. Though astronauts exercise at least twice a day while in space, muscle loss is still a problem. Dr. Wolfe and his team are trying to find out if nutritional supplements can help prevent some of the muscle loss (or atrophy).

Doctors and researchers know that people here on Earth experience similar muscle loss when they are confined to bed for long periods of time due to illness or other circumstances. Dr. Wolfe enlisted the help of healthy people (subjects) to stay in bed for 28 days. The subjects could get up only briefly to use a bedside commode. They ate and bathed from their beds, and their daily physical activities were limited to watching television, reading books or using a computer—all done while in lying or sitting in bed.

> Everyone has unique nutritional and health care needs. The information provided here is not intended as a replacement for professional medical advice. Before beginning any supplement, diet or exercise program, discuss it with your doctor or qualified health care provider.

During the study, some of these subjects received nutritional supplements of amino acids (the raw materials of protein, which makes up muscle) three times a day. Other subjects in the study received a similar drink, but without any supplements. None of the subjects knew whether they were receiving the drink with the amino acid supplements.

Each subject's muscles were measured before and after the bed-rest study. Halfway through the study, researchers also measured the muscles and function of all subjects by testing their strength and body composition.

The researchers also looked at the role of stress in muscle loss. Under stress, the body breaks down proteins (muscles are made of protein). Conditions in space elevate the body's level of the stress hormone, cortisol, which increases the rate at which proteins—and therefore muscles—break down.

To study this process further, Dr. Wolfe's team gave stress hormones to some of the subjects in order to mimic the cortisol concentrations found in astronauts' bodies during space flight. The scientists hoped to learn whether the amino acid supplement was effective under conditions experienced by astronauts during space missions.

Early results from this NSBRI study suggest that nutritional supplements may lessen muscle loss brought on by space travel, prolonged bed confinement or immobility.

Muscle loss is common in many populations on Earth, as well as in astronauts working in space. The elderly, children with burns, patients in intensive care, some physically challenged individuals, and people who have had major operations often suffer from muscle loss. Though the study was begun to keep astronauts healthy while they work in space, the results also may benefit many people here on Earth.

The NSBRI, funded by NASA, is a consortium of institutions across the United States studying the health risks related to long-duration space flight.

CONCEPTS

- Nutritional requirements vary with body weight, age, gender, activity level and body functioning.
- Diet consists of all the foods that someone eats. Sometimes people must adjust their diets.

OVERVIEW

Students will learn about healthy eating habits to meet special needs, such as for athletes, diabetics and vegetarians.

SCIENCE, HEALTH & MATH SKILLS

- Using printed material
- Inferring
- Communicating

7. Nutritional Challenges

Background

The Food Pyramid is a guide to determine what to eat each day. It is not a rigid prescription. Instead, the Food Pyramid calls for eating a variety of foods to obtain all of the nutrients needed by the body. In general, it is a good idea to choose lower fat foods whenever possible, limit the fats and sugars added to foods (butter, margarine, gravy, jam, etc.) and choose fewer foods that are high in sugars (candy, desserts and soft drinks).

The Food Pyramid has been adapted in a variety of ways to reflect ethnic preferences, personal beliefs and health needs. This activity allows students to consider the nutritional needs of people with specific dietary requirements and to create a full-day menu for these individuals.

Time

10 minutes for setup; 30–45 minutes for students to plan menus; 30–45 minutes for presentations of menus

Materials

Each group of students will need:

- Copy of "Serving Sizes & Calories" and "Healthy Choices" sheets from previous activities.
- Copy of one "Challenging Choices" sheet photocopied, trimmed and folded in half vertically to make a card. Students will complete the inside of the card with their menus. If possible, each group should receive a different card.
- **Optional.** Provide copies of the "Menu Plan" student sheet for students to use as a preliminary worksheet. OR photocopy the sheet on the back of each "Challenging Choices" sheet (prior to making a folded card) so that students have a complete menu.

Setup and Management

Have students work in groups of four.

Procedure

1. Ask students, *Should all of us follow the same guidelines for choosing foods to eat? Why or why not? What about people with special requirements?* Mention athletes, vegetarians and astronauts as examples of people who follow different eating plans by choice and because of their activities. Follow by asking, *What about people who need to make different dietary choices for health reasons?* Mention people with diabetes (who must restrict sugar intake), people with lactose intolerance (who cannot digest the sugars in milk) and pregnant women as examples of persons who must pay special attention to what they eat.

2. Distribute a Specialty Menu card to each group of four students. Explain that each group has a different card that describes specific challenges for making a daily menu. Have each group plan a menu for breakfast lunch, dinner and snacks that meets the particular dietary needs described

Hydrogenation and Trans Fats

- The process of hydrogenation turns plant-based oils into solid fats. Hydrogenated fats are more stable at room temperature and give food products a longer shelf life.
- Hydrogenation produces a class of fats known as "trans fats." Trans fats are found in foods such as vegetable shortening, some margarines, crackers, candies, cookies, snack foods, fried foods and many processed foods. Diets high in trans fats are linked to heart disease and increased levels of "bad" cholesterol.

Crewmembers share a meal on the International Space Station. From the left are astronauts Ellen Ochoa, mission specialist; Michael J. Bloomfield, STS-110 mission commander; Jerry L. Ross; Lee M.E. Morin; and Steven L. Smith (all mission specialists); and Stephen N. Frick, pilot.

(Photo courtesy of NASA)

on the card, and write the menus on the inside of the cards. Students should follow the guidelines on the "Serving Sizes & Calories" and "Healthy Choices" student sheets, making substitutions where necessary to accommodate the dietary and caloric requirements outlined on the card, and to provide a balanced diet.

3. Have each group of students come up with a skit or other creative way to present their menus to the rest of the class. Each group's presentation should include an explanation of how their food choices meet the specific nutritional needs of the dietary type they considered.

Extensions

- Have students think about other special circumstances that might require different eating programs. Have them design menus to meet the needs they identify.
- Personal fitness, particularly cardiovascular fitness, also is essential for good health. Have students create exercise programs for each of the categories described on the Specialty Menu cards, using information from the library or the Internet.
- Eating in space has changed considerably from the earlier days of the US Space Program. Have students investigate how space foods and dietary provisions for astronauts have been modified over time.

Astronauts usually lose weight while in space because of the following reasons.

- **Boredom with foods provided.**
- **Busy schedules, which lead to skipped meals.**
- **Poor appetite because fluid in the upper body and head during microgravity causes a runny nose and simulates a cold.**
- **Difficulty eating in microgravity. For example, foods and utensils float and astronauts must stand and float while eating.**
- **Nausea and motion sickness, especially early in a space flight, which make eating less desirable during the first few days in space.**

Nutrition researchers are investigating whether some vitamin-rich fruits and vegetables can help prevent cell damage that leads to cancer.

SERVINGS COMPARISONS FOR THREE CALORIE LEVELS (USDA)

	Sedentary women, some older adults, children	Sedentary men, mildly active women, teen girls	Teen boys, active men, active women
FOOD GROUP, FAT, SUGARS	1,600 CALORIES	2,200 CALORIES	2,800 CALORIES
Bread	6 servings	9 servings	11 servings
Vegetable	3 servings	4 servings	5 servings
Fruit	2 servings	3 servings	4 servings
Meat	2–3 servings	2–3 servings	2–3 servings
Milk	2–3 servings	2–3 servings	2–3 servings
Total Fat	36 grams (20%) 53 grams (30%)	49 grams (20%) 73 grams (30%)	62 grams (20%) 93 grams (30%)
Total Added Sugars	24 grams (6 tsp)	32 grams (8 tsp)	44 grams (11 tsp)

Activity 7

Challenging Choices

PERSON WITH HYPERTENSION

Who: Older Man

Age: 65

Height: 69 in.

Weight: 180 lbs (10 lbs overweight)

Energy Level: Low

Total daily Caloric intake need: 2,119 calories

Hypertension is the medical term for high blood pressure. It affects about one out of every four American adults. High blood pressure makes the heart work too hard and increases the risk of heart disease and stroke. It also can cause other problems, such as kidney disease and blindness. People who have diabetes or are overweight are at an increased risk for high blood pressure.

Reducing the amount of salt in the diet can help lower and control high blood pressure. People with hypertension should limit their consumption of processed foods that contain a lot of salt, such as cereals, soups, canned goods, frozen dinners, ketchup and pickles. Some foods that can help to reduce high blood pressure are shown (with recommended daily servings) below.

- Whole grains and grain products: 7–8 servings (also soybean products like tofu)
- Vegetables: 4–5 servings (especially calcium-rich leafy green vegetables)
- Fruits: 4–5 servings
- Low-fat or nonfat dairy foods: 2–3 servings
- Meats, poultry or fish: 2 or fewer servings (trim away visible fat and skin from meat and broil, roast or boil, instead of frying)
- Nuts, seeds and legumes: 4–5 servings (per week)

Specialty menu

HIGH BLOOD PRESSURE

1. You will plan a one-day menu that includes breakfast, lunch, dinner and snacks to meet the particular dietary needs of an inactive person who suffers from hypertension (high blood pressure) and who is slightly overweight. Record the menu on the inside of this card. Use an additional sheet of paper if necessary.
2. Review and refer to the guidelines on the "Serving Sizes & Calories" and "Healthy Choices" sheets to make substitutions, if needed, to provide this person with a balanced diet.
3. Information regarding this person and the special needs of other people with hypertension may be found on the back of this card.

Activity 7

Challenging Choices

STRICT VEGETARIAN

Who: Teenage Boy

Age: 14

Height: 65 in.

Weight: 118 lbs

Energy Level: Medium

Total daily Caloric intake need: 2,459 calories

There are several types of vegetarians. A strict vegetarian is someone who eats only plant-based foods and doesn't eat any form of animal foods. However, there are many variations on a vegetarian diet. Some vegetarians avoid meat, fish and poultry, but include dairy products and/or eggs in their diets. Others exclude only red meat. People choose to follow a vegetarian diet for religious, political, personal or health reasons.

It is very important that a vegetarian eat a wide variety of foods. Teenage vegetarians must be particularly careful to get sufficient amounts of protein, calcium, iron and vitamin B12. Vitamin B12, which helps in the formation of red blood cells and in the functioning of the nervous system, is not naturally present in plants. But lots of cereals are fortified with B12, as are some brands of soymilk.

Vegetarians also have to pay attention to the kinds of proteins in their diets. Most plant foods do not contain all of the amino acids (building blocks of proteins) and must be combined to obtain the right balance. Examples of combinations include: peanut butter and bread, rice or corn and beans, and lentils and pasta. Beans and nuts are the best plant sources of protein.

Specialty Menu

VEGETARIAN

1. You will plan a one-day menu that includes breakfast, lunch, dinner and snacks to meet the particular dietary needs of a moderately active person who follows a strict vegetarian diet. Record the menu on the inside of this card. Use an additional sheet of paper if necessary.
2. Review and refer to the guidelines on the "Serving Sizes & Calories" and "Healthy Choices" sheets to make substitutions, if needed, to provide this person with a balanced diet.
3. Information regarding this person and the special needs of different types of vegetarians may be found on the back of this card.

Activity 7

Challenging Choices

PREGNANT WOMAN

Who: Young Woman

Age: 27

Height: 64 in.

Weight: 125 lbs

Energy Level: Medium

Total daily Caloric intake need: 2,350 calories

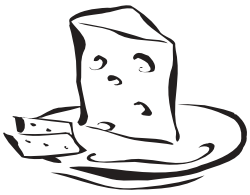
When a woman is pregnant, a healthy diet is important because everything she eats or drinks affects her baby's development. A pregnant woman needs increased daily servings of proteins and dairy products. She also may need to eat smaller meals more often (for example, six small meals instead of three large ones). Her diet should include the following.

- 3 servings of high protein foods, such as beans, meat, fish, tofu and nuts
- 3–4 servings of dairy products
- 3–5 vegetables, especially green leafy ones
- 2 servings of vitamin C-rich foods, like citrus fruits, tomatoes, peppers and potatoes
- 8 cups of non-caffeinated fluids every day. Fluids are important to help maintain proper body temperature, transport nutrients and, most importantly, cushion and protect the baby.

A pregnant woman should avoid certain foods and beverages. These include the following items.

- Alcohol
- Undercooked or raw meat
- Raw eggs (found in uncooked dough or batter, for example)
- Soft, unpasteurized cheese
- Fish that are high in fat
- Empty Calories (food and drinks that have little nutrition, such as soft drinks and candy)

Specialty Menu



PREGNANCY

1. You will plan a one-day menu that includes breakfast, lunch, dinner and snacks to meet the particular dietary needs of a moderately active woman who is in her sixth month of pregnancy. Record the menu on the inside of this card. Use an additional sheet of paper if necessary.
2. Review and refer to the guidelines on the "Serving Sizes & Calories" and "Healthy Choices" sheets to make substitutions, if needed, to provide this person with a balanced diet.
3. Information regarding this women and the special needs of pregnant women in general may be found on the back of this card.

Activity 7

Challenging Choices

LACTOSE INTOLERANT

Who: Young Active Man

Age: 22

Height: 72 in.

Weight: 185 lbs

Energy Level: High

Total daily Caloric intake need: 3,784 calories

Lactose is a kind of sugar found in milk. Some people have difficulty digesting lactose and may have symptoms, such as nausea, cramps, gas and diarrhea, when they eat foods containing milk products. Young children with lactose intolerance should not eat milk products. Most older children and adults differ in the amounts of lactose they can handle. Lactose intolerance is very common in adults and is not dangerous.

The most important nutrient in dairy products is calcium, which is essential for the growth and repair of bones. It can be difficult for people with lactose intolerance to get enough calcium. However, lactose-reduced milk and other products are available at many supermarkets. Also, many nondairy foods are high in calcium. Green vegetables, such as broccoli and collard or turnip greens, and fish with soft, edible bones, such as salmon and sardines, are excellent sources of calcium.

Lactose intolerant people may have to avoid many prepared foods that contain milk, such as bread and other baked goods; processed breakfast cereals and drinks; instant potatoes; soups; margarine; lunch meats; salad dressings; candies and other snacks; mixes for pancakes, biscuits, and cookies; and some products labeled nondairy, such as powdered coffee creamer and whipped toppings.

specialty menu

LACTOSE INTOLERANCE

1. You will plan a one-day menu that includes breakfast, lunch, dinner and snacks to meet the particular dietary needs of an active person who cannot eat foods containing lactose. Record the menu on the inside of this card. Use an additional sheet of paper if necessary.
2. Review and refer to the guidelines on the "Serving Sizes & Calories" and "Healthy Choices" sheets to make substitutions, if needed, to provide this person with a balanced diet.
3. Information regarding this person and the special needs of others who are lactose intolerant may be found on the back of this card.

Activity 7

Challenging Choices

TYPE 2 DIABETIC

Who: Teenage Girl

Age: 16

Height: 63 in.

Weight: 172 lbs

Energy Level: Low

Total daily Caloric intake need: 2,125 calories

Cells of the body receive energy from sugar dissolved in the bloodstream. The hormone, insulin, allows cells to take glucose, a kind of sugar, from the blood. Type 2 Diabetes makes it harder for cells to take in glucose. Over time, diabetes can result in damage to the eyes, kidneys, nerves, heart, teeth and gums.

Diabetics should eat about the same amount of food at the same times each day and avoid eating too much at one time. Regular exercise under a doctor's supervision also is beneficial. An overweight person with diabetes can safely lose weight by lowering his/her daily Caloric intake by 300–500 calories/day. Diabetics should do the following.

- Eat less sugar (regular soft drinks and sugary foods) and refined carbohydrates (processed, white foods, like white bread, white rice, and white potatoes). They should eat high-fiber foods that contain whole grains (whole wheat bread, whole grain pasta, brown rice and beans).
- Reduce the fat in their diets by eating lean meats, grilled foods and part-skim or low-calorie cheeses. They also can eat more fish and poultry (without the skin) but only 3–4 eggs per week. Protein intake should come mostly from grains and vegetables instead of meats.

Specialty menu

TYPE 2 DIABETES

1. You will plan a one-day menu that includes breakfast, lunch, dinner and snacks to meet the particular dietary needs of an inactive person diagnosed with Type 2 Diabetes. This person also is overweight and needs to reduce his or her daily Caloric intake safely. Record the menu on the inside of this card. Use an additional sheet of paper if necessary.
2. Review and refer to the guidelines on the "Serving Sizes & Calories" and "Healthy Choices" sheets to make substitutions, if needed, to provide this person with a balanced diet.
3. Information regarding this person and the special needs of diabetics in general may be found on the back of this card.

Activity 7

Challenging Choices

ATHLETE IN TRAINING

Who: Teenage Girl

Age: 16

Height: 62 in.

Weight: 105 lbs

Energy Level: High

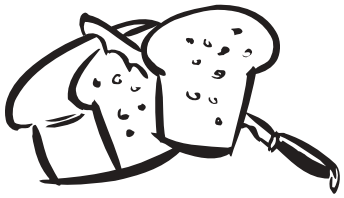
Total daily Caloric intake need: 2,541 calories

To perform at the highest level, athletes must have proper nutrition, as well as exercise and practice. The main differences between an athlete's diet and a non-athlete's diet are that an athlete needs more Calories and fluids. Athletes must consume more Calories than most people do to replace energy consumed during physical exertion. Nutrients also need to be replenished. Athletes should drink water before, during and after exercise and physical activity. They should drink water even when they are not thirsty to maintain adequate fluid levels in their bodies and prevent dehydration.

It is usually recommended that athletes eat three to four hours before a competition. Allowing enough time between eating and competing gives enough time for food to digest and makes maximum energy available from food.

- High fat foods (products with whole milk or cream, for example) can take longer to digest and may interfere with athletic performance.
- Carbohydrate foods, such as pasta, breads and cereal, are popular choices before competition because they provide energy, as well as fiber, vitamins and minerals.

Specialty menu



ATHLETIC TRAINING

1. You will plan a one-day menu that includes breakfast, lunch, dinner and snacks to meet the particular dietary needs of an athlete in training for an upcoming competition. Record the menu on the inside of this card. Use an additional sheet of paper if necessary.
2. Review and refer to the guidelines on the "Serving Sizes & Calories" and "Healthy Choices" sheets to make substitutions, if needed, to provide this person with a balanced diet.
3. Information regarding this athlete and the special needs of athletes in general may be found on the back of this card.

Activity 7

Challenging Choices

ASTRONAUT IN SPACE

Who: Man

Age: 39

Height: 70 in.

Weight: 180 lbs

Energy Level: High

Total daily Caloric intake need: 3,457 calories

The gravity felt by astronauts in orbit is about one-millionth of the gravity we feel on Earth. Without the pull of gravity, fluids distribute themselves equally throughout the body (instead of being pulled toward the legs and feet), leading to changes in the circulatory system. At the same time, muscles and bones become smaller and weaker because they do not have to work as hard in space.

The body uses about the same amount of energy in space as it does on Earth. Menus for space meet each individual's daily nutritional requirements based on age, body weight and activity. The portions of fats and proteins consumed by astronauts may be slightly higher because fats are energy dense (so less volume is needed to meet energy needs). Fats also improve the taste of foods in space. Increased protein intake helps to offset changes to muscles.

All foods are selected for easy handling in space (some foods could float into equipment or be inhaled). Liquids are served in plastic bags and sipped with straws. Space food favorites include tortillas (stay fresh longer and have fewer crumbs than bread) and beef steaks. Spicy food also is preferred, because microgravity and head congestion dull astronauts' sense of taste. Fruits and vegetables are important because they may help protect astronauts' bodies from damage by cancer-causing radiation in space.

Specialty Menu

DINING IN SPACE

1. You will plan a one-day menu that includes breakfast, lunch, dinner and snacks to meet the particular dietary needs of an active person who is working onboard a space station orbiting Earth. Record the menu on the inside of this card. Use an additional sheet of paper if necessary.
2. Review and refer to the guidelines on the "Serving Sizes & Calories" and "Healthy Choices" sheets to make substitutions, if needed, to provide this person with a balanced diet
3. Information regarding this person and the special needs of other astronauts may be found on the back of this card.

Activity 7

Menu Plan

DAY | DATE	**Water:** Eight cups (or 8-oz glasses) per day ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	FOOD GROUP					
		Breads	Vegetables	Fruit	Meats	Milk	Fats
TIME	**FOOD ITEM & AMOUNT** (List major ingredients for prepared foods.) **CALORIES**	Br	Ve	Fr	Me	Mi	Fa
Physical Activity	**DAILY TOTALS**						
	Calories _____	Br	Ve	Fr	Me	Mi	Fa