Mighty Macros

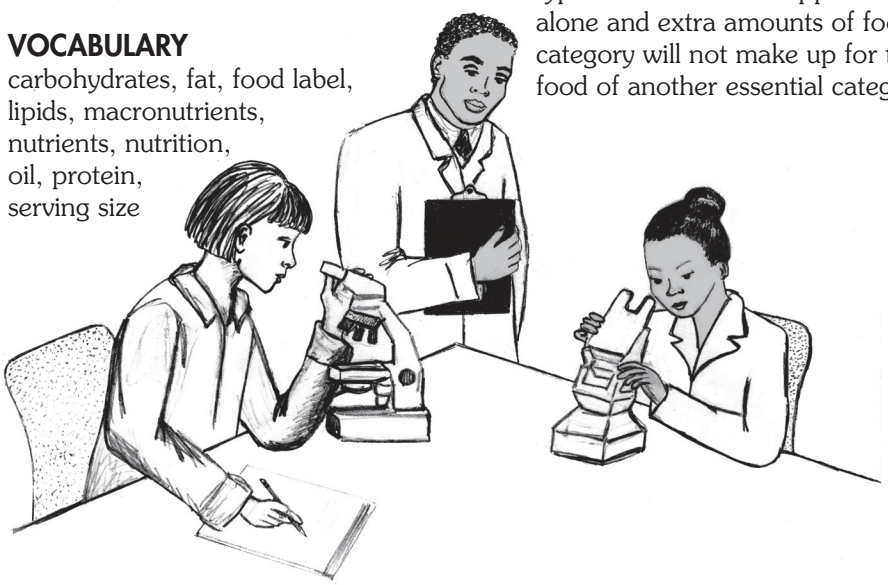
LEVEL: Grades 6-12
SUBJECTS: Health, Mathematics, Science, Consumer Education
SKILLS: Applying, classifying, collaborating, collecting data, comparing similarities and differences, computing, describing, discussing, evaluating, identifying, observing, organizing, predicting, recording, writing

MATERIALS

Several large brown paper bags; a variety of foods (see Getting Started for each session); empty containers to hold foods; dropper bottle with water; one tablespoon of solid or liquid vegetable oil; containers and eye droppers for various liquids; empty containers for used food; multi-sticks for glucose and ketone testing (check with the school nurse); iodine; either 3 percent copper sulfate solution and household ammonia or Biuret's solution; foods known to contain protein; transparency of the ***Food Label*** located in the Appendixes; transparencies and two or three photocopies of the ***Nutritive Value of Some Foods*** and ***Estimating Some Food-Serving Sizes*** located in the Appendixes; photocopies of the attached ***Fat in Our Food***, ***Carbohydrates in Our Food***, ***Protein in Our Food***, ***Nutrient Consumption Chart***, and ***Nutrient Comparison: Actual vs. Recommended***; and a variety of food and beverage labels. **Optional**: calculators.

VOCABULARY

carbohydrates, fat, food label, lipids, macronutrients, nutrients, nutrition, oil, protein, serving size



RELATED LESSONS

Chewsy Choices
Calorie Counting
What's the Shape of Your Diet?
Be Label Able

SUPPORTING INFORMATION

The human body needs food, oxygen and water to survive. It needs nutritious foods, clean air, and clean water to thrive. This lesson deals with the first of those three necessities, nutritious food. In simple terms, nutrition is food and its relation to the well being of the human body. Nutrients are important chemical substances that supply the body with energy for daily activities, provide energy and materials for growth, and aid in the regulation of body parts and processes. There are 50 known nutrients essential to human life. No single food or food group contains all 50 nutrients. Therefore, health professionals recommend that we consume a variety of foods daily from different food categories. One type of food cannot support the body alone and extra amounts of food in one category will not make up for too little food of another essential category.

BRIEF DESCRIPTION

Students conduct simple food experiments and collect data about their personal food choices to learn how the foods they eat satisfy the body's nutritional needs for macronutrients: carbohydrates, protein and lipids.

OBJECTIVES

The student will:
- identify specific foods that provide carbohydrates, proteins and fats;
- give examples of carbohydrates, proteins and fats, and describe their importance to maintain a healthy body; and
- evaluate personal food choices and determine if they create a nutritionally sound diet.

ESTIMATED TEACHING TIME

Session One: 60 minutes.
Session Two: 45 minutes.
Session Three: 45 minutes.
Session Four: Homework assignment requiring a 24-hour period.
Session Five: 60 minutes.

These nutrients include carbohydrates, proteins, fats, vitamins, and minerals. The major nutrients needed are macronutrients. These are carbohydrates, fats and oils (lipids), and proteins. These three nutrients are known as macronutrients because the body needs them in relatively large quantities in comparison to the micronutrients - vitamins and minerals - that are needed in very small quantities. Micronutrients (vitamins A, B complex, C, D, E, and K and minerals calcium, phosphorous, iron, zinc, potassium, magnesium, manganese, etc.) will not be addressed in this lesson. Water will not be addressed, although it is sometimes considered a nutrient because it is essential to life. This lesson focuses on the macronutrients: carbohydrates, protein, and fats and oils. These are the mighty macros.

A **carbohydrate** is any complex molecule that has carbon, hydrogen and oxygen. Examples are sugars, starches and cellulose. Most are made by green plants under the influence of sunlight (photosynthesis). Sugars are the simplest of these compounds. Some types of sugars are glucose, sucrose, lactose, galactose, fructose and maltose. Glucose is the primary sugar that provides a fuel source for the body. Complex carbohydrates include starch, glycogen and cellulose. Starches are made up of sugars connected in long chains. Cellulose is even more complicated. In cellulose, long chains of starches are cross-linked in parallel bundles. Humans cannot break down cellulose because we do not possess the enzymes necessary to do so.

Carbohydrates are found in a variety of foods, including breads, fruits, and many vegetables. Generally, fruits and vegetables are mostly carbohydrates with small amounts of protein and fat. Good sources of complex carbohydrates include corn, potatoes, rice, dry beans and peas, breads, cereals, and pasta. Sucrose (table sugar) is a carbohydrate that might be considered nonessential for most people because it has only calories and provides no other nutrition.

Current recommendations indicate that complex carbohydrates should be the primary source of calories from the foods we eat. They digest less quickly than sugars, providing slow release energy to the muscles, brain, and central nervous system and water to the body. The body burns carbohydrates and proteins faster than fats. Carbohydrates burn completely and cleanly without the production of toxic by-products, an advantage over proteins and fats. Carbohydrates are needed to break down fats. Small amounts of carbohydrates can be stored in the body's liver and muscles as glycogen. This stored glycogen can be converted to glucose and used for energy. Because only a certain amount of glycogen can be stored, excess glucose is usually converted into fat and stored in adipose tissue.

Complex carbohydrates are a better nutritional choice than sugars and are found in foods that also are rich in vitamins, minerals and fiber. Carbohydrates contain 4 calories per gram. It is suggested that 55 to 65 percent of our daily caloric intake be carbohydrates, with no more than 10 percent from sugars.

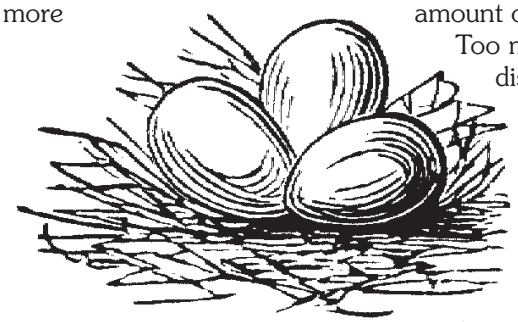
Like carbohydrates, **proteins** contain carbon, hydrogen and oxygen. In addition, they always contain nitrogen and sometimes sulfur. The building blocks of proteins are smaller molecules called amino acids. About 20 different amino acids occur in protein. Of these, nine are considered essential amino acids. They must be supplied by the diet because the body cannot make these amino acids. The remaining amino acids are called nonessential amino acids because our body can make these, if they are not present in foods consumed.

Protein is primarily used to build, repair and maintain body tissue. It is important in growth, pregnancy and lactation, to heal injuries, and in the functioning of the immune system. All enzymes, certain hormones, blood cells, and infection-fighting antibodies contain proteins. Proteins provide a protective coating for hair, skin and nails and help develop strong bones and teeth. The body can use protein as an emergency source of energy if carbohydrates and fats are lacking. Protein used as fuel, however, is no longer available for cell growth, repair or maintenance.

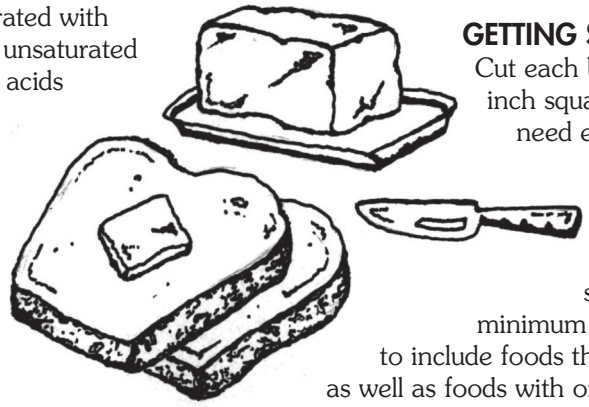
Because the body does not store protein, it must be regularly supplied. Most Americans eat more protein than they need. Healthy individuals need 0.8 grams of protein per kilogram (kg) of body weight. Like

carbohydrates, there are 4 calories per gram. About 10 to 15 percent of our daily total caloric intake should consist of protein. Excess protein is not stored as protein or converted into muscle protein. Excess protein is broken into components (carbohydrate and nitrogen.) The nitrogen is converted into urea and excreted in the urine. The carbohydrate is used as fuel, if needed, or stored as fat, if not.

Food sources from animals most closely resemble the proteins in the human body. Unlike plant protein, all of the amino acids in the right proportions are contained in foods from animals. Meats, fish, poultry, cheese, eggs and milk are animal sources of foods that are rich in proteins. Plants contain incomplete proteins because they lack one or more of the essential amino acids. Vegetarian diets can provide adequate amounts of all the essential amino acids by combining two or more complimentary incomplete proteins to form complete proteins. Ovo/Lacto vegetarians have the benefit of complete proteins from milk and eggs. Plant sources of protein include beans, tofu (soybean curd), rice, sunflower seeds, sesame seeds, nuts, and lentils.



Fats are similar in composition to carbohydrates, but they contain less oxygen in proportion to carbon and hydrogen. The major building blocks of fats are called fatty acids. During the digestive process, fats are broken into fatty acids, which are either used by the body or stored as human fat. Fatty acids are classified as saturated or unsaturated. Saturated fatty acids have single chemical bonds between all of the carbon and hydrogen atoms and are saturated with hydrogen. There are two types of unsaturated fatty acids: monounsaturated fatty acids are missing one pair of hydrogen atoms and have one double bond; polyunsaturated fatty acids are missing two or more pairs of hydrogen atoms and have two or more double bonds. Unsaturated fatty acids can become saturated fatty acids by the addition of hydrogen atoms.



Fats aid in the absorption of essential fat-soluble vitamins, including A, D, E, and K. Fats transport these vitamins throughout the body. Fats are digested and absorbed at a slower rate than carbohydrates and proteins, delaying the feeling of hunger. Fats absorb and hold flavors and are a major contributor to the good smell and tastes of foods. Fats are used as fuel after carbohydrates are depleted.

Fat deposits in the body are important for several reasons. Organs such as the kidneys are supported and cushioned by moderate fat deposits. All cells have membranes made up of fat. In women, fat deposits aid to cushion the fetus during pregnancy. As an insulator, fat protects against rapid heat loss and helps the body maintain normal temperatures.

Fats provide the most concentrated source of food energy of the three macronutrients. Fats and oils contain 9 calories per gram of fat, more than twice that of carbohydrates and proteins. We need a certain amount of fat in our diet, but in moderation. Too much fat may contribute to heart disease and cancer. It is recommended that no more than 30 percent of our daily total caloric intake come from fat, with no more than 10 percent from saturated fats.

Animal fats and vegetable oils contain a mixture of both saturated and unsaturated fatty acids. The proportion of saturated to unsaturated fatty acids gives fats and oils their individual properties. Fats that contain more saturated than unsaturated fatty acids are typically solid at room temperature. Fats that contain more unsaturated than saturated fatty acids are typically liquid at room temperature. Regardless of type, saturated or unsaturated, all fatty acids provide the same number of calories per gram (9) when metabolized in the body for energy.

SESSION ONE - **Fat Detection**

GETTING STARTED

Cut each brown paper bag apart into 3-inch squares using a paper cutter. You need enough squares so each pair of students has one square for each food item. Decide whether you will supply the food items or if you want students to help. Provide a minimum of 10 food items, being sure to include foods that you know are high in fat, as well as foods with only a trace of fat. Food items should consist of fruits, vegetables, meats, cheeses, breads, and various snacks such as cookies, popcorn, peanuts, and candy. Include both solid and liquid food items. Solid items should be cut into enough pieces so each student pair has one piece to test. Use a dropper bottle or a container such as a jar or glass that will hold

an eyedropper for liquids. All foods should be kept in a container (plastic may be best, if breakage is a concern). You need a dropper bottle of water and one tablespoon of oil and containers for disposing of the used solid food. Set up stations so you have one station for each food item. Photocopy the ***Fat in Our Food*** sheet one per student.

PROCEDURE

1. Divide the class into pairs of students. Explain to students that the human body requires a variety of foods to get the nutrients necessary for good nutrition. Ask each pair to make a list of the different foods they eat and give the reasons why they eat those particular foods.

2. After about 10 minutes, open the discussion. In a visible place, record responses to the following questions (save this list for comparison in Session Four):

   - What are some of the foods you currently eat?

   - What are some of the reasons you choose to eat certain foods? *(Answers will likely include taste, cost, easily prepared, convenience of fast foods, parental approval or encouragement, religious and/or cultural customs.)*

   - Which of the foods do you eat because you think your body needs them? (Place an N next to those foods.)

   - Which of the foods do you eat because you want them? (Place a W next to those foods.)

   - Is it possible to eat the right number of calories, but not have a balanced diet? Why? *(Yes. If we do not eat foods that provide a correct balance of carbohydrates, proteins, fats, vitamins, and minerals, our body will not get the nutrients it needs.)*

3. Introduce the word "nutrition," especially if it was not mentioned as a reason for choosing foods, by asking:

   - What does nutrition mean? *(Food and its relation to the well being of the body.)*

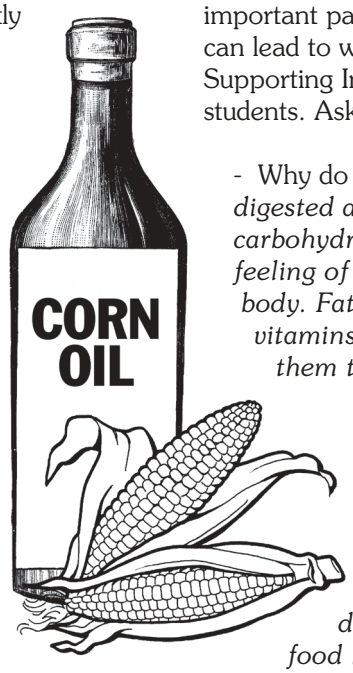
   - What are some of the reasons children and teenagers should learn about nutrition. (*Possible responses include:*
     - *To give me energy.*
     - *So I eat the right foods to be healthy today and in the future.*
     - *To help me develop and maintain a healthy body.*
     - *To know what good, quick meals can be eaten after school or before sports or a part-time job.)*

   - What nutrients does the human body need? *(The nutrients we need are carbohydrates, proteins, fats, vitamins, and minerals.)*

   - What are macronutrients? *(These are the nutrients carbohydrates, proteins and fats. They are needed in much larger amounts than vitamins and minerals.)*

4. Many of the foods we eat contain fat. Fats are an important part of healthy eating, but too much fat can lead to weight and health problems. Share the Supporting Information about fats with the students. Ask:

   - Why do we need to eat fats? *(Fats are digested and absorbed at a slower rate than carbohydrates and proteins, delaying the feeling of hunger and supplying energy to the body. Fats store and carry several essential vitamins including A, D, E, and K and move them throughout the body.)*

   - What are some foods you think contain fat? Why?

   - How can we tell if a food contains fat? *(Possible responses include greasy feel or texture, does not dissolve in water, reading food labels, learning about different foods or food groups, books identifying nutrient content of foods, and so on.)*

5. Tell students they are going to conduct a simple experiment to determine if some specific foods contain fat. Distribute enough paper squares so each pair of students has one for each food and one for fat and one for water. Tell students to label each square with the name of one of the foods.

6. Distribute the ***Fat in Our Food*** sheet, one per student. Write the names of the foods to be tested in a visible place. Ask students to fill in the Food column, listing each food to be tested. Note that

fat and water are already on the sheet as examples. Students predict which foods contain fat.

7. Working with the student pairs at their desks, place a drop of vegetable oil or rub the fat (solid) on their "fat" square. (Students use this square, comparing it with the marks left by the other foods, to determine whether the other foods contain fat.) Have students write a very brief description of the mark left by the fat in the Test Results column on their ***Fat in Our Food***. This establishes a baseline for comparison.

8. Using this same process, place a drop of water on the "water" square. This will help students see the difference between the mark left by the "fat" and "water." Have students write a very brief description of the mark left by water in the Test Results column on their ***Fat in Our Food***.

9. Assign each student pair to one of the food stations. They test each food to determine whether it contains fat and record the results on their ***Fat in Our Food***. If the food is a liquid, they put one drop of the liquid on the brown square. If it is a solid, students rub the piece of food on the square, making a spot at least the size of a quarter. Tell students not to touch the part of the food they rub on the square. This will keep the food clean (free from impurities) and minimize contaminating the food as students change stations. (Note: If you have a sink in the room, it is best for students to wash their hands between stations.) Once students have rubbed the food on the square, they place the food in the used food container. Students write a brief description of the results in the Test Results column (e.g., *grease mark, wet but not greasy*). After two to three minutes, students move to the next station to test the food.

10. When students have completed their last station, ask them to wash their hands before returning to their desks to complete the ***Fat in Our Food*** sheet.

11. Summarize the results by asking:

    - Using the fat test, which of the foods contained fat? (If results differ, ask a student to retest the food as a class demonstration.)

    - How many of your predictions were correct?

    - What were your predictions based on? *(Accept any reasonable response.)*

    - Were you surprised at some of the foods that contained fat?

    - Were there foods that did not contain fat that you thought should contain fat?

    - Using this simple fat test, how can you tell if a food contains fat? *(A grease spot is made by foods that contain fat. The grease spot does not dry; a water spot will dry.)* Tell students that all foods contain at least a trace of fat because all cells have some fat in them. The brown paper bag test will not pick up trace amounts of fat.

    - Do you think all foods that contain fat should be eliminated from our diets? *(No. They are important, but should be eaten in moderation.)* Why? *(Fats store and carry essential vitamins throughout the body and are a source of energy, and are needed to create important molecules such as hormones.)*

    - How will you use this information to decide if other foods contain fats?

SESSION TWO **Carbohydrate Detection**

GETTING STARTED

Before preparing for this session determine whether it should be conducted as a teacher demonstration or student activity based upon your knowledge of school policy.

Bring various foods to class (you and/or the students), including foods you know contain carbohydrates. Include foods such as noodles, potatoes, cheeses, meats, fruits, vegetables, milk, and sweets. You need only a small amount of each because this session is conducted as a class demonstration. You need a dropper bottle of iodine, apron (to protect your clothes), clear plastic or glass bowls to hold the food (one for each food item), multi-sticks used to test for glucose or ketones, and photocopies of the ***Carbohydrates in Our Food***, one per student.

1. Begin by sharing the Supporting Information about carbohydrates. Ask:

    - Why do we need to eat carbohydrates? *(They are the primary source of fuel, providing energy to the body. They digest quickly and supply energy to our muscles, brain, and central nervous system. They also are needed to break down fats.)*

- Name some foods that you think contain carbohydrates.

- How can we tell if a food contains carbohydrates? *(Possible responses include reading food labels, some will have a sweet taste, and reading books identifying nutrient content of foods.)*

2. Distribute one copy of the ***Carbohydrates in Our Food*** sheet to each student. Write the name of foods to be tested in a visible place. Ask students to complete the Food column, listing each food to be tested. Have students predict which foods contain high amounts of carbohydrates.

3. Place a piece of each food in separate clear containers. For this class demonstration, work with one piece of food at a time. Place one drop of iodine on the food. Iodine turns from brown to blue-black in the presence of starch (complex carbohydrate). **Show the food to the students, cautioning them <u>NOT</u> to touch or taste the food, since concentrated iodine is poisonous!** (Iodine is a necessary nutrient in trace amounts, but in high dosages can burn the skin and damage the tissues of the eyes and nose.) Tell students to write a brief description of the results in the Test Results column. Mix a few drops of water with the same food and smear it on or swirl the multi-stick in it to determine the presence of sugar. Continue the demonstration until all food items have been tested. Properly dispose of the food items. To be sure no one ingests them, you may want to place the foods tested in a plastic bag with a proper label before discarding them.

4. Have students complete their ***Carbohydrates in Our Food*** sheet.

5. Summarize the results by asking:

   - Which foods did you predict would contain carbohydrates?

   - Using the carbohydrate test, which of the foods contained carbohydrates?

   - For which foods were your predictions correct? Incorrect?

   - Were you surprised at some of the foods that contained carbohydrates?

   - How will you use this information to decide if other foods contain carbohydrates?

<u>SESSION THREE</u> - **Protein Detection**

GETTING STARTED

Before preparing for this session determine whether it should be conducted as a teacher demonstration or student activity based upon your knowledge of school policy.

Several food and beverage labels; *eye* droppers; water in a squeeze bottle; either 3 percent copper sulfate solution and household ammonia or Biuret's solution; glasses or plastic cups, or petri dishes; foods known to contain protein (include milk); transparency of the ***Food Label*** found in the Appendixes; transparencies and two or three photocopies of the ***Nutritive Value of Some Foods*** and ***Estimating Some Food-Serving Sizes***; and photocopies of the ***Nutrient Consumption Chart*** and ***Nutrient Consumption: Actual vs. Recommended*** sheets one per student.

PROCEDURE

1. Begin by sharing the Supporting Information about protein. Ask:

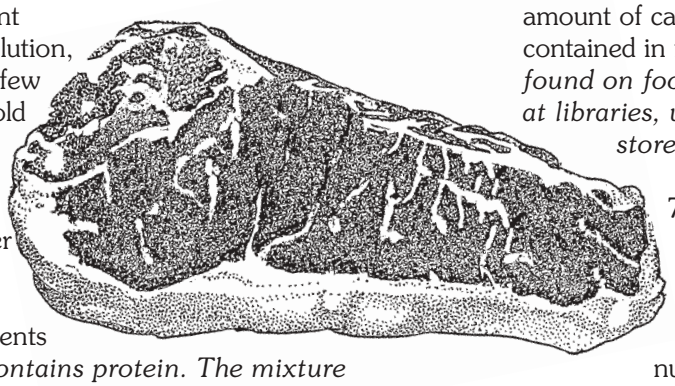
   - Why do we need to eat protein? *(Protein is primarily used to build, repair and maintain body tissue. It is important in growth, pregnancy, lactation, healing and the immune system. All enzymes, certain hormones, blood cells, and infection-fighting antibodies contain proteins. Proteins provide a protective coating for hair, skin, and nails and help develop strong bones and teeth. The body can use protein as an emergency source of energy, if carbohydrates and fats are lacking.)*

   - Name some foods you think contain protein. *(meats, eggs, cheeses, yogurt, tofu, chicken, fish, etc.)*

- How can we tell if a food contains protein? *(Possible responses include reading food labels, identifying the source of the food [animal sources will likely be high in protein], and books with nutrient content of foods.)*

2. Provide each student one copy of the ***Protein in Our Food*** sheet. Write the name of foods to be tested in a visible place. Ask students to complete the food column, listing each food to be tested. Have students predict which foods contain high amounts of protein.

3. Begin with a small amount of milk in a clear beaker, glass or plastic cup. If using the 3 percent copper sulfate solution and household ammonia, inform the students that if the mixture turns violet it indicates the presence of protein. Add a few drops of 3 percent copper sulfate solution, and swirl. Add a few drops of household ammonia, and swirl. Note the change, if any. Repeat with other foods.



What do the students observe? *(Milk contains protein. The mixture should turn violet.)*

If you are using the Biuret's solution, break a small amount of food that you think contains protein, add to it 10 drops of water, mix thoroughly. Continue this process until you have 5 mL of food and water mixture. To the 5 mL of food and water mixture add 10 drops of Biuret's solution. Inform the students that if protein is present, the solution will turn from pink to purple. Note the change, if any. Repeat with other foods.

4. Have students complete their ***Protein in Our Food*** sheet.

5. Summarize the results by asking:

   - Which foods did you predict would contain protein?

   - Using the protein test, which of the foods actually contained protein?

   - For which foods were your predictions correct? Incorrect?

   - Were you surprised at some of the foods that contained protein?

   - How will you use this information to decide if other foods contain protein?

6. It is important to eat nutritionally balanced meals that promote healthy living. That means eating the right balance of carbohydrates, proteins, and fats. Ask:

   - Do you think you are eating the proper amounts of carbohydrates? Proteins? Fats? How can you find out? What could you use as a guide? *(The Food Guide Pyramid, nutrition tables)*

   - Where can we find information about the amount of carbohydrate, protein, and fat contained in food? *(The information can be found on food labels or from charts available at libraries, weight-loss centers, grocery stores.)*

7. Use the ***Food Label*** transparency and several food and beverage labels to show students where to find serving size, number of calories, and the number of grams of carbohydrate, protein and fat. Use your sample food and beverage labels to point out that serving size depends on the food; there is not one uniform serving size. Serving size must reflect typical consumption for that food and should be consistent between similar products. For example, all sodas should use 12 fluid ounces as the serving size. Explain that if a serving size is 1 ounce and you eat 2 ounces of that food, you will have twice the amount of calories and twice the number of grams of carbohydrate, protein and fat.

SESSION FOUR - **Homework Assignment**

1. Distribute the ***Nutrient Consumption Chart*** to individual students. They record everything they eat or drink during a 24-hour period. For each food or drink, they also record serving size and the number of grams of carbohydrate, protein and fat.

   A. Encourage students to use food and beverage labels wherever possible. These are the most accurate source of information.

   B. Combination foods include foods from two or more food groups. Students must break combination foods into the component food

items. For example, a salad might include vegetables, fruits, dressing, meats, and cheeses (identify specific dressing, vegetables, meats, and more).

C. Where necessary, students should give their best approximations on serving sizes. If students eat a meal at a restaurant or school, tell them to ask the food server the approximate serving sizes (e.g., 3-ounce beef patty, 1/2 cup of green beans, 1-ounce slice of cheddar cheese, 1 medium apple). Students also can use the ***Estimating Some Food-Serving Sizes*** sheet to estimate serving sizes. Show the transparency and talk about each of the comparisons. Tell students where copies will be located for their use.

2. Show the transparency ***Nutritive Value of Some Foods***. These pages provide information for some typical foods students may eat and for some foods that do not have food labels (e.g., raw vegetables, fruits). Tell students where you will display one or more copies for their use. (Note: A more comprehensive listing is provided by the USDA publication *Nutritive Value of Foods* [see Resources]). Students also can obtain information on nutritive values at libraries.

SESSION FIVE

GETTING STARTED

In preparation for Session Five, ask students to weigh themselves before coming to class. If they do not have a scale at home, bring your scale in or make arrangements with the school nurse. Have the photocopies of the ***Nutrient Consumption Chart*** and ***Nutrient Consumption: Actual vs. Recommended*** available, one per student.

PROCEDURE

1. Begin by sharing data from the ***Nutrient Consumption Chart***. Add new food items to the list saved from Session One. Ask:

   - Were you surprised by some of the foods that contained carbohydrates? Protein? Fat?

   - Which of the three macronutrients was dominant on your chart? Which did you eat the least?

   - How did your three meals compare in the distribution of carbohydrates, protein and fat ? How did your snacks compare in their distribution?

   - How do the foods you ate compare with the foods you listed in Session One?

2. Have students work in pairs. Distribute ***Nutrient Comparison: Actual vs. Recommended*** sheet to individual students. Each student uses data from their ***Nutrient Consumption Chart*** sheet.

3. Tell students they are going to determine the recommended amounts in grams for each of the macronutrients they should eat daily. To do this they will use information from Session Three and their weight in pounds. Work through the following examples in a visible place to ensure that students understand how to make the calculations using their data. Students will make these same calculations using their data to complete their ***Nutrient Comparison: Actual vs. Recommended*** sheet, Part 1.

   A. Determining grams of protein. (Note: This is the calculation for Part 1, number 1). It is recommended that the average person have 0.8 grams of protein per kilogram (kg) of body weight. To determine how many grams of protein a person needs to eat, one must first convert their body weight from pounds to kilograms (there are 2.2 pounds per kilogram [lb/kg]),

   $$\frac{\text{120 pounds}}{\text{2.2 lb/kg}} = 54.5 \text{ kg}$$

   Determine how many grams of protein are needed by multiplying a person's weight in kilograms by 0.8 grams/kg.

   54.5 kg x 0.8 grams/kg = 43.6 grams of protein

   B. Determining grams of fat. (Note: This is the calculation for Part 1, number 2.) It is recommended that no more than 30 percent of our total calories come from fat. To determine how many grams of fat one needs to eat, first determine how many of your total calories should come from fat.

   2,200 calories x 0.30 (30%) = 660 calories

   There are 9 calories per gram of fat. To calculate how many grams of fat are needed:

   $$\frac{\text{660 calories}}{\text{9 calories/gram}} = 73.3 \text{ grams of fat}$$

C. Determining grams of carbohydrates. (Note: This is the calculation for Part 3, number 1.) It is recommended that 55 to 65 percent of caloric intake be carbohydrates. To determine how many grams of carbohydrates one must consume, first determine the total number of calories that should come from carbohydrates. For example, if you ate 2,200 calories on your ***Nutrient Consumption Chart,*** 60 percent of those calories should be carbohydrates.

2200 calories x 0.60 (60%) = 1,320 calories

There are 4 calories per gram of carbohydrate. To calculate how many grams of carbohydrates are needed:

1320 calories = 330 grams of carbohydrates
4 calories/gram

4. Have the students complete Part 2 of the ***Nutrient and Comparison Actual vs. Recommended*** sheets using the 24-hour recorded ***Nutrient Consumption Chart*** and the ***Nutritive Value of Some Foods*** chart.

5. Summarize this session by asking:

   - How many of you ate the recommended amount of carbohydrates? Protein? Fat?
   - How many of you ate more than the recommended amounts of carbohydrates? Protein? Fat?
   - How many of you ate less than the recommended amounts of carbohydrates? Protein? Fat?
   - What meal did you re-create? What change(s) did you make?

6. Summarize the lesson by asking:

   - Why are carbohydrates important? Protein? Fat?
   - Why is it important to develop and maintain an enjoyable and nutritionally sound diet?
   - What have you learned from this lesson that you will share with others?
   - How will what you learned help you in the future?

EVALUATION OPTIONS

1. Assess the student's ability to work efficiently at each food station (collect data and write test results).

2. Evaluate the student's ability to follow directions, complete the tables, and set up and complete mathematical computations.

3. Assess the student's understanding and ability to apply actual versus recommended quantities of each macronutrient to his/her diet.

4. Appraise students' level of classroom participation in responding to questions.

5. Have students write one paragraph describing why the body needs carbohydrates, one paragraph describing why the body needs protein, and one paragraph describing why the body needs fat. Have them include in the respective paragraphs foods that are primary sources of carbohydrates and protein, yet low in fat.

6. Have the students write a paragraph using one of the following phrases:

   - I would have a more nutritionally sound diet, if I ate more _____ because…
   - I would have a more nutritionally sound diet, if I ate less _____ because…

EXTENSIONS AND VARIATIONS

1. Explore variations in macronutrient consumption for different diets such as those for vegetarians, diabetics, heart patients, or athletes.

2. Invite a dietitian to speak to the class. Explore topics such as dietary evaluation and nutrition counseling.

3. Discuss where carbohydrates, proteins and fats are found in the *Food Guide Pyramid* (copy provided in the Appendixes). The *Food Guide Pyramid* includes icons which indicate what food groups are significant sources of protein and carbohydrates. Read some food labels and see if students can determine which food group to which the food belongs.

   (- *The Milk, Yogurt, and Cheese Group provide protein and are the primary source of calcium and vitamins A and D.*
   - *The Meat, Poultry, Fish, Dry Beans, Eggs, and Nuts Group is important for protein, fats, B vitamins, and trace elements such as iron*

and zinc. Milk, milk products, poultry, fish, and meat are the primary sources of fats.
- *The Breads and Grains Group, including cereals, rice, and pasta, is important for carbohydrates, B vitamins and iron, and they are generally low in fat.*
- *The Fruit Group and the Vegetable Group are the primary sources of vitamins A and C; they also provide calcium, B vitamins, iron, trace elements, and fiber. Most fruits and vegetables are naturally low in fat. Olives, avocados, and coconuts are exceptions.)*

4. Pose this question to the students:

   If you choose to create a new diet for yourself, what are some of the things to remember? *(Set reasonable, achievable goals: make changes gradually. Start by adding foods with higher nutritive value, letting them replace foods of lower nutrition. Encourage yourself, do not criticize. As goals are achieved, compare yourself with where you were, not with someone else. Allow yourself time for any new eating style to become familiar and comfortable. Include a proper exercise program from the physical education instructor or school nurse.)*

   For more information on this topic use the FLP lesson "What's the Shape of Your Diet?"

5. Talk to your school cafeteria staff. Ask them how they use nutritional guidelines to put together lunches. Do they consider lower fat when planning lunches? What percentage of the meals are carbohydrates versus protein versus fat?

6. Look at the trends in the American diet regarding carbohydrates, protein and fats. Are Americans eating too much of one and not enough of the others? What are some of the health issues related to non-nutritional diets?

7. Explore whether the social environments and/or television commercials affect what we eat. Research food, weight loss, and exercise ads on television and in newspapers and magazines.

8. Compare food labels of regular and low-fat varieties of food. What differences are there in grams of carbohydrates, proteins and fats?

9. Research the importance of water to the human body. *(Water is a major ingredient of blood and other body fluids. Most of the water comes from drinking water and other beverages. It also comes from the foods we eat, and it is a by-product of the metabolism of various nutrients.*

   - *It carries water-soluble nutrients from foods throughout the body;*
   - *It helps digest food; it helps eliminate waste materials such as carbon dioxide and urea from the body; and*
   - *It helps regulate body temperature.)*

ADDITIONAL RESOURCES

American Dietetic Association. 216 W. Jackson Boulevard, Suite 800, Chicago, IL 60606-6995. 1-800-877-1600 or (312) 899-0040.

American Heart Association. National Center, 7272 Greenville Avenue, Dallas, TX 75231-4596. 1-800-242-8721.

Farley, Dixie. *Vegetarian Diets: The Pluses and The Pitfalls.* A Reprint from FDA Consumer Magazine, May 1992, Publication No. (FDA) 943-2258.

Public Health Service, Office of Public Affairs, Food and Drug Administration, United States Department of Health and Human Services. 5600 Fishers Lane, Rockville, MD 20857.

Foulke, Judith E. *Good News About Good Nutrition.* Reprinted from FDA Consumer, April 1992, Publication No. (FDA) 92-2257. Public Health Service, Office of Public Affairs, Food and Drug Administration, United States Department of Health and Human Services. 5600 Fishers Lane, Rockville, MD 20857.

Gebhardt, Susan E. and Ruth H. Matthews. *Nutritive Value of Foods.* Home and Garden Bulletin No. 72, rev. ed. 1991. Human Nutrition Information Service, United States Department of Agriculture. Available from the Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954 or your nearest U.S. Government bookstore. (202) 512-1800 or fax (202) 512-2250. Stock number 001-000-04575-0.

Making Healthy Food Choices. Home and Garden Bulletin No. 240, Human Nutrition Information Service, United States Department of Agriculture. February 1993. Available from the Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954 or your nearest U.S. Government bookstore. (202) 512-1800 or fax (202) 512-2250. Stock number 001-000-04592-0.

Nutritional Materials. National Cattlemen's Beef Association. 5420 South Quebec St., Greenwood Village, CO 80111. (303) 694-0305 or fax (303) 694-2851. http://www.teachfree.com

National Dairy Council. 10255 W. Higgins Road, Suite 900, Rosemont, IL 60018-5616. (708) 803-2000 ext. 220.

Nutrition and Your Health: Dietary Guidelines for Americans, HG-232. Food, Nutrition and Consumer Services, United States Department of Agriculture 1120 20th Street NW, North Lobby, Suite 200, Washington, DC 20036.

Dietary Guidelines and Your Diet, HG-232-1 through 11. Food, Nutrition and Consumer Services, United States Department of Agriculture. 1120 20th Street NW, North Lobby, Suite 200, Washington, DC 20036.

Directory of State NET Program Coordinators. Nutrition Education and Training (NET) Program. Food and Consumer Service, United States Department of Agriculture. 3101 Park Center Drive, Room 607, Alexandria, VA 22302. (703) 305-2554. (Contact state coordinator for nutrition education materials, including teacher kits, videos, and resource library; most coordinators are in state's department of education.)

Sports Nutrition: Eat to Fuel Performance. Iowa Beef Industry Council. P.O. Box 451, Ames, IA 50010. (515) 296-2306. http://www.teachfree.com

Weinstock, Cheryl Platzman. *"The 'Grazing' of America: A Guide to Healthy Snacking."* Reprinted 1993 from *FDA Consumer*, March 1989. Public Health Service, Food and Drug Administration, United States Department of Health and Human Services. 5600 Fishers Lane, Rockville, MD 20857.

Vancleave, Janice Pratt. *Food and Nutrition for Every Kid: Easy Activities That Make Learning Fun*. John Wiley & Sons. 1999. ISBN: 0471176656.

WEB SITES

Center for Food Safety and Applied Nutrition, United States Food and Drug Administration. 5100 Paint Branch Parkway, College Park, MD 20740-3835. http://www.cfsan.fda.gov

Egg Nutrition Center. 1050 17th Street NW, Suite 560, Washington, DC 20036. http://www.enc-online.org

Food. Federal Consumer Information Center. Pueblo, CO. 2002. http://www.pueblo.gsa.gov

Food and Nutrition Information Center. National Agricultural Library. United States Department of Agriculture. 2002. http://www.nal.usda.gov/fnic

Fueled for Flight. National Cattlemen's Beef Association. http://www.teachfree.com

Mirror, Mirror. National Cattlemen's Beef Association. http://www.teachfree.com

Nutritional Analysis Tool. C-FAR. University of Illinois, Urbana/Champaign. 2002. http://www.aguiuc.edu/~food-lab/nat

Nutrition Explorations. National Dairy Council. 2002. http://www.nutritionexplorations.org

Tufts Nutrition Navigator. Center on Nutrition Communication, Gerald J. and Dorothy R Friedman School of Nutrition Science and Policy, Tufts University. 2002. http://navigator.tufts.edu

USDA Nutrient Database for Standard Reference Release 15. Nutrient Data Laboratory, Agricultural Research Service, United States Department of Agriculture. 2002. http://www.nal.usda.gov/fnic/foodcomp/Data/SR15/sr15.html

EDUCATOR'S NOTES

 Conceptual Framework Reference: IV.E.3., IV.E.5., VI.

FAT IN OUR FOOD

Name:_____

Directions: Write each food to be tested in the Food column. Predict whether the food contains fat by writing "yes" or "no." Test each food on a separate square of brown paper. If the food is a liquid, place one drop on the paper. If it is a solid, rub the food on the paper, being careful not to touch that part of the food. Write a brief description of your results in the Test Results column. Based on the test results, place a + in the last column, if the food contained fat; place a - in the last column, if it did not contain fat.

Food	Prediction	Test Results	Fat + or -
Baseline Fat			
Baseline Water			

1. How did your predictions compare with the test results?
   How many predictions were correct?

2. In one or two sentences, describe the kinds of food that contain fat.

CARBOHYDRATES IN OUR FOOD

Name:_____

Directions: Write each food to be tested in the Food column. Predict whether the foods contain carbohydrates by writing "yes" or "no." Write a brief description in the Test Results column for each food tested by the teacher (e.g., iodine remains brown on the food; iodine turned blue-black on the food). Based on the test results, place a + in the last column if the food contained carbohydrates; place a - in the last column, if it did not contain carbohydrates.

Food	Prediction	Test Results	Carbohydrates + or -
Baseline Water			

1. How did your predictions compare with the test results?
   How many predictions were correct?

2. In one or two sentences, describe the kinds of food that contain carbohydrates.

PROTEIN IN OUR FOOD

Name:_____

Directions: Write each food to be tested in the Food column. Predict whether the foods contain protein by writing "yes" or "no." Write a brief description in the Test Results column for each food tested by the teacher (e.g., the solution turns purple when applied to the food). Based on the test results, place a + in the last column if the food contained protein; place a - in the last column, if it did not contain protein.

Food	Prediction	Test Results	Protein + or -
Baseline Water			

1. How did your predictions compare with the test results? How many predictions were correct?

2. In one or two sentences, describe the kinds of food that contain protein.

NUTRIENT CONSUMPTION CHART

Name:_____

Directions: Record your food and beverage consumption during the next 24 hours by providing the specific information in each column for each item.

Meal/Food or Beverage	Serving Size	Number of Calories	Grams of Carbohydrates	Grams of Protein	Grams of Fat
Breakfast					
Lunch					
Supper					
Snacks					
Totals					

NUTRIENT COMPARISON: ACTUAL VS. RECOMMENDED

Name:_____

Part 1 Recommended Nutrient Consumption

1. Determine recommended grams of protein. We need 0.8 g of protein per kilogram (kg) of body weight.

   a. Convert your body weight from pounds to kilograms by dividing your weight in pounds by 2.2 pounds per kilogram (2.2 pounds = 1 kilogram).

   b. To determine how many grams of protein you need, multiply your body weight in kilograms by 0.8 grams.

   _____ kg x 0.8 grams = _____ grams
   (your weight)

2. Determine recommended grams of fat. It is recommended that no more than 30 percent of total calories come from fats. There are 9 calories per gram of fat. What is the maximum number of grams of fat that you should eat based on your total number of calories.

   _____ x 0.30 (30%) = _____ calories of fat
   (total calories)

   _____ calories of fat = _____ grams
   9 calories/gram

3. Determine recommended grams of carbohydrates. It is recommended that 55 to 65 percent of total calories come from carbohydrates. Using an average of 60 percent and knowing there are 4 calories per gram of carbohydrate, calculate the number grams of carbohydrates you should eat based on the total number of calories you recorded on your ***Nutrient Consumption Chart***.

   _____ x 0.60 (60%) = _____ calories of carbohydrates
   (total calories)

   _____ calories of carbohydrates = _____ grams
   4 calories/gram

NUTRIENT COMPARISON: ACTUAL VS. RECOMMENDED (page 2)

Part 2 Comparing Recommended Consumption with Actual Consumption

1. Complete the following table. Use your calculations from Part 1 to complete the Recommended column. Use data from your ***Nutrient Consumption Chart*** to complete the Actual column.

Macronutrient	Recommended (in grams)	Actual (in grams)
Proteins		
Fats		
Carbohydrates		

2. Write a statement about each of the macronutrients addressing whether you are eating more or less than the recommended amount.

3. Do you need to make any changes in the foods you eat to be closer to the recommended amounts of each of the macronutrients? If so, what would you do differently?

NUTRIENT COMPARISON: ACTUAL VS. RECOMMENDED (page 3)

4. Use the results of your ***Nutrient Consumption Chart*** and the ***Nutritive Value of Some Foods*** table to answer the following questions.

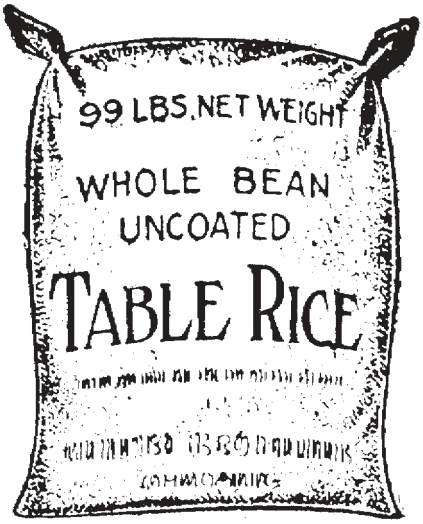
   a. Which foods are highest in carbohydrates? Lowest?

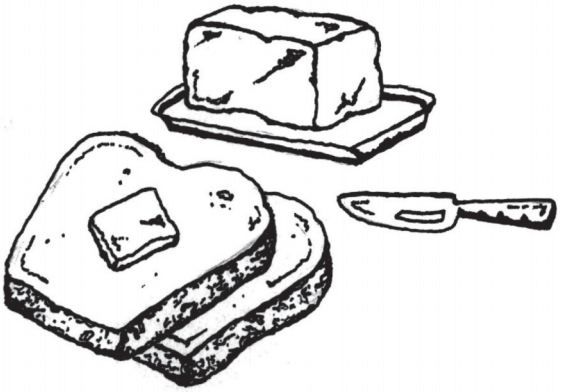
   b. Which foods are highest in proteins? Lowest?

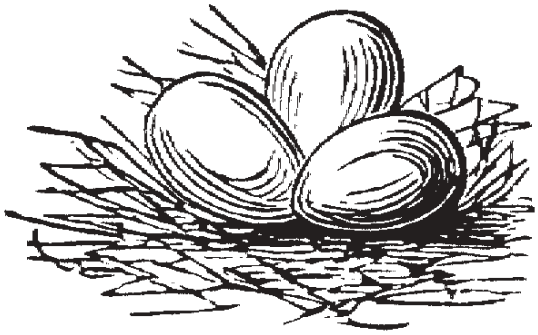
   c. Which foods are highest in fats? Lowest?

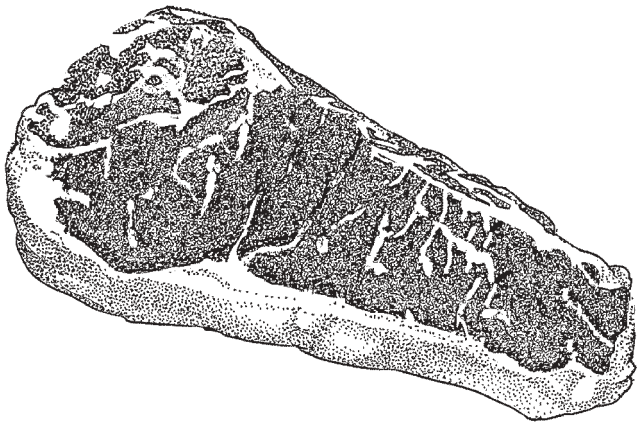
5. Based on your responses to questions 3 and 4, re-create one of your meals from ***Nutrient Consumption Chart***. This could mean making substitutions or creating an entirely different meal. Give the reason(s) for your meal change(s).

6. What have you learned that you are willing to share with others?









When tillage begins, other arts follow.

The farmers therefore are the

founders of human civilization.

Daniel Webster